
Type: Abstract Oral Presentation
Category: Others

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Occupational Safety and Health issues are increasingly receiving attention and found as important in Malaysian Industries. In an operational analysis report of the Occupational Safety and Health Regulations (Penggunaan dan Standard Pendedahan Bahan Kimia Berbahaya Kepada Kesihatan) 2000 has found that 80 percent of more than 800 workplace investigated failed to adhere fully to regulations. In addition, the Small Medium Enterprises (SMEs) has been reported to contribute some 30 to 50% more towards industrial accidents in Malaysia. Since SMEs constitute almost 99% of the Malaysia's business establishments, and contributing 32% of the country's GDP. As a developing nation, improvements to its workers safety and health issues should go hand in hand with Malaysia economic development. With the increased number of its small and medium enterprise (SME), Malaysia is facing greater challenge to monitor OSH requirements are adhered to in spite of trying to stay competitive and survive with its limited capital or financial resources. This research aims to investigate the effect of management practices toward OSH implementation in SMEs. In addition, the study will examine the role of legislation in moderating the relationships between management practice dimensions and OSH implementation in SMEs. Using a questionnaire distributed to a total of 152 SMEs in the Northern Region of Malaysia results were analysed using the SPSS software. These questionnaires were answered by either the safety officer or personnel incharged of the safety management in the SMEs. Almost 60% of the respondents reported accidents of 4 or less in the past year. Factor analysis identified six main dimensions in explaining about OSH implementations. The results showed that safety training and employee participation in management practices are significant in OSH implementation in the SMEs. Safety reward is important in influencing OSH implementation with SMEs when legislation moderates the relationship. In addition, legislation moderates dimensions of management practices that has no direct relationship with OSH Implementations. Legislation moderates and establish indirect relationships toward OSH Implementation for SMEs. This study extended our understanding of how OSH implementations in SMEs can be improved. Practical implications are discussed. Recommendations include implementations in SMEs with specific and formal type of regulations placed by formal authority.
Brazil has the second largest agricultural aircraft fleet of the world, and more than 70 million hectares are sprayed annually by national agricultural aviation. Previous studies indicate that the work of agricultural pilots involves a series of risks factors and difficulties of physical, cognitive and organizational nature. Although agricultural aviation in Brazil represents only 5% of the national fleet, it accounts for 25% of all air accidents. This study aims to identify the main determinants of agricultural pilot activity, responsible for problems in the field of ergonomics and work safety. The method adopted is based on the application of semi-structured interviews, based on questionnaires, to the main actors involved in the problem: pilots, aircraft designers and air accident investigators. The main results allowed the characterization of the agricultural pilots according to demographic and labor relations criteria. The main ergonomic and occupational safety problems pointed out by the actors refer to aircraft design deficiencies and organizational issues. The conclusion points to the need for adjustments and improvements of several elements of the aircraft cabin, especially the flap lever, seat and joystick. Also, the environmental cabin conditions and organizational issues should also be improved.

**Keywords:** agricultural aviation, ergonomics, safety, design.
Healthcare systems have been increasingly demanded to be more efficient, which has encouraged the use of process improvement initiatives. From these, lean production has emerged as a widely used approach, regardless of skepticism in some circles. Some disappointing results of lean can be partially due to the lack of consideration of the complexity of healthcare. Complex socio-technical systems, such as healthcare, are fundamentally different from linear systems, as they are plagued by uncertainty, diversity, and non-linear interactions.

In this paper, we explore the concept of kaizen in healthcare, from a complexity lens. Kaizen is a core lean principle, which means that many small improvements should be conducted on a frequent basis, giving rise to new work standards to be tested and refined over time. As such, there may be several "kaizen projects" running in parallel, involving partially overlapping team members and work systems.

The interactions between kaizen projects are discussed in this study. Indeed, the modelling and management of interactions has long been at the core of socio-technical systems theory, and systems-oriented safety approaches in general. Furthermore, interactions between kaizen projects are not usually explicitly modelled nor managed during lean implementation. Thus, their outcomes may be framed as emergent phenomena, which arise as result of the self-organization of project teams, rather than centralized control. Project team members may or may not realize the interdependences between the kaizen projects, which pose a risk of unintended effects.

The empirical basis for our discussion is provided by five kaizen projects carried out in an in-patient surgical ward of a teaching hospital. These projects comprised of: (i) the reorganization of supplies stored in the automated dispensing machines, in order to reduce awkward postures and manual materials handling; (ii) the levelling of the daily demand for medications, so as to avoid peaks of administering medications to all patients at the same time; (iii) the creation of a safe zone for the preparation of drugs, aiming at the reduction of interruptions that could cause errors; (iv) the reorganization of routines so as all patients always have a valid medical prescription; and (v) the placement of a digital screen on the wall of the nursing station, which would publicly display updated information on the clinical condition of patients hospitalized in the ward.

The interactions between the projects were modelled through the development of a causal-loop diagram, which accounted for variables related to all five projects. Variables were identified from interviews, observations, and documents. Principles from both complexity thinking and lean production were adopted for making sense of the analyzed interactions, emphasizing their implications for the safety of both patients and providers.

Type: Abstract Oral Presentation
Category: Healthcare
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The modelling and management of interactions has long been at the core of socio-technical systems theory, as well as systems-oriented safety approaches in general. The growing interest of human factors researchers in complexity science has also put a spotlight on interactions, which are a defining feature of complex socio-technical systems. Regardless of the key role played by interactions, there is a lack of deep investigation of this construct by itself, whose meaning and nature is often implicit and taken for granted by most studies. For example, formal definitions of what counts as an interaction are not easily found in the human factors literature. In this study, a taxonomy of interactions in socio-technical systems is proposed, aiming at supporting their modelling and the resulting identification of leverage points in work system design. While this taxonomy can be useful for different modelling approaches, it was conceived having in the mind their association with the Functional Resonance Analysis Method (FRAM). The emphasis on the FRAM is due to the fact it allows for exploring a variety of archetypes of work, focusing on the functional nature of interactions to explore the nitty-gritty of a work domain. The taxonomy accounts for eleven categories, namely: nature of the agents, nature of the outputs, duration, concurrence in time, distance, frequency, degree of coupling, degree of linearity, visibility, safety hazards, and replications. Our general proposed definition of interaction is as follows: a dependence relationship between two functions in a socio-technical system, which does not necessarily involves the exchange of energy or physical interaction between the agents that perform the functions. This dependence can be either one or bi-directional. From an operational FRAM perspective, an interaction consists of any coupling between two functions, which by definition starts with the output O of an upstream function, which in turn is used by any other aspect (input I, precondition P, resource R, control C, and time T) of a downstream function. In this sense, an interaction means that an output: triggers the start of another function (I); sets a precondition for the effective performance of the function, although this by itself does not start the function (P); increases or decreases as a result of carrying out the function (R); sets expectations and thresholds of acceptable performance (C); sets time constraints for performing the function (T). An application of the taxonomy is presented for an event of providing emergency obstetric care in a major hospital. A FRAM model representing work-as-done in the analyzed system is presented, and insights arising from the application of the taxonomy are discussed.
Assessing the urban environment accessibility and safety conditions: what do the citizens perceive?

Type: Abstract Oral Presentation
Category: Building and Construction

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The aging of the population in conjunction with the growing recognition of people with disabilities has resulted in a growing demand for accessible and safe urban spaces. This demand is even greater in urban spaces dedicated to trade or tourist activities. Recently, some local governments in Mexico have made some efforts and actions to build accessible urban spaces. However, there is a lack of evaluation of the results of such efforts, especially from the perspective of the citizens who use those environments.

The objective of this study was twofold: 1) to identify the conditions of accessibility and safety of an urban environment in Guadalajara, Mexico from the perspective of the citizens, and 2) to explore the levels of empathy of the participants towards the needs and problems of vulnerable groups when making use of that public space.

A questionnaire was developed to obtain from the participants their demographic data; empathy towards other user groups; and its perception of the conditions of accessibility and safety of the urban environment. The application of the questionnaire was carried out in the public space to be evaluated while the users passed by the place. A total of 299 people aged 18 to 72 years participated in the study.

The results suggest that more than a third of respondents perceive that space is well designed and that it has no safety or accessibility problems. The rest of the participants pointed out the presence of obstacles to free access and conditions that represent a risk for the users of that space. More than half of the participants considered that the design of the space could give use problems to the elderly, people with disabilities and small children. Overall, the study allows recognizing a series of elements of the urban space that need to be considered in order to create a friendly environment for all.
IT driven transformation processes in manufacturing result in major changes for employees’ daily work and they are ever-present in media and research called inter alia computerization or Industry 4.0. There is a variety of research that focusses technological feasibility [1, 2, 3] or concepts to support workers [4, 5]. Additionally, there is particular emphasis on which competencies are needed to be able to cope with these changes [6, 7]. However, there is a lack of research that deals with motivational processes and attitudes of employees in manufacturing. How do they face these changes? A future working environment in smart factories is generally associated with lifelong learning, codetermination, self-determination, or versatility [8]. Do young employees like the idea of a more and more digitized job?

Data has been collected using a standardized questionnaire (KFZA) that has been returned by n=109 apprentices working in manufacturing. The questionnaire queries the actual state of the working situation, as well as the target state. Additionally, fears, opportunities, and general aspects they associate with a highly digitized working environment were interrogated.

In relation to the current working situation an independent samples t-test revealed differences between employees in large corporations and small and medium-sized enterprises (SME). Participants working in large corporations had a significantly lower quantitative workload and better operational benefits than participants in SME.

For all participants, results show an ambivalent relationship of the young employees towards digitization in manufacturing. For one thing, they do like many issues that characterize a highly digitized environment, then again they are negatively opposed to terms like Industry 4.0. There is a severe anxiety of job loss in conjunction with digitization in manufacturing. However, they favour the idea of learning something new, having a greater degree of self-determination, and versatility. What is more, participants would prefer a working environment that is characterized by greater room of action and codetermination, what is also connected to future working tasks.

This study evinced the great fear of young employees towards terms like Industry 4.0 or digitization. There are barely positive aspects associated with a workplace that is strived for by smart factories. The opposite results that show up with future work tasks that are characterized by Industry 4.0 exemplify that there is a strong need for clarification what a future workplace in highly digitized environments stands for. In order to create a working environment that motivates rather than frightens young employees, they need to be enlightened about opportunities of future work. By having a deeper understanding of future working scenarios employees would have the chance to get ready for a highly digitized manufacturing.
HEMATOLOGIC EFFECTS OF CHRONIC EXPOSURES TO LOW-DOSE X-RAYS AMONG RADIOGRAPHERS IN SELECTED PORT-HARCOURT HEALTHCARE FACILITIES

A RESEARCH PAPER

BY

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TITLE: HEMATOLOGIC EFFECTS OF CHRONIC EXPOSURES TO LOW-DOSE X-RAYS AMONG RADIOGRAPHERS IN SELECTED PORT-HARCOURT HEALTHCARE FACILITIES

OBJECTIVE: THIS RESEARCH DETERMINED THE EFFECTS OF CHRONIC EXPOSURES TO LOW-DOSE EXTERNAL X-RAYS ON BASIC HEMATOLOGICAL INDICES, AMONGST RADIOGRAPHERS IN PORT-HARCOURT.

BACKGROUND: EXPOSURES TO IONIZING RADIATION HAVE BEEN IMPLICATED IN THE AETIOLOGY OF SOME MEDICAL CONDITIONS SUCH AS HEMATOLOGICAL CANCERS. RADIOGRAPHERS ARE FREQUENTLY EXPOSED TO THESE RADIATIONS WITHIN THEIR WORK ENVIRONMENT IN THE FORM OF LOW-DOSE (‘SCATTER’) X-RAYS. BASIC HEMATOLOGICAL INDICES WERE ANALYSED FROM BLOOD SAMPLES OF RADIOGRAPHERS IN SELECTED HEALTHCARE FACILITIES WITHIN PORT-HARCOURT, TO DETERMINE THE EFFECT OF EXPOSURES TO LOW-DOSE XRAYS WHERE PRESENT.

METHOD: A RETROSPECTIVE CASE-CONTROL ANALYTICAL STUDY WAS CONDUCTED ON 80 PARTICIPANTS AGED BETWEEN 25-54YEARS OLD COMPRISING 40 RADIOGARPHERS AND NON-EXPOSED PERSONS RESPCTIVELY.
BLOOD SAMPLES WERE OBTAINED AND EXAMINED IN A MEDICAL LABORATORY USING A DIGITAL HEMATOLOGY AUTO-ANALYZER. STANDARD QUESTIONNAIRES WERE ALSO ADMINISTERED TO ASSESS THE LEVEL OF KNOWLEDGE, ATTITUDE AND WORK PRACTICE OF RADIOGRAPHERS TO X-RAYS.

RESULTS: THESE INDICATED THAT THE BASIC HEMATOLOGICAL INDICES WERE NOT SIGNIFICANTLY CHANGED BETWEEN BOTH POPULATIONS. HOWEVER, THE BLOOD CELL MORPHOLOGIES SHOWED INCREASED MICROCYTOSIS AND TARGET CELLS IN THE RED BLOOD CELL OF THE RADIOGRAPHERS. QUESTIONNAIRE RESPONSES INDICATED HIGH VALUES FOR KNOWLEDGE, ATTITUDE AND WORK PRACTICE AMONG THE RADIOGRAPHERS.

CONCLUSION: CHRONIC EXPOSURES TO LOW-DOSE X-RAYS DID NOT SIGNIFICANTLY AFFECT THE BASIC HEMATOLOGICAL INDICES WHICH COULD HAVE BEEN ATTRIBUTED TO THE RADIOGRAPHERS' HIGH LEVEL OF KNOWLEDGE ATTITUDE AND PRACTICE.

APPLICATION: THIS RESEARCH ILLUSTRATES THE IMPORTANCE OF CONDUCTING EMPIRICAL ANALYSES TO ENCOURAGE ADEQUATE SAFETY MEASURES AND PREVENT UNNECESSARY WORKPLACE HAZARDS.
It is important to recognize that Musculoskeletal Disorders (MSD) prevention requires a multi-faceted approach due to the complex nature of MSD. A proactive approach and early intervention strategies are integral to the reduction and elimination of the incidence of work-related MSD. Ergonomics should also be a key consideration in the return to work process. Organizations are supportive of the coordinated approach to MSD prevention being proposed by many regulated and international bodies. An approach of coordinated approach in Nigeria is recommended in this paper. This has yielded positive results.

Injuries and downtime was greatly reduce while productivity and efficiency was enhanced.
In many parts of the world, compliance with relevant standards is a mandatory requirement in many services, but even when it is not, we believe standards are a good idea because they:

- Provide definitive, authoritative widely agreed statements of good practice
- Require organizations to consider and meet the needs of their people
- Help organizations meet their legal requirement under disability and health and safety legislation
- Promote consistency by providing a consistent reference across design teams or across

Integrating ergonomics principle to existing standards is essential if progress is to be made in our country technological advancement, managing a business continues to set new challenges and demands especially when viewed against:

- Significant competition;
- High customer and community expectations;
- Returns on capital employed;
- Regulatory compliance;
- Executive liability risk.

Standards and legislation affecting health, safety, environment and quality assurance share many common elements that if effectively integrated will stimulate business improvement and risk reduction. Integration will expose areas of waste and non-value-added activity, and provide opportunities for rationalization
Minimising the Effect of Noise Pollution and musculoskeletal disorders among Milling Machine Workers in North-West Nigeria

Commercial activities are mostly centralized to main markets in many towns and cities of the Northern part of Nigeria. Such central markets constitute the noisiest parts of the towns. Yet, there is no evidence that the workers and traders in such markets are aware of the challenges excessive noise pollution poses to their health. Apart from noise pollution, some of the workers work in non-neutral posture that is a risk factor for musculoskeletal disorders. These problems serve as the basis for this research, which investigated the major sources of noise pollution and musculoskeletal disorders in the central market of Birnin Kebbi, a state capital in the North-western part of Nigeria. The market was divided into thirteen sections based on activities. These sections were visited twice a day for two weeks to measure their sound levels. The sound level was measured with a CEM digital noise level meter with an accuracy of ±3.5dB@1KHz. Thereafter, an ergonomic observation assessment of the noisiest section was carried out. The assessment was carried out based on rapid entire body assessment (REBA) methodology. Statistical analysis was carried out using SPSS version 18. The average sound intensity in all the sections exceeded the recommended safe sound level of 40dB. However, only the sound intensity at the grain and spices milling section (89.13 dB) exceeded the noise harmfulness level of 85dB. The assessment also revealed serious exposure of workers to musculoskeletal disorders because of the milling operation especially in the neck, shoulder, elbow, back and leg. Hence, a new sit-stand chair was designed to minimise the musculoskeletal disorders. The new chair has two seats to cater for the operator when using the pestle and when checking the milled grains. Also, operators were encouraged to use ear muffs or earplugs to minimise their exposure to harmful noise level. The findings emphasised the need for government and relevant authorities to carry out occupational safety awareness among workers in the non-formal sector of the society.

Keywords: Noise, Musculoskeletal disorder, occupational safety, ergonomic assessments
Effect of Redesigning School Furniture Based on Students’ Anthropometry in North-West Nigeria.

Type: Abstract Oral Presentation
Category: Education and Training

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ABSTRACT

Mismatch between classroom furniture and the students’ anthropometry have been identified as a major cause of musculoskeletal disorders (MSDs) among schoolchildren. These MSDs can be a distraction for students during learning and affect students’ overall performance in schools. This paper reports the furniture intervention carried out among students in some tertiary institutions in the Northwest part of Nigeria. The Cornell’s MSD questionnaire was used to investigate the prevalence of MSD in different body regions of 250 students aged between 17 and 25 years. Dimensions of some classroom furniture used in the institutions were measured and eleven students’ anthropometric measures, relevant to furniture design, were gathered using appropriate equipment. Standardized regression equations for furniture design were used to compute the ergonomically compliant furniture dimensions for the participants. A new set of ergonomically designed furniture using the students’ anthropometry was introduced in one of the institutions and a retest using the Cornell’s MSD showed a reduction in the prevalence rate among the students. Also, the students’ performance also improved compared to the other classes using the old furniture. The study further highlights the importance of using a population’s anthropometry for the design of facilities for their use.

Keywords: Anthropometry, musculoskeletal disorders, furniture mismatch, School Ergonomics.
Intravenous Therapy (IV therapy) refers to a treatment in which medication and nutrition is provided to the patient via a system that infuses the fluids directly into the patient's bloodstream. Patients that are admitted to intensive care facilities, often require infusion of multiple fluids because physical systems fail to operate as intended. IV therapy administers drugs and nutrition into the patient’s bloodstream by placing tubing, through which fluids can be transported, into the vein. The smallest fluctuations in dosages or drug administration delays have the most severe consequences for the new-born infants in the Neonatal Intensive Care unit. This study focuses on the development of an innovative IV set based on a new principle for merging various drugs and nutrition, the so-called “Tulive”.

A user-centred approach, including analysis of the complex healthcare context, literature study, observations & interviews with the different stakeholders and mainly its key user the ‘nursing staff’, generative sessions, contextual design models & methods, multiple user feedback sessions, etc. was applied during the whole design process.

Main themes that were uncovered include: product-user communication in terms of simplistic & unambiguous use cues, a sense of feedback regarding product related actions on multiple levels, user confidence to positively influence their actions with the product and inconveniences with fluid flow distinction.

Multiple design iterations have been made where the needs, expectations and limitations of the user in context played a central role and were the motivation behind the design decisions made during the process. All these insights were translated and integrated in the final design, the “Tulive”. The name “Tulive” relates to the aesthetic design, the tulip shape and conceal the complexity in a user-friendly way.

The value of user centred design lies in the increased product acceptance that can be achieved after new product implementation. In designing for healthcare, barriers that impede successful product acceptance can most often be attributed to the fact that majority of the medical products are not designed according to the needs, expectations and limitations of the medical professionals. Centralising the intended user of the product during the design phases, and allowing user input and contextual factors to shape the design in a systematic will help evade these barriers and support product acceptance of any innovation.
Importance estimation of issues related to a new nuclear safety guide by its
designers and users

Type: Abstract Oral Presentation
Category: Others
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Safety rules (laws, guides, policies, procedures, etc.) remain a key component of safety management in at-risk systems. In the modern and dynamic environment, the design of these rules is a real challenge for both regulatory bodies and regulated industries. A principal issue that users encounter seems to be attributable to how the rules are designed. Our study focused on the design process for a new nuclear safety guide. Seventeen stakeholders, divided into 2 groups: 8 designers (working for the French Nuclear Safety Regulatory Body) and 9 user representatives (working for various electricity providers) participated. The aim was to compare their points of view regarding the contents of a new safety guide. First, the user representatives group evaluated the guide, highlighting areas where they believed it was inconsistent with their tasks, and identified 28 issues that we classified in five categories: A) not in line with practices of nuclear operators, B) lack of precision, C) discrepancies in terminology, D) limiting the possibilities of the Pressurised Water Reactor (PWR) designers’ initiatives, and E) no compliance with existing safety requirements. Next, both groups were asked: (i) to assess the importance of these issues (six-point Likert scale), and (ii) to explain the reason(s) why they attributed this level of importance. A manual thematic content analysis has been made from the verbatim, giving rise to 28 themes. The results highlighted that, as expected, designers assessed the issues as less important than user representatives. For both groups, the category E) was assessed as the most important. This is in line with the fact that, for designers, it is their duty to write a guide in line with the other safety requirements, and for user representatives, it would be difficult to enforce regulations if there are contradictory. The evocations' number of the themes was differently distributed in relation to the group and the category. It is interesting to observe that the high levels of importance were justified by several themes, on which “negative criticism of the guide” and “negative consequences for nuclear operators”. These findings may help to target areas where improvements can be made in the design of nuclear safety rules.
Safety and quality of maternal and neonatal pathway: implementation of the WHO Safe Childbirth Checklist in the hospital of Torregalli (Florence)

Type: Abstract Oral Presentation

Category: Healthcare

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Background

Ensuring quality and continuity of care from pregravidic to post-natal age is of primary importance to ensure the improvement of global health. Maternal and neonatal mortality and morbidity associated with childbirth are global health indicators of the highest priority and it is important to act on these through focused interventions. It has been estimated that, globally, 10.7 million women and over 2.5 million babies died in the period 1990-2015 for reasons related to maternity[1][2]. In the period 2005-2015, the Italian Ministry of Health recorded 55 sentinel events in the intrapartum phase and 82 in the perinatal phase[3] and it has been estimated that about 50% of those are potentially avoidable[4]. Data monitoring and reporting systems are extremely important[5] and the use of tools to support the work of health professionals to manage clinical risk is widespread[6] so WHO, in 2008, designed a safe childbirth checklist for low and middle-income countries, now available also for developed countries. A pilot study has been conducted by the Centre for clinical risk management and Patient safety (Florence) in the hospital of Prato and now the Center aims to carry out the experimentation in another Tuscanian hospital.


Objective of the study
The aim of the study is to evaluate the effects of the checklist on clinical assistance evaluating health care professionals’ adherence to essential clinical practices and the effect on the standardization of processes, in order to design and refine a tool that can improve the work.

Methods
Firstly, a literature review was made and a multidisciplinary group including obstetricians, gynecologists and ergonomists and experts of clinical risk management and safety of care was set up, with the aim of carrying out a further evaluation and adaptation of the checklist to the context. A pre-post-intervention prospective study was designed, based on a qualitative and quantitative analysis of data. Then a training course was organized for health professionals dealing with maternal and neonatal care unit of Torregalli hospital to train them on the checklist’s purposes and methods. A checklist test phase followed, lasting from January to May 2016, following which the checklist finally became part of the clinical practice tools. The population included women who had access to the obstetric area for the childbirth during June, July and September 2016 and June, July and September 2017. Patients who undergone elective caesarean section, pregnancies <24ws, voluntary interruptions of pregnancy and spontaneous abortions were excluded. The sample was estimated by calculating 9% of the initial population and 100 pre-intervention and 100 post-intervention medical records were extracted from and anonymous database provided by obstetric coordinators. Various indicators about clinicians’ compliance and clinical assistance will be evaluated. Also, an anonymous questionnaire will be administered to health professionals to evaluate their perception on usability and impact of the checklist on the clinical practice.

Expecting results
Regarding the health professionals’ adherence to the checklist, we expect an incremental use of the tool with a high general compliance. Since the pilot study showed a strong correlation between the use of the checklist and the increase of correctly completed partogram presence, we expect to obtain a similar result in this trial. Regarding the impact on the outcomes, we expect complications related to the childbirth to reduce, according to the data available in the recent literature. We also expect a broad acceptance of the tool in clinical practice, since further adaptations of the checklist have been made to ensure adaptability. The data collected in this trial will be merged with the pilot study ones, to ensure validity of the entire study.

Completed results will be presented in the full paper or during oral presentation.

Keywords
Checklist, maternal and neonatal safety, health care professionals’ compliance, usability

eSports: Opportunities for Future Ergonomic Studies

Recently the eSports has grown internationally. It is estimated that in 2017 its global audience will reach 385 million people and that its revenues should reach 696 million dollars [1]. In addition, the International Olympic Committee analyzes the inclusion of the eSports in the Olympic Games in 2024, as it considers the preparation and training of eSports players comparable to those of traditional athletes. Some challenges arise, such as regulating eSports as an Olympic sport politically and socially, including the development of anti-doping and gambling policies [2]. In Brazil, the eSports ecosystem is in an early stage of maturity [3, 4]. In this context, a research project has been developed at the Federal University of Rio de Janeiro, focusing on designing eSports future work systems.

This study aims to generalize knowledge about this new professional area and reflections on the prospects of the future ergonomic studies in the field.

The literature review showed that in recent years the number of eSports publications has grown dramatically. Some of the authors point out difficulties regarding team coordination, professionalization and market regulation [5, 6, 7, 8, 9]. Thirty-nine eSports professionals confirmed facing the issues mentioned above in semi-structured interviews. Contradictions in their answers also allowed the identification of the sportsmen's main demands and the elaboration of the general preliminary diagnosis of the national eSports situation. The results showed that there are few professional teams in Brazil and most of them train abroad where the infrastructure and interaction between teams is better developed. Professional Brazilian players are mostly young middle class and upper middle class people; most of them study and often do not have any financial support to dedicate themselves exclusively to the eSports.

In these circumstances, the formation of strong national teams presents some difficulties. The situation may worsen if the sector regulation does not take into account that the creation of eSports national teams is a conception process [10] of the future work system. This could have far-reaching consequences for the relevant activities [11] and the society as a whole. The analysis of reference situations, the creation of libraries containing characteristic situations of action, and simulations, as well as the conception ergonomics [12] can help to envision and prevent the problems that may arise in the process of...
developing this sector model. Important professional transitions are already occurring [13, 14], and, in this process, ergonomists can bring their multidisciplinary studies on cooperation of distinct emergent professional worlds [10], the conflict between logics [15] and the experience exchanges [16] among different actors to practical and theoretical aspects of eSports.
[2281] Evaluation of the human-machine interaction with computed to-mography – CT, in a real context

Type: Abstract Oral Presentation
Category: Healthcare

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The clinical diagnosis based on radiological imaging has been subject of thorough changes in the last years, due to the adoption of technological systems such as the Computed Tomography (CT). The use of this technology has objectively become pervasive, increasing from year to year, acquiring the role of an essential diagnostic tool for many different pathologies.

Despite the common use of CTs, their usability and their suitability as tools with adequate safety level, have not been object of many studies.

The purpose of this research is to comprehend the evolution of the relations between the users, most specifically the technical operators, and the complexity of a technological system as that of the CT in their real context of usage.

The analysis of human-machine interaction has been the focus point of this study, which also was aimed at evaluating the operator's perceptions about their work while they were actually operating into a real radiodiagnostic environment.

The research was entirely made in Siena at the radiological ward of “Santa Maria alle Scotte” emergency room, where a CT system is operative 24/7.

The first part of this study was conducted in 2011. Data were collected in the period of two days through ethnographic observations made of 30 examinations, considering: examinations completion time, influx of people who entered in the CT room during the examinations, dialogues (functional or distractive) between who were inside the room and operational drawbacks and various interruptions.

Six years later, the second part of this study is still in progress. It expects to verify if there has been real improvements on user-friendliness and if operational drawbacks during the examinations have actually decreased.

Preliminary results indicate that the duration of an exam is attested between a minimum of 7 to a maximum of 51 minutes, with an average of 21.3 minutes. The flow of people analysis, inside the operating theatre, discloses that 4.0 people were present during the course of the exams. The highest amount of people inside the rooms is 13 while the minimum is 1.
The number of conversations for each exam are 9.3 and most of them are functional for the exam. The most significant result concerns that during one out of three exams, one or more operational drawbacks of different nature were registered; those happened mainly in the night and while the patient was still in the operation room.

Comparative observations are still in progress and they will allow to highlight if the evolutive paths are accurately aimed at the improvement of different factors such as the usability of the User Interface, a safer execution of the exam, the increase of technicians satisfaction.
The digital era is bringing fundamental transformations to all areas of society. The penetration of everyone’s professional and private lives with modern information and communication technology is constantly increasing. However, the developers responsible for this transformation are currently often oriented too heavily towards what can be accomplished technically, what is economically promising or politically desirable and not primarily towards the requirements of above all older and very old people.

The Aachener DenkfabrEthik (Aachen ethical think tank, www.denkfabrEthik.de) is a success model for participatory identification of regional potential and challenges related to technology while also addressing this problem. As an independent exchange and networking platform, it forms precisely the required interface between citizens of all age groups, researchers in a wide range of disciplines, and regional decision-makers, making it possible to proactively record and convey the implications of using technology. The initiative is supported actively by an interdisciplinary advisory board of regional personalities from religion, culture, politics, science, and industry.

Until now, there has been a lack of such a place of exchange in which ethical, social and legal problems can be communicated and discussed through participation together across all age groups. With the DenkfabrEthik, an incubator has been created that closes this gap and also contributes to shaping participatory gerontechnology research. The cross-faculty, academic evaluation is undertaken using a multi-methodological approach in which procedures from various disciplines such as psychology, sociology, IT, engineering, economics and medicine are combined and transformed for use in new areas of application. This process results in an interdisciplinary research paradigm in which technical innovations are designed in a user-centric manner, implemented across domains, and assessed on a macrosocial level.
In modern conditions, taking into account international recommendations (ICAO, IATA), the system of continuous training of the Airline’s aircrew maintains 8 main competences at a sufficient level:

1. Application of Procedures.
2. Communication.
3. Aircraft Flight Path Management, automation.
5. Leadership and Teamwork.
7. Situation Awareness.
8. Workload Management.

Monitoring and methods of development of the above-mentioned competences are the instructors’ methodological tools. Therefore, each instructor needs not only comprehensive improvement, but also ability to apply innovative methods, which "pull up" the aircrew morally to the PROFESSIONAL’S level. The flying person needs to develop special characteristics, which will surely be useful to him in the sky: humanity, responsibility, conscientiousness, self-criticism ... everything that generates truth, good, love, peace.

One of methods that is offered to build and develop the competences recommended by the international aviation community is to use generative games which have well worked in power engineering as the instrument to increase reliability of the personnel and which are successfully played in Russia, the CIS countries, France, Germany, and the USA.

The generative games in aviation are used to increase readiness for actions in an extreme situation due to accelerated building and further maintenance of the IMAGE of a PROFESSIONAL, including the image of professional flight activity, which leads to increase in reliability of the activity.

An important element of the generative scenario in a crew / group is to add experience and put it into practice, i.e. to strengthen it. At the same time, different crews / groups creating the participants’ experience resort to different scenarios, which can finally lead to absolutely unlike results including those that concern flight safety.

Several versions of the generative games are elaborated today:

✓ The "Flight" game;
✓ The "Limitations" card game;
✓ The "SAFA Inspection" game;
✓ The "VIP onboard" game.

In the course of a game situation, pilots can see the interaction process, on the one hand, and they are engaged into it, on the other hand. Everyone resorts to their own scenario and can see what their actions lead to in the end of the game.
During the game, one could study how leadership skills are demonstrated and how situational understanding of any following action is formed by the group when a passenger in a game situation spontaneously assumes responsibility and says: "Landed…", i.e. the game generates a chain of the situations that requests decision-making.

In general, one could speak of development of skills recommended by the international community in course of games. The basis is made by of participants’ interaction in a game situation together with resorting to one’s own scenario.
How could and should Ergonomics/Human Factors (E/HF) be implemented in healthcare? The Chartered Institute of Ergonomics & Human Factors (CIEHF, UK) has developed a White Paper as a vision for the future to complement the strategic views expressed by the Care Quality Commission, NHS Education for Scotland (NES), Health Education England (HEE), Medicines and Healthcare products Regulatory Agency (MHRA) and others.

The initiatives delivered in the National Health Service (NHS, UK) have succeeded in sparking an interest in E/HF. Whilst there have been successes in introducing local improvements using risk management, quality improvement and patient safety methods, the participative nature of E/HF supports collaboration by all stakeholders ensuring that a system-wide approach is taken. The White Paper provides a new beginning for a common understanding of E/HF in healthcare, accessible to all healthcare service stakeholders and provides a vision for education, capacity building and implementation.

Education

- There will be sufficient competence and experience to fill the various roles required for effective E/HF implementation.
- There will be relevant and sufficient inclusion of E/HF education in clinical curricula with Professional Bodies and Regulators liaising with the CIEHF for support with the delivery of E/HF principles and practices. Capacity
- Every health and social care organisation will have an identified E/HF professional at a senior level.
- There will be sufficient E/HF capacity to deliver a resilient system that encompasses safety culture and improved workloads for all healthcare providers. Implementation
- E/HF best practice will be common across all healthcare and social care processes including audit, planning new and redesign of services, investigation and procurement; from for example, local pharmacy services and medical devices to national inter-agency information communication systems, across all service providers (public and private), and sectors (primary, secondary, mental health, ambulance, community, intermediate, social and home care).
- There will be proven strategies for E/HF Implementation, such as integration with Quality Improvement, including a sector-specific competency matrix that all practitioners adhere to (and which underpins the education and capacity aims of the vision).
- International Standards for E/HF will be embedded in healthcare design and systems for planning, acquisition, safety and wellbeing.
Through ongoing collaboration, co-creation and discovery involving clinicians, HF experts and other professionals within and beyond healthcare, this approach will contribute towards developing, and implementing sustainable system level improvements. This paper will describe the consultation process for the development of the White Paper and give examples of 'what good looks like'. For example making the best use of human capabilities (physical, cognitive, psychological and social characteristics); mitigating for human limitations; and utilising people in ways that maximise system safety and minimise risk.
If objects have the ability to talk, if environments have the chance to get around this, it is definitely due to light. If this is spontaneously accepted less spontaneously we accept that objects and environments have their own autonomous experience with whoever uses them.

Yet in them there are phenomena that do not depend on the wishes of the user, but rather express conditions that suggest moods, purely emotional perceptions.

The logic that wants the isometry of the form to determine functions or uses is often a logic of perceptual suggestions, relational relationships between light and shadow. Light not only illuminates but characterizes shapes and spaces. Not only does it allow perception, but it is through it that emotional relationships arise. Objects, spaces through light modulation, chromatic declination, and tonal intensity, offer varying dimensions of fruition.

It is an example that if physical space is always equal to itself in time, luminous space can change and transform perceptual conditions by cognitively altering and even suggesting the psychological relationship of the use of things.

Designing the light today also means refining the approaches to the discipline by adopting training pathways that can interact in close co-operation both with the design of physical parameters and with the intangible content project.

To this is added education to perception as a cultural structure. As Arnheim has already largely argued, perception requires time and in this need to be educated to be aware of it.

According to Arnheim, our perception, in the general sense, is not differentiated beyond what is necessary. That is to say that the concepts are so generic as it is allowed by applying them to understand what you are observing.

To perceive an object as unchangeable means to move it to the highest possible level of generality. In the physical world, however, the modifications exist. The control and design of this variability condition greatly contributes to the comfort of fruition to be more in line with what we actually see, otherwise everything will remain motionless enough to suggest that variations either do not exist or do not matter, thus renouncing emotional sensory.

On this increased awareness, accelerated by the evolution of technological possibilities, new aspects of the light project are being developed today. Now skilled in scientific hardship, the lighting designer needs to draw on the sweet sensuality of light as a research tool for visual comfort before even as a method of rationalizing perceptual cognition.
The new dimension of designing light overtake, with the support of increasingly sophisticated implementation tools, the commitment to make a correct contribution to lumens by expanding the lighting design to a strongly cultural trajectory: educating well-being by educating the perception of light.
Workplace Ergonomic Factors among MIS Surgeons with Neck/Shoulder and Visual Symptoms

Type: Abstract Oral Presentation
Category: Healthcare
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background:
The introduction of Minimally Invasive Surgeries (MIS) has delivered benefits to patients with a concomitant increase in the prevalence of musculoskeletal and visual symptoms among surgeons who regularly perform these procedures.

The aim of the study:
The aims of this study were to determine: a) the prevalence (7 day and 12 month) of the neck/shoulder and visual symptoms among surgeons performing MIS, and b) the association between the prevalence of these symptoms and workplace ergonomic factors.

Methods:
Surgeons were invited to complete an online survey hosted by Checkbox (The University of Queensland). This survey consists of 54 questions including workplace ergonomic factors, musculoskeletal symptoms, and visual symptoms. The Nordic Musculoskeletal Questionaire was used to record the presence of neck/shoulder symptoms. The severity of neck/shoulder symptoms was assessed with the 11-points Visual Analogue Scale. The Computer Vision Syndrome-Questionnaire (CVS-Q) was used to provide information on visual symptoms while performing MIS. Chi-Square explored the relationship between variables of interest.

Results:
To date, 266 surgeons have completed the survey (mean age 46.5+/− 11.1 years; male 53.0%), of which 202 (75.9%) were gynecologists, mostly from Australia 210 (78.9%). Lifetime history of neck/shoulder and/or vision symptoms were reported by 168 (63.2%) surgeons. The 12 months prevalence of neck/shoulder symptoms was 146 (54.9%), while 81 (30.5%) of surgeons reported neck/shoulder symptoms during the last 7 days. Mean (SD) severity of neck/shoulder symptoms was 4.4+/− 1.3. Visual complaints while performing laparoscopic/robotic surgeries were reported by 133 (50.0%) of surgeons, but only 7 (2.6%) surgeons met the criteria for Computer Vision Syndrome. Sixty percent of surgeons with a history of neck/shoulder symptoms reported 3 or more visual symptoms.
while performing MIS. Workplace ergonomic factors most commonly modified during surgery were changing the height of the operating table (57.5%) and positioning of the laparoscopic foot pedals (50.8%). There were significant associations between the prevalence of neck/shoulder symptoms, visual complaint while performing MIS and several workplace ergonomic factors. Surgeons with neck/shoulder symptoms in the last 12 months and visual complaints while performing MIS reported often or always changing the general lighting conditions and the localized lighting levels, adjusting the height of the monitor, changing the height of the operating table, positioning the laparoscopic foot pedals and changing the placement of the patients arm boards. Meanwhile, surgeons with neck/shoulder symptoms in the last 7 days were never or rarely changing the height of the operating table and changing the placement of the patient arm boards.

**Conclusion:**

This study reported that the majority of surgeons who performed MIS experienced either neck/shoulder and/or visual symptoms. Several workplace ergonomic factors were associated with the presence of these symptoms.
The Brazilian legislation, through your Federal Constitution, guarantees every citizen the right to "Come and Go" and access to education. Brazilian laws ensure a portion of the vacancies in public education for people with disabilities, as well, reserve 1% of the vacancies on the staff in companies, public or private, with more than 100 employees. Moreover, many spaces are not accessible and, therefore, prevent the enjoyment of such rights. In this context, this paper presents a study on the Campus of the Federal University of Sergipe located in Laranjeiras-SE, city of historical significance and tourist to the State of Sergipe, and where is located the course of Architecture and Urbanism. The implantation of the Campus, opened in 2007, it was an initiative of the program Monumenta of the Federal Government, in partnership with the International Development Bank (BDI) and Institute of National Historical and Artistic Heritage (IPHAN), restored a set of buildings in ruins with the objective of enabling the economic stabilization of the city. The choice of the object of study is given for being a space of training of architects and urban planners and that, for this reason, should be an inclusive environment reference.

With the objective of identifying the accessibility conditions, the methodology included the steps: 1) Physical and Legal Survey: Measurements were made in the built environment to identify compliance with specific legislation; 2) Accessibility experience: the students of the architecture and urbanism course simulated the difficulties faced by people with disabilities while walking through the historic city center and on campus; and 3) Analysis of results and intervention proposal for adequacy. As a result, inadequate paving of external access areas, absence of signaling (visual, tactile or sound information) and the presence of steep ramps have been proven. It was also possible to promote the awareness of the student body about the importance of the architect in the adequacy of the built environment and the promotion of fairness of opportunities. It is known that there are numerous limitations to the adaptation of this space, for being listed by IPHAN as a city of national historical interest, autarchy of the Government of Brazil responsible for preserving the material and immaterial assets of the country. However, the institute proposes guidelines for interventions in historic centers in order to promote the accessibility and mobility of people with disabilities and their access to culture. In the case of the studied campus, to improve accessibility, it is proposed to install ramps, information devices (visual, tactile and sound) and circulation lanes with level and non-slip flooring, solutions that do not permanently damage the built environment and use materials and contemporary constructive techniques in order not to create a false historical.
The use of Electronic Health Records (EHR) is related to the improvement of service quality and care coordination (1,2,3). The development of this kind of platform, however, does not necessarily consider workers' needs during the designing process (4). The aim of this paper is to explore the contributions of Activity Ergonomics (AE) on the designing process of an EHR to support child and youth collaborative mental health care. It is a qualitative research based on the theoretical framework of AE. This paper addresses the preliminary findings of this research. As a procedure for data collection we interviewed mental health and primary care professionals within the public health network in Rio de Janeiro, Brazil. The interviews aimed to get inputs into the difficulties of using an information sharing device which was built by these professionals, as well as the desirable requirements for a new system. The analysis of the interviews showed that, in Brazil, child and youth mental health care encompasses an intersectoral network of services that are articulated in the construction of therapeutic plan. This type of organization requires an intense exchange of information from experts of distinct areas like social workers, education and health professionals. As the workers have different professional worlds (5), the challenge of sharing information is not overcome for an overlap of narratives. For designers, the first challenge identified is to built a tool that integrates different values and practices in the children and youth care. Besides, the difficulties identified in the use of the old device were: fear of error in the insertion of data in the system, rework, misunderstanding of codes used as landmarks to cases. The requirements that the workers pointed out as desirable for a new tool were: access through smartphones; option for consulting a summary of the cases or more detailed information; dynamic communication between the services; generation of alerts for urgent situations. The relationships between AE and the design of electronic devices have been evidenced through the use of user-centered design methodologies and methods for evaluating the usability of interfaces. By that, the AE favors the improvement of the project considering that the worker is not only a user of a device, but an operator whose actions have purpose. Therefore, from the perspective of EA's framework, the worker is a co-designer (6). In this sense, early reports from this research indicates the workers' perception about the use of EHR in order to incorporate the work dimension into the design of a new tool. For further analysis, simulations will be conducted using a paper mockup of the software to simulate work situations to confirm or discourage design requirements showed in this paper.

References


International Labour Organization classifies rural work as significantly riskier than other fields and estimates that millions of farm workers suffer severe health issues (ILO, 2009). Ergonomics’ challenges are considerable in order to improve well-being and productivity in an environment that poses such a situational variability and a bias of indifference towards labour conditions. Despite agriculture’s great economical importance, particularly of orange crops, it has been observed a lack of research about labour conditions evaluation related to the use of artifacts in manual harvest - the predominant picking method in Brazilian orchards.

From a qualitative analysis, were explored the relations established during execution of orange picking activity and artifact design by the worker in real-use situations, from the viewpoint of activity analysis and instrumental genesis, assessing variabilities, the path from artifact to instrument, as well as self-regulation process. A multiple case study was conducted in six farms within the main Brazilian orange belt (São Paulo State), during three harvesting seasons. One-hundred and seven (107) workers were interviewed and extensive image record was captured.

This research presents the operating strategies identified throughout the artifacts’ appropriation. This examination encompasses design-in-use perspective and composition of schemes to reduce physical stress and promote productivity. It is pointed out the relevance of pickers’ empowerment in design process as a means of expertise dissemination, highlighting creativity and tacit knowledge (workers’ know-how) as critical routes to better labour conditions and sustainable agriculture.

Keywords: activity analysis, scheme, instrumental genesis, design in use, agriculture.

References:

Introduction

The use of handheld mobile devices (tablets and smartphones) is common among the general population. Previous studies have shown that the use of handheld mobile devices is associated with several adverse health effects, including musculoskeletal disorders. It is acknowledged that the use of handheld mobile devices exposes users to the recognised ergonomic risk factors of duration, repetition and awkward and static postures; but the nature of this exposure is currently poorly defined. With the increasing use of handheld mobile devices in the workplace, work and the work environment are changing, and a better understanding of exposure is critical for the health of workers.

Aim

The aim of this research is to explore workers’ use of handheld mobile devices and to document key ergonomic risk factors associated with the use of these devices.

Methods

The first phase of this research involved an online survey distributed to University of Queensland staff and Higher Degree by Research students. The survey collected data regarding: type of device, device ownership, duration of use, location of use, purpose of use, postures/positions during use and hand grip style. Participants also provided demographic information and details on musculoskeletal discomfort (neck, shoulder, arm, wrist/hand, back) experienced during the last seven days.

Results

A total of 398 surveys were completed, including 72% university staff and 28% Higher Degree by Research students. The respondents had a mean age of 39 years (SD ±12yrs) and females represented 64% of the sample. Smartphones were used for work purposes by 74% of the respondents. They were used frequently in a wide variety of settings, including work offices (80%), public places (83%), on public transport (81%) and in the home (82%). This resulted in the reporting of a large variety of postures adopted during use. Smartphones were primarily used for email (94%), web browsing (83%) and organisational tasks (74%). Tablets were used for work purposes by only 36%, and they were used predominately either at home (64%) or at work away from an office (55%).
Discomfort (during the last seven days) was most commonly reported in the neck (65%), followed by the back (54%) and the dominant shoulder (39%).

Data analysis to date shows a significant correlation ($p<0.05$) between musculoskeletal discomfort experienced during the last seven days and gender, location of use, hand-grip style, purpose of use and postures/positions assumed during use. Further data analysis will be conducted to explore the relationship between the use of the devices and musculoskeletal discomfort.

**Conclusion**

The research is expected to help in establishing an evidence-based management strategy for work-related use of handheld mobile devices.
Sweden was among the first countries to embrace the idea that the adaptation of existing and new built environment was a prerequisite for including people with disabilities on equal terms in the surrounding welfare society. Back in the 1960s, this ambition forged the concept of accessibility, which generated lists of minimum requirements to meet in architectural designs for new developments or refurbishment. Since, accessibility has been a key concept in the Swedish disability policy as well as an integral part of other legal frameworks and standardisation works, e.g. the building act and the UN convention on equal rights for people with disabilities (UN CRPD). Driven by the essential mechanism in Swedish disability policy – i.e. the so-called disability perspective (in Swedish the Funktionshindersperspektivet) which promotes a universal level of accessibility in any type of built environment, service or transportation mode to which assistive technologies can be added according to personal needs – several Swedish standardisation works from the period 2012-1017 have been focused on converting visionary welfare political goals into down-to-earth-oriented guidelines for subsequent realization and implementation.

Problem and method:

The present paper focused on the conversion of general welfare goals into detailed guidelines that are applicable to areas that require a trans-disciplinary approach in order to address accessibility issues in built environment, services and transportation. The study is anchored in a self-reflective inquiry framework that moves freely between the inner and outer arcs of attention. Two key informants were interviewed. The self-reflective inquiry allowed for detecting assumptions, dilemmas, themes or reoccurring patterns that are part of the political viva voce of contemporary Swedish disability policy but necessitate interpretation to be converted into clauses in the two international standards, the Guide 6 and the recent Design for all. In order to validate the adductive theorems, notes and standardisation drafts were revisited.

Results

The study suggests that standardisation with a design for all perspective becomes an interpretive work in which words and phrases are contemplated in relation to an ethical and multi-professional framework. This framework is situated at the very interface between real-life settings and visionary thinking. As a consequence, participants in standardisation works revolving around design for all activate several individual knowledge fields of ethical, ideological, practical and theoretical nature. In communal discussions between the participants, the development of standards proceeds through an analytical work that is similar to an iterative creative process that uses concepts, phrases and words as instruments. The overall conclusion from the two standard developments is that a design
for all approach has to be centred on the fit between the design of a built environment, product or services and a wide range of human abilities.
Autostereoscopic 3D displays for in-vehicle applications.

Type: Abstract Oral Presentation

Category: Automotive

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Novel technologies like autostereoscopic 3D displays are providing a perception of the depth in a scene towards theirs users. Those added spatial informations allow a better user performance in recognizing and classifying on-screen objects as well as enabling better judgements of positions and distances for displayed objects and on-screen elements.

Autostereoscopic 3D displays, if implemented user-friendly into Advanced Driver Assistance Systems (ADAS) or In-Vehicle Information Systems (IVIS), are able to increase the effectiveness of such systems by providing distinguishable spatial relationships. Possible applications using an autostereoscopic where users' can benefit from spatial cues are for instance the instrument cluster, the navigation device or an intersection assistant. When implemented correctly, 3D displays will allow a better understanding of complex user interfaces and are overall capable of lowering driver distraction in decreasing the total eyes-off-road time and therefore, benefit directly towards traffic safety. The study examines the technology with regards to in-vehicle applications with their special requirements in content creation and influence on human factors like visual fatigue and content complexity.

We present a study with 40 participants judging the criticality of an intersection manoeuvre in a simulated traffic environment using an autostereoscopic display. The basic assumption of the experiment is that autostereoscopic monitors in comparison to 2D monitors allow a better assessment of traffic situations in the context of ADAS/IVIS applications as 3D displays are beneficial towards attention distribution, perceptual speed and motion detection. Therefore, we simulated two cars approaching an intersection with controlled time-to-intersection values ranging from highly critical to non-critical situations (0.3 - 2.0 seconds). Twelve manoeuvres were presented randomly in a bird's-eye view and a driver perspective on an autostereoscopic and a non-stereo display using a between study design. Data from basic visual function, subjective image quality and fatigue questionnaires as well as socio-demographic data were collected.

Results show, that 3D displays enable a better accuracy and judgement of positions in simulated traffic situations. While display technology does have an impact on the participants’ judgements, perspective does not have a high impact independent of the examined displays types. Regarding visual fatigue, the usage of autostereoscopic seems to be unproblematic despite a long exposure time. To conclude the paper, the proven overall suitability of autostereoscopic displays as an ADAS/IVIS application as well as implications for future research will be discussed.
Abstract

This study explores the relationship between space experience and human anthropometric sizes in different aircraft seat pitch. 294 participants experienced economy class seats in a Boeing 737 with 28 inches, 30 inches, 32 inches and 34 inches pitches for 10 minutes each. Sizes of the body parts were measured according to the DINED method (Molenbroek, Albin, and Vink 2017). The sizes taken were: stature, sitting height, eye height seated, buttock-knee length and popliteal height sitting with shoes. A space experience questionnaire was developed by using psychological comfort questions related to pitch from the study of Krems et al. (2012), and Menegon et al. (2017). The questions were tested using a 9-scale Likert with half using positive descriptors leading to comfort and the other half using negative descriptors leading to discomfort (Helander and Zhang 1997). These questions were completed while sitting in the current seat after the 10-minute period given to explore seat. A Spearman-rank correlation was done to the data using SPSS version 24. This study found that there is a strong correlation for all anthropometric measurements with the feeling of being restricted and the ability to stretch legs with out difficulty in the 28 and 30 inches seat pitch. The results also show that there are no correlations for the space experiment results for 34 inches pitch, while only the question related to the ability of stretching legs without difficulty had a relationship to the seated eye height in the 32 inch seat pitch. The data also shows that there were no correlations for the question on feeling lost and on the backrest to the anthropometric measurements.

Keywords: Aircraft seat pitch, Space experience, Anthropometric measurements

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Reference


Today there are two main ways to support activity of operators who manage complex process (technological) systems. First approach consists in transference of part of mental logical activity from human-operator to a computerized system with artificial intelligence, such as an expert system. Second approach intends for extension of human capabilities to process information and to make decisions in complex situations. An image based human-machine interface (such as ecological interface, cognitive graphics, high performance display) transferring a part of mental activity to the perception level (so called perceptual thinking) is one of the broadly recognized examples of the second approach implementation.

The present paper describes some ideas and experience gathered in the area of improvement of situational awareness of operators managing complex process system, such as nuclear power plant (NPP). We propose to combine conventional mimic based interface, ecological interface and function-oriented interface into integrated multi-layered adaptive interface which is sensitive to current situation. The ecological interface is considered as an image-based representation of dynamical process information. The function-oriented interface is aimed at representation of state of process functions rather than state of process equipment. The ecological interface and the function-oriented interface form two independent layers which can be superimposed on some basic layer, such as conventional mimic based process flow diagram.

The paper focuses on the problem of adaptivity of the interface depending on the situation and the task to be performed by operator. Adaptivity consists in making of a decision about which combination of particular layers should be visualized at the moment. The experience described in not numerous publications and gathered by us in result of empirical evaluation of ecological interface demonstrates prominent advantage of such approach to visualization in certain situations. However, in another situations this type of interface is not so useful and effective. In order to make decision about appropriate combination of interface layers some clear criteria should be elaborated. These criteria must take into account complexity of the task to be performed, the role of operator in this task (observer, supervisor or active participant), type of control actions to be done by operator, unexpectedness of the task, and other factors. All these factors are considered in connection with various process system operational modes and various control strategies.

One of the main problem arising when developing advanced interface is a formalization of the development process. Cognitive work analysis is recognized by many researchers as a universal approach to decomposition and representation of a process system. A modified version of this method combined with task analysis methodology is used for the purpose of adaptive interface design. The design process and the adaptivity mechanism are illustrated in application to simplified heat generation process system.
As preoccupation for climate change is of growing significance and call for disruptive innovation (Tyfield, 2017), Hydrogen Energy Technologies (HET) have been steeply identified as a potential key factor to address the energy transition (Cany, Mansilla, da Costa, & Mathonnière, 2017). Whereas social acceptance is recognized to be of great importance – and even equal to the technology – in the success of energy projects (Fournis & Fortin, 2017), HET’ acceptance is controversial.

The aims of this communication are (1) to portray the works that have focused on the acceptance of HET, (2) to highlight the limits of acceptance-based approaches to sugar the pill, (3) to point out the benefits of adopting a Prospective Ergonomics (PE) approach rather than an acceptance-based approach in technology acceptation issues, (4) to attest its relevance in the context of HET and (5) to propose a PE approach related to a need-seeker innovation strategy.

We gathered a total of 63 papers with a focus on HET acceptance, from 11 scientific journals within a wide variety of disciplines (psychology, energy, technology, sustainability etc.). Those papers were analysed through 39 criterions regarding study’s scope, innovation, method, theory, results and implications.

Our findings indicate that 54 studies followed a techno-centered approach of acceptation. Such method focuses on changes in the deployment of technologies, furthermore, it highlights technologies’ inadequacy to users, thus being subject to rejection. Hence, we stand for a human-centered and prospective approach which considers that user’s needs and uses must be anticipated to design technologies that meet those needs and offer positive experience. To shape technologies through future user’s needs and uses, we rely on the methodological approach adopted in PE which combine ergonomics, prospective and creativity (Brangier & Robert, 2014). Here traditional ergonomics methods are augmented with prospective and creativity, to consider the future in its complexity and to foster design process and make suitable innovation emerge. As such, this method is congruent with the need-seeker innovation strategy which is based on needs and uses’ anticipation to lead innovation. This strategy is known to be more efficient than the customary market-readers and technology-driver strategies (Jaruzelski, Staack & Goehle, 2014).

We propose a paradigm shift regarding technology acceptance approach by making the dichotomy between traditional acceptance-based approach and PE approach. While the first is techno-centered and aim to push for the use of a technology by modulating deployment conditions, the second is human-centered and have the ambition to shape the technology to the user’s requirements. Thereby, given the high stakes and the future oriented nature related to HET issues, we support the idea that a PE approach must be applied to ensure future uses. Future works foresee the use of the PE approach in designing HET.
Introduction. To set up standard references for output in forestry work, is not enough to carry out work studies, having only subjective criteria to choose the workers and to decide after if they are doing the job at the right pace. Output depends on the workload that a worker can reach in a sustainable way without fatigue or other risks and on the difficulties he can found to carry out his job, mainly related to the type of trees, climate and ground. In other words, in forestry there is no chance to demand of a worker always the same amount of work. This puts a difficulty to calculate incentives and salaries, especially when workers are paid by piece rate, Apud and Meyer (2004).

Objective: To propose reference tables for calculation of yields in manual forest workers.

Methods Follow-ups in the field were carried out using techniques proposed by Apud, et al (1989). Work load was estimated from cardiac frequency which was measured minute by minute during complete shifts together with time studies. Slope of the ground, environmental temperature and characteristics of the trees were also monitored. On this basis, statistical procedures were applied to the data and equations were proposed to calculate output. Afterwards, the equations were tested in forests of different degree of difficulty. For the purpose of this presentation, data collected during pruning will be discussed.

Results and discussion. The equation to estimate pruned trees per hour from the work load and characteristics of the trees was highly significant. When it was tested afterwards in different conditions, the estimation was within the standard error of the experimental equation. In this respect, the prediction could be transferred to the operation and used for the calculation of expected output and for the calculation of basic salaries or basic salaries plus bonus. The output, in any forest operation tends to be broad. Therefore, with predictions like the one proposed, managers and planners may have an objective basis to calculate salaries. For example, if a stimulus for production is going to be paid, this should be based on the difficulty of the job. However, it is important to highlight that these equations should not be used rigidly because they propose an estimation of yields per hour, but at least allowances for rest pauses and lunch should be considered to avoid fatigue.

Conclusion: The approach to obtain information on standard performance is laborious. Material and human resources are needed to spend time observing and measuring work. However, it is difficult but not impossible. Ergonomics specialists should struggle to develop research programs more than isolated studies with the aim to make forest work fair aiming to keep balance between wages and reasonable effort.
The aging population worldwide increasingly requires more research from different areas, where ergonomics plays an important role due to its multidisciplinary nature.

The relationship of the elderly with their objectual environment is specific and marginal in the representation of design. This makes it difficult for them to do the basic activities of daily living (ADLs) in the home environment. Their physical and cognitive specificities make us question and reflect on the factors that interfere in their performance and affect their autonomy, this requires us to promote an inclusive design for the elderly.

Therefore, we value the need to prevent the deterioration of older people, and thus promote their quality of life and autonomy. The more dependent senior citizens a country has, the higher the individual and collective costs that will affect the well-being of society.

By 2025, Chile is projected to be the oldest country in the Region with around 25% of the population being classed as elderly, with a progressive increase of dependent elderly people that adds to the structural inequality, thus we have an increased elderly population associated more and more with impoverishment and femininity. The social services approach this situation incipiently, where from the perspective of health, the dependence of the elderly is a health priority.

This proposal is part of the first phase of the institutional project of the University of Santiago de Chile, which seeks to relate the physical characteristics (postures and movements) and cognitive characteristics (perception) of older adults and the transition to dependence, in their ADLs. The scientific development of the subject was explored, through an INTEGRATIVE REVIEW that answered the question: What are the risk factors in daily life and its objectual environment, which threaten the posture, anthropometry and biomechanics of older adult men and women, which influence early dependence? We used 2 PUBMED and WOS search engines.

The results highlight that "physical space must be adjusted to adapt to the changes of physical, cognitive and emotional order caused by natural aging". On the other hand, it can be seen in several studies that lighting, the difficulty of hygiene maintenance and inappropriate furniture, are constant problems in the home, this is compounded by the risk of decreased memory, among others.

**Keywords**: Aging, Design for All, Healthcare.
The relationship between accounting and ergonomics has the potential to present two sciences that should already work together, but which have almost never been presented together. When performing an ergonomic intervention, the ergonomist is affecting the object of study of accounting, the equity of the company. These values are already available in several studies and in the experience of the ergonomist, however the general public does not have access to this information.

One of the objectives of accounting is to reduce informational asymmetry, by showing external users to the company all relevant information related to its assets. Thus, external users are able to have an appropriate amount of information for decision making regarding the company.

International accounting standards are issued by the International Accounting Standards Board (IASB) and followed (completely or partially) by 113 countries. In this scenario, it is emphasized that there are no standard or mention to the possibilities of the equity alteration that the ergonomic intervention can causes in the company.

The purpose of this paper is to elaborate an accounting standard in the same model used by the IASB, to be used by companies after the ergonomic interventions, in order to present the equity variation caused by the intervention and future possibilities of variations.

The methodology comprised of a combination of the expert knowledge of the researchers in Accounting and Ergonomics, a literature and exploratory interviews with experts from both fields.

Due to the nature of the accounting standards and legislation regarding them, the validation of the pronouncement will be based on the data of a case study with the company Petrobras, in which the team of the GENTE laboratory of COPPE / UFRJ performed an ergonomic intervention. The results are real, but have not been demonstrated by the company in the year that took the intervention, because there was no such regulation. It provides a basis for real comparison of the effects of the absence of such standard.

The development and application of such a standard with the ability to demonstrate the financial consequences of ergonomic intervention and its good practices will have as direct results, the disclosure of values with the intervention, the values that the company would lose without ergonomics intervention, etc. In addition, several indirect results, such as the presentation of ergonomics and its consequences for all users of financial statements, among other results.
The purpose of this study was to investigate the maximum acceptable weight of lift (MAWL) of Indonesian inexperienced manual material handlers. Twenty-one females, which had three different physical activity levels, voluntarily participated in this study. The participants were asked to determine their MAWL using the psychophysical method for two lifting task conditions that varied based on different lifting frequencies (0.2 lift and 4 lifts/minute). Heart rate data were also recorded to be utilized for physiological validation for the obtained MAWLs. The obtained MAWLs were compared to the MAWLs of experienced manual material handlers, using published data. A two-way analysis of variance was also performed to examine the effects of physical activity level and lifting frequency on the MAWL. Also, one sample t-tests to examine the position of the obtained MAWL to the physiological criteria cut-off value were performed. The results of this study determined that the MAWL that could be lifted by 75% of the study population under 0.2 lift/minute lifting frequency was 12 kg. Furthermore, the analysis of variance test results showed that the differences in physical activity level did not significantly affect the obtained MAWL (p=0.890). A significant effect was more attributed to the lifting frequency differences (p<0.001). Moreover, the physiological analysis shows that the energy expenditures which required for lifting under 0.2 lift/minute were less than the physiological criteria cut-off. On the other hand, those for lifting under 4 lift/minute was significantly more than the cut-off. The result of this study might be utilized to be considered during the determination of the safety lifting limit for inexperienced manual material handlers.
[1402] Patient Safety Culture in Education and treatment centers: Regional Subcultures

Type: Abstract Oral Presentation
Category: Healthcare

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Background: There is increasing interest to prevent patient injury as the main value in healthcare institutes. However, many patients are still in danger while they receive care services. One factor which influences patient safety is national culture. However, there is no evidence of regional subculture contributions. The aim of this study was to investigate the relation of two different regional subcultures on patient safety culture in education and treatment centers (medical universities hospitals).

Methods: This cross-sectional study assessed the relationship of two regional subcultures in Iran (Turk and Kurd) on patient safety culture. Four education and treatment centers affiliated to Zanjan (Turk subculture) and Ilam (Kurd subculture) were investigated. A sample of 421 nurses, laboratory, and radiology staffs participated in this study. Two kinds of data gathering tools were used, including hospital survey on patient safety culture questionnaire (HSOPSC), and Hofstede’s cultural values. Besides descriptive statistics, analytical statistics tests were used at .05 confidence level, including Chi-square, Mann-Whitney, and Linear regression.

Results: Positive response of the dimensions of HSOPSC questionnaire has not been more than 75% (patient safety strength). The total scores of HSOPSC for Turks and Kurds were significantly different (p-value = .016). Moreover, comparing the results of HSOPSC and Hofstede’s cultural values questionnaires showed significant coloration (p-value = .01) between patient safety culture and three dimensions of Hofstede’s cultural.

Conclusions: It seems regional subculture has its own contribution to patient safety culture. Therefore, considering subculture values as predictors will be helpful to improve patient safety culture.
Comfort of a large goods vehicle driver has a crucial factor on fatigue one of which being physical (muscular) fatigue, which has common indicators of pain in the back and legs caused by prolonged voluntary and involuntary muscle activities as an attempt by the body to counteract the vibrations induced via the seat. Therefore, drivers working under uncomfortable driving conditions, encounter ergonomic problems, increased fatigue and require additional rest time. Consequently, these rests increase both in time and numbers resulting with lost logistics time and reduced efficiency. Additionally, these drivers suffer from medical issues both physically and mentally. It is shown that muscular health complaints is mostly accompanied by mental health complaints (e.g.: stress, burnout etc.). These muscular and mental health complaints increase drivers need for recovery, however drivers undergo problems to recover from this work-related fatigue at the end of work day. Though it may be seen as an acute issue, in long term, the accumulation of restlessness may induce the development of psychosomatic health problems. Hence, drop in medical status and efficiency of drivers burden the organizations with major financial costs, via sickness absence of worker, compensations of absenteeism, errors or mistakes occurred at work caused by sudden pain, stress, and etc. Therefore an uncomfortable driving experience becomes not only a health issue for the drivers but also an economical inconvenience to the company. To increase comfort and prevent these issues a $H^\infty$ controller with a dynamic output feedback was proposed in this study. This controller was designed and modeled with linear matrix inequality (LMI) method, and implemented on a model of a half semi-trailer truck augmented with a human-seat couple model. Both uncontrolled and controlled cases were simulated and compared in terms of the comfort level of the driver with respect to ISO 2631 standard. As a result, controller decreased the root mean square (RMS) acceleration on the human-seat couple and increased the comfort. Originating from these results, a discussion was made in the perspective of human factor such that, reducing the vibration is not only meant to increasing comfort of driver, but also eliminating the negative effects of discomfort on safe driving and reducing fatigue.
The contribution of organizational creativity to safety: the key role of requisite imagination

Type: Abstract Oral Presentation
Category: Others

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The inclusion of HFE in the design of safer sociotechnical systems first began, with the advent of Human Reliability Analysis methods, with a shift from technical to human failures as possible causes to system failures and accidents (Swain & Guttman, 1983). Subsequent authors went on to argue that failures of the human component of these systems (i.e. “unsafe acts”) might be best understood in terms of “latent conditions” – system characteristics which only lead to failure in specific conditions, and which are often the result of organizational decisions (Reason, 1990). This led to two major consequences: 1) a shift away from the view of human agents as an agent of unreliability to an agent of reliability, and 2) the acknowledgement that organizational factors might contribute to system reliability, and not just to possible failures (Weick & Sutcliffe, 2001).

Creativity is often described as the ability to produce work that is both novel and suited to task characteristics (Amabile, 1996). In the context of systems safety, this is generally understood in one of two ways: 1) the ability for workers to adapt to situations where resources provided by the organization to ensure system safety are ill-suited to the situation, and to improvise novel and more appropriate solutions; and 2) the ability for systems designers and other stakeholders involved in organizational design to exhibit “requisite imagination”, i.e. to anticipate what might go wrong and propose means to prevent such failures or mitigate their effects (Adamski & Westrum, 2003). The existence of two kinds of resources – individual and organizational - to ensure systems safety is sometimes referred to as a distinction between regulated safety on the one hand and managed safety on the other (Nascimento et al., 2014).

In this paper, we argue that this anticipation of potential situations of system operation and failure can be considered as a manifestation of organizational creativity (Mumford et al., 2012). We conducted an intervention within a nuclear facility whose goal was to anticipate adverse effects of evolutions in domain regulations concerning systems safety. In order to anticipate future problems and propose solutions, various stakeholders took part in a process of inquiry. However, this inquiry was mostly of a technical nature, whilst organizational aspects were largely excluded. To remedy this, we opened up a discussion space to gather the stakeholders to discuss organizational design whilst stimulating requisite imagination. Exchanges uttered in this discussion space were transcribed and subjected to an analysis of the dynamics of interaction (Détienne et al., 2016) and narration (Lorino, 2005), allowing the identification of the various stages of the inquiry and the narratives constructed around present and future situations of system operation. We discuss three implications of these findings.
Driving is a complex and demanding activity, thus, is mostly accompanied with stress. Driver stress is found to influence psychological and physiological health of drivers, resulting with, increase probability of fatal accidents (Hennessy, Wiesenthal & Kohn, 2000). Stress can impair driver performance by both distracting and leading to maladaptive coping strategies (e.g. confrontive coping). Matthews (2002) who developed first driver stress model, defined five coping strategies specific to drivers. These are confrontive coping strategies, emotion focused coping, task-focused coping, reappraisal coping and avoidance coping. Confrontive coping is found to be related with risk-taking behaviors (Emo, Matthews & Funke, 2016) and higher mistakes and violations (Kontogiannis, 2006). Similarly, emotion-focused coping was found to be related with higher mistakes (Kontogiannis, 2006) and higher injury rates (Shamoa-Nir & Koslowsky, 2010). On the other hand, task-focused coping was found to be an important factor on explaining driver’s performance and safety behaviors (Machin & Hoare, 2008). Coping strategies are related with not only driver behaviors, but also driver health. According to study of Machin and Hoare (2008), confrontive coping was found to be related with need for recovery and physical symptoms of bus drivers. Bus drivers who prefer confrontive coping strategies were observed to be experienced more severe symptoms to warrant medical attention, became more fatigued and reported more negative affect. On the other hand, appraisal coping strategy was found to be related with more positive affect at the end of workday. Matthews and his colleagues (1991) linked drivers’ emotional well-being to their ability of detecting hazards and dealing effectively. In current study, it is investigated whether Turkish driver’s affect as emotional well-being predicts drivers’ coping strategies. The regression analysis showed that negative affect is significantly predicted confrontive coping strategies. On the hand, positive affect significantly predicted reappraisal coping, task-focused coping and avoidance coping. To sum up, better the drivers feel, better and safer they cope with stress in traffic. It was suprising that emotional-focused coping is found to be related with both positive and negative affect. This result might be related with cultural traits. In Turkish culture, worry, self-criticism and regulating emotions by repression, which are characteristics of emotion-focused coping, are promoted behaviors. Therefore, drivers with high positive and negative affect reported significantly high emotion-focused coping. Based on the results, it is clear that drivers’ emotional well-being, affective state, predicts coping strategies they prefers. Preferring maladaptive coping strategies results in fatal accident and poor health. Especially, for professional drivers, whom work in traffic, stress is important part of their job. Organizations should pay great attention to this issue.
Abstract:

Since 2004 we have been analyzing and understanding aviation accident investigator’s work, starting from France at the BEAD-air board, and following with JIAAC, in Argentina during the last two years. Our work started by a requirement from the BEAD accident investigators who were very concerned about applying well their conceptual and methodological knowledge following James Reason's principles in the accident investigation process. The problems they face having to investigate violation of rules was the first object of our research, since it was directly stated by these investigators as a real problem to solve during the accident investigation process. We have stated our PhD Project on that basis, focusing our analysis on that problem, understanding why it was really practically impossible for them to accomplish that goal during accident investigations without having to infer too much the intentions of actors who have violated the rules, without having to avoid publishing their findings when they finally could access that level of information. The context of accident investigation is, indeed, a very hard one and other objects of investigation are also difficult to grasp, like the second one we got to better understand little by little: systemic causality. Indeed, this other object is complex for the accident investigators to analyze, to obtain information about, and also to write in the reports. As violation of rules, the difficult part of their work is writing what has been analyzed with many difficulties. It is in a sense, an impossible goal to achieve, that has impacts on their reliability and health, being sometimes judged on the basis of the reports that don’t really reflect their real performance. Nowadays we are starting a new Project with JIAAC which combines an ergonomic approach with a psychological approach to be able to prevent the consequences of stress during inevitable context that are exposing them to the death, to suffering people like victims or their families, to their own suffering since sometimes they lose friends or family members. This kind of suffering comes in addition to all the organizational and judicial aspects that interfere with their work, and our goal as a team is from now on, to prevent as much as possible the factors that generate stress in accident investigators. Lately we have combined our intervention as ergonomists with the necessary psychological assistance to avoid further post trauma stress disorder symptoms. This work is an innovation in our aviation world, and we would be delighted to share our advances during 2018 IEA congress.
Architectural risk of buildings relates to the possibility that technical and environmental elements of buildings interiors and outdoor spaces, may create dangerous situations for health and safety of occupants due to their engineering properties and their state of preservation, maintenance and use. Criteria of architectural risk are mainly related to the safety and well-being performance of the buildings, since these qualities provide occupants the conditions to meet their personal, social and material prerogatives, protecting their health.

The paper discusses a study on a risks assessment protocol related to the characteristics of buildings. Despite architectural risk is mentioned in few work safety regulations, everyday practices demonstrate a poor consideration of this risk category, that is applied to a limited number of built environment aspects. On the other side, many evidences highlight the strong relation between occupants’ injuries or diseases and technical and environmental characteristics of life and work environments. From this background, the study presents a Protocol for the Assessment of Architectural Risk defined for working environment by the LEAS, Laboratory of Applied and Experimental Ergonomics of University of Naples Federico II, in partnership with the Campania chapter of INAIL, the National Institute for Insurance against Accidents at Work. Occupants comfort and safety have seen as Key Performance Areas for architectural risk controlling; KPAs have been detailed in architectural requirements for technical and environmental aspects of buildings. Then, specific sets of risk indicators, for each requirement, have been defined and arranged in forms, to be simply applied for the assessment of the building in its whole as well as for each single room or space.

Through the application of the Protocol to an office building, the paper also discusses Protocol applicability to buildings for different sectors of activities. Main results of its application are presented.
Differential Effects of 8 and 12 Hour Non-rotating Shifts on Alertness, Sleep and Health of Public Safety Workers

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The public safety workers follow shift schedules to provide round the clock safety and security for our community. It is well established that shift work disturbs sleep, which impacts alertness, and health of the workers [1, 2]. A compressed work week utilizing 12 hour shifts is gaining popularity because it requires fewer workdays and provides a larger block of time off, in a week [3, 4]. However, longer work shifts have been found to increase fatigue, and decrease performance and alertness. Several researches investigated these effects of rotating shifts [5, 6, 7], but research of non-rotating 8 h and 12 h shifts are limited and not well understood [7].

The present study evaluated employees of the Public Safety Department of New Jersey Institute of Technology, working in five non-rotating shifts (8 h: Morning, Afternoon, Evening and 12 h: Day, Night). A questionnaire survey, based on the standard shiftwork index [8] and, approved by the Institutional Review Board, was used to acquire data from volunteer participants. The data collection was continued for about two months and 39 participants out of 78, (50% response rate) filled out the questionnaire. The survey included 29 questions covering alertness, sleep habits, and wellness factors.

Participants were aged between 18 and 50, predominantly male (78%), had an average (stdev) shift work experience of 5.68 (0.85) years, overtime per week 9.75 (9.91) hours. The workload ratings were not significantly different between any of the groups studied.

The survey data were analyzed using single factor ANOVA, with Turkey’s test of difference to compare 8 h versus 12 h shifts. Those that work 12 h shifts noted significant reductions in alertness level at the early stage (p=0.033), mid-stage (p=0.052), and during the overall shifts (p=0.076). They scored less sleep duration (p=0.023) and scored higher sleep insufficiency (p=0.088) and negative effect of shift type on sleep (p=0.037). Among various wellness factors, 12 h shift workers noted significantly (p= 0.005) higher frequency of “back or lower back pain.” As opposed to the other studies on rotating 12 h shifts [3, 5, 9], the mean satisfaction score for 12 h shift type was not any different from that of the 8 h shift type.

The results of the study strongly support the hypothesis that a decreasing level of alertness and increasing sleep and health problems are associated with a non-rotating 12 h shift, which is also
highlighted by the previous researchers on rotating 12 h shifts [5, 9, 10, 11]. The results of this study could be useful when designing interventions to improve the shift work experience.
MEDIATING ROLE OF LONELINESS AND ORGANIZATIONAL CONFLICT BETWEEN WORK OVERLOAD AND TURNOVER INTENTION

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Abstract

The fact that organizations offer employees a positive organizational climate not only increases employees' happiness levels but also raises the level of creativity of employees. When it is thought that the only way for organizations to survive in a competitive environment is innovative and creative applications, the positive dynamics within the organization once again emerges.

This research focuses on negative behaviors such as work overload, loneliness, organizational conflict and turnover intention which affect employees' creativity and it aims to discover the mediating role of loneliness and organizational conflict between work overload and turnover intention.

In the present research, a survey was conducted including 145 service sector employees. To analyze the demographic characteristics of the participants, internal consistency and correlations of scales, SPSS 22.0, and to test the mediating role, SmartPLS 2.0 for were used.

According to the analysis results; it is determined that between work overload and turnover intention, loneliness and organizational conflict have a mediating role. When all the results are evaluated together, work overload in the organization forces employees to extreme behavior and it is found that employees feel loneliness or conflict, and as a result, their turnover intention increases. Related to this, it is possible to say that the overloaded employees get further away from creativity.

Keywords: workload, loneliness, conflict, turnover intention
This paper investigates a relationship between democracy and migration using a panel of 190 countries over the period 1960-2015. We employ a dynamic panel model in identifying the impact of democracy on migration. Following earlier literature, our model includes lagged dependent variables of migration to capture the effects of social network. The reason of controlling for social network is that it plays a significant role in migration as the migrants attempt to take their families, friends and relatives back in home countries to host countries. We use a dynamic fixed effects (DFE) within estimator capturing time invariant country and year fixed effects. If democracy and social network are uncorrelated with the error term and both follow stationarity process then DFE estimators are consistent.

A more worrying fact is that our model may suffer from endogeneity resulting from the correlation of democracy with the time-varying unobserved factors. We follow an instrumental variable (IV) strategy to address this problem. This paper uses democratization and reversal waves as instruments for democracy.

We pursue different strategies to check the robustness of our results: First, we modify our model including different economic factors (economic development, population and employment) and political factors (political stability, rule of law). Second, we use different other measures of democracy (freedom house and polity2), and finally, we apply other instruments for democracy (domestic democratic capital and foreign democratic capital) to check robustness of our results. All these strategies show that the main result remains comparable with these modification of our model. We also find that the persistence in social network is less than 1 which implies our DFE within estimator is consistent.

We also discover mechanisms through which democracy functions on migration. The intermediate variables such as dual citizenship, outgoing remittances, health, human development and human capital are the channels through which democracy works on migration. Our test of mechanisms suggest that democracy attract migration by improving human development and human capital while other channels are not confirmed due to small sample size.
Our analysis indicates that the estimated effects of democracy on migration is positive and statistically significant both in the short-run and long-run. Our results provide evidence that democracy can increase migration by 53% in the long-run. On the other hand, the results of this analysis show that persistence in social network is 0.60% implying a 1% rise in social network attracts a 0.60% migrants in democratic countries in the long-run.
An Ergonomic Program in a Chemical Plant of Rhodia/Solvay in Brazil

Type: Abstract Oral Presentation
Category: BUSINESS CASE - Manufacturing

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Since 2002, an ergonomic program, assumed by the management of the industrial site, including the participation of employees, being done comes to identify, analyze, solve and control ergonomic risk factors at work. The steps of the ergonomic process are: 1. training of the employees in ergonomics (main concepts, risk factors identification, simplified and some advanced methods of ergonomic analysis, record activities/tasks; discussion and choice of solutions, action plan, implementation of solution, follow-up); 2. formation of the working group by plant; 3. identification of activities with potential risk to cause damage to health; 4. ergonomic analysis of activities/tasks at workplace and photo/filming of them; 5. discussion of collected data, seeing photos/films and classification of risk degree, in group; 6. discussion and choice of solutions in group; 7. elaboration of technical report; 8. fill indicator «ergostatus»; 9. elaboration of action plan by the team of the plant; 10. implementation of solution; 11. follow-up after implementation of solution; 12. update the indicator. The main achievements were: office furniture adequations; labs furniture and practices adequation; elimination of manual lifting to loads > 20 kg; mounting of several mechanical lifting load devices; installation of force reduction devices in valves; automation of processes (ex.: filling and charging barrels at logistic; silica amorphous packing); improvement of management of equipments (forklifts in logistic); the initiative of each area or plant to identify and eliminate ergonomic risk factors (nowadays each area or plant has an employee in charge of ergonomics issues). The solution to eliminate or reduce the intensity of ergonomic risk factors range from simple adjustments of the positioning of a computer monitor on a desk to complex modifications that involve automating the packaging of chemical substances in powder or in the packing of liquid products. In parallel, gymnastics activities in the workplace are performed daily by the teams. In 2009, in a critical analysis system (CAS) involving all HSE practices, there were 91 tasks with high risk to cause injury in the upper limbs or in the vertebral column. In the last critical analysis system (CAS), in 2016, there were only 02 tasks to solve. As a result of the ergonomics program, the occurrence of WRMD or a more severe Low Back Pain cases are rare events: 1 case each 4 years. More recently, the application of Ergonomics of design in the construction project of a new chemical production plant came to ratify the recognition of the Ergonomics Program by the site managers. In conclusion, the political will of the industrial site management of a Chemical Plant of Rhodia Solvay associated with employee participation were determinant to reduce or eliminate the ergonomic risk factors of work activities.

PS: There are photos to illustrate this presentation.
Thinking with hands, acting with minds: embodied cognition and creative practice

Type: Abstract Oral Presentation
Category: Manufacturing

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Traditional conceptions of 'creativity' have often assumed that the creative person is able to imagine a finished product and then bring this forth through their skill in making things. This separation of the creation from the production of objects is a central aspect of Mass Production systems. It is also used to separate the 'artist' from the craftworker. In this paper, I show how the newly developing theories of Embodied Cognition (in which 'thinking' is shown to be as much a matter of physical interaction with things as it is mental representation) can be used to illustrate when and how 'creativity' arises in the design and production of jewellery. Through a series of case studies and data collection in the field, I demonstrate the points at which creative reflection are acted upon (even when the jewellers might not be able to put into words what their 'cognition' was. This part of the presentation will be draw partly on a recently published paper written by the author, a philosophy and a jeweller, and partly upon the author's previous work on cognition and tool use.

I argue that not only does Embodied Cognition provide a clear and parsimonious account of how jewellers create their objects, but that it also provides a strong and compelling theoretical basis for Ergonomics. By marrying our understanding of how people physically interact with their tools and the world around them, with our understanding of how goal-directed actions are performed, the theory of Embodied Cognition (and, in particular, Chemero’s Radical Embodied Cognitive Science) will be shown to be fundamental in shaping Ergonomics ability to explain and analysis human activity.

From the discussion of Embodied Cognition, and its relationship to creativity in jewellery making, the talk will conclude with observations on how Manufacturing practice (particularly in terms of low-volume, high-quality production) can be reimagined and how this could create new visions of the practices surrounding this.
The welfare state has been, and perhaps may still be, the most effective instrument to guarantee a fair and redistribution of resources among citizens and the removal of obstacles that do not allow everyone to have equal start opportunities.

The necessary multidisciplinary in the "healthy and sustainable" management of welfare, clearly not only limited to the economic level, calls into question the ergonomic methodology.

The research examines the Italian context that historically has seen an internal imbalance in favor of the social security system in constant growth over the years compared to other items of expenditure, also because it includes social assistance. The crisis has exacerbated the sustainability of welfare state, because the offer of public system does not cover the increase in the demand for social safety net, and privatization of welfare seems to become a necessity.

The study discusses the relationship that should be established between public intervention and private action to guarantee the universality of social rights, that is accessibility to quality services. It is part of the debate that aims at reforming and enhancing the welfare state in cooperation with the private sector.

The research was carried out by a multidisciplinary group, with the participation of researcher with humanistic, sociological and psychological background, and the use of various investigative tools such as bibliographic analysis, historical research and a survey through qualitative interviews to exponents of the academic, business and political world.

Reference:

Dr. Daniele Babusci deals with Labour History, Ergonomics studies and Welfare system. He graduated from the University Roma 3 with a thesis on the absenteeism of the workers in the seventies, he obtained a master's degree in Ergonomic and Human Factors promoted by the SIE and now he is working at the CNR-IRPPS, social policies sector.
Slips and falls have been known as the primary causes of hospitalization of seniors in Canada. Footwear that is designed to have good slip resistance on snow and ice can reduce the risk of falls and allows older adults the ability to safely stay active year-round. Until very recently there was no objective information available to consumers to help them select footwear for use in icy weather.

Our team at Toronto Rehabilitation Institute (TRI) has recently developed a new method to evaluate the slip resistance of winter footwear by having participants walk up and down icy slopes in ecologically valid environment. To date, over 200 footwear models have been tested, only 20 have been found to surpass our minimum standard for reasonable slip-resistance performance and some of them lose their slip-resistant properties with minimal wear.

To overcome the limitations of existing footwear outsole materials, we have developed our own line of novel textured composite materials with superior slip-resistance and abrasion-resistance. Our composites have a unique structure that consists of soft rubber compound (thermoplastic polyurethane, TPU) reinforced with microscopic fibers protruding out from the surface and were fabricated by means of compounding followed by ablation.

The ice friction characteristic of our novel composites were assessed before and after simulated wear using SATRA STM 603 Slip Resistance Testing machine by applying a specified normal force pressing the test material onto a test surface and then moving the test surface horizontally while recording the shear force. The ratio of the normal force and shear force is used to calculate the Coefficient of Friction (COF). The surface science of the composite was also analyzed by using Scanning Electron Microscopy (SEM) imaging for visual characterization.

Results of this work have demonstrated our novel composites have excellent slip-resistance performance on ice with a very high COF (0.61 ± 0.05) even after extensive wear. For comparison, the best footwear on the market today have COFs in the range of 0.15 as measured by the SATRA machine. We can estimate that a footwear outsole with COF 0.6 will be able to maintain grip on icy inclines of ~31 degrees while outsoles with COF of 0.1 will likely only maintain grip on icy slopes of up to ~8.5 degrees. The results of SEM images confirmed that the hard microscopic fibres extending out of the surface penetrate icy surfaces, while softer components of the outsole mold against hard substrates ensuring good grip on icy surfaces. Our results have demonstrated that our new surface-textured composites have superior tribiological properties than what is currently available in the market and therefore have great potential for preventing many winter slips and falls once they are incorporated in commercial footwear.
European law concerning Occupational health and safety prevention recognise the Medical Doctor, specialised in prevention at work, as one of the most important players in evaluating a work place in relation to the people that will use it and in relation to their specific health status.

The MD is supposed to visit the work place just once a year, sometimes twice. Medical visit are usually concentrated in one week, once a year. Sometimes, in biggest factoryes, once every two weeks. So the MD is usually in the factory for a couple of days in the year, or maybe one day every week...but not much more.

We proudly follow 1600 factories, since 1992, and the media of the days in each one is twice. There are just a few exception.

But it frequently happens that the patient needs the doctor during the year. After a long period at home for example, or because something occured to him and work seems to get it worste, or just to change the work activity.

So we tried to find out a way to create a new relation with them, using telemedicine. Now there are just a few experience about it, concerning the monitoring of blood pressure and some blood parameters like glucose, but nothing about lungs and heart, no significant usage for abdomen.

We started working with an expert of hardware, able to build sensors that can not only register sounds of lungs and heart (actually that is not simple at all, there is nothing yet built and it's half a year we are working on it) but that can simulate the touch of the hands on the abdomen for example, so that we can feel the liver or the intestine of the patient, without being there.

This new way of relating to workers can create an innovative way to "live" with the MD in workplace, being closer to him, making it easier for him to reach the person when he/she needs.

In biggest factories all the sensors and hardware can be left in an nursing room. In smaller ones we can imagine that a nurse can carry the hardware to the place in which the worker is, apply it, and then connect by a PC with an apposite software, to the MD in remote.

We do believe telemedicine applied in healthcare prevention can be very useful and complementary to the "old" way of acting. Can generate a great amount of data about individual health in the years that will be very important in the getting elder of people and in their follow up after the end of the employment relationship.
The effect of a passive trunk exoskeleton on metabolic costs during lifting and walking

Type: Abstract Oral Presentation

Category: Healthcare

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Background

Physiological strain needs to be considered in addition to mechanical work-related risk factors for low back pain (LBP). High physiological strain can result in systemic or local fatigue which might increase LBP risk. Using assistive devices, i.e. exoskeletons, that passively support the user’s trunk may reduce moments around the low back and hence muscle activity. Therefore, it could be expected that these exoskeletons also reduce metabolic load and as such reduce the risk for injury in the lower back. On the other hand an exoskeleton may hamper performance by increasing energy cost of other tasks such as walking.

Objective

To assess whether wearing a passive trunk exoskeleton affects the metabolic costs during repetitive lifting and walking and analyse which underlying changes in movement strategy and muscle activation patterns could explain these effects.

Methods

We measured energy expenditure in 11 healthy men during 5 min of repetitive lifting and 5 min of walking, with and without an exoskeleton (Laevo Interspring Delft, NL). Participants had to lift and lower a 10 kg box from two heights at an auditory imposed pace (6 lifts/ min) in three different conditions: (1) Control (without the exoskeleton), (2) Low-cam Exoskeleton (supports at bending angles >20 degrees) and (3) High-cam Exoskeleton (supports at bending angles 0-20 degrees). In the walking protocol, participants walked with the Low-cam Exoskeleton and without the exoskeleton at two different walking speeds: a) preferred walking speed determined without the exoskeleton and b) preferred walking speed determined with the exoskeleton. For both tasks, kinematics and muscle activity of back and abdominal muscles were collected.

Results

During lifting, metabolic costs decreased by 8% and 16% when wearing the low and high-cam exoskeleton, respectively. This could partially be accounted for by the fact that participants tended to move through a smaller range of motion when wearing the exoskeleton. When lifting from ankle height, the amplitude of the COM was smaller with the exoskeleton than without, due to a decrease in downward movement. Additionally, back muscle activity decreased, while abdominal muscle activity increased with the exoskeleton.
For walking, metabolic costs increased by 14% when wearing the exoskeleton. Participants preferred to walk faster without the exoskeleton and shortened their steps when walking with the exoskeleton. EMG showed an increase in abdominal muscle activity when walking with the exoskeleton.

**Conclusion**

Wearing an exoskeleton during lifting decreased metabolic costs and may hence reduce the development of fatigue and LBP risk. On the other hand walking with the exoskeleton increased metabolic costs. This stresses the need for a support system that can be disengaged when walking.
Stereotypes are conditioned reflexes which have become subconscious and ‘automatic’. The term “population stereotype” is used to describe this response preference, which refers to long-term habits and well-ingrained knowledge of a particular population. Colour is one of the main features of any visual scene having the potential to improve or spoil the user experience. It is a highly salient feature of a stimulus in human visual perception. The need of colour stereotype study lies at the works which constantly needs to use repetitive colours by the workers. Evaluation of the expectations of the workers during these type of visual works can be helpful in designing the colour set ups which may lead to more error free works and pleasant user experience. The main aim of the present work was to study and analyze the color stereotypes patterns of the female population in Eastern India. To serve this purpose a color chart was prepared with four set of concepts represented by nine different colors. A total of 1640 adult female subjects from West Bengal, Bihar, Jharkhand and Orissa were volunteered for this study. A male population sample (n=1987) was also drawn for comparison purpose. The subjects were asked to choose colors for different concepts and their color preferences were recorded as the result. It was observed that a relatively larger percentage of the female subjects preferred red color (66.42%) for “hot”, blue (35.65%) for “cold”, green (54.31%) for “on”, red (47.0%) for “off”, green (37.9%) for “safe”, red (77.4%) for “danger”, green (75.3%) for “go”, yellow (46.2%) for “caution” and red (76.5%) for “stop” symbols. It was also noted that there was no significant difference in the color preference between male and female subjects (except the female subjects who mostly preferred black color for “off” symbol than the red color). Significant gender difference (p<0.05 or less) was found for color stereotype strengths. There was no significant difference in color preferences and color stereotype strengths between the rural and urban subjects of both sexes. However, rural–urban difference in color preference was noted in male subjects only in one case. The urban male subjects predominantly preferred pink color for “cold” whereas rural males selected blue color for “cold”. It may be concluded that no rural-urban difference in color stereotype was observed among the subjects whereas gender had predominant impact on color stereotype in the population of Eastern India.
Sustaining overload caused by arresting load is the main factor of the pilots' neck injury during the arrested landing of carrier-based aircraft. Take the neck load and injury of the carrier-based aircraft pilots as research object in this study. As a consequence of the induction and analysis of the existing research methods for neck injury, the method based on finite element simulation was chosen to simulate and analyze human neck load and injury when the pilots were subjected to the arresting load during arrested landing of carrier based aircraft. The results of this study may provide important theoretical basis and references for the design of the carrier-based aircraft landing training task as well as the design and improvement of the neck safeguard of the pilots. The main research work of this study is as follows:

(1) Proposed a finite element model that of highly biofidelity. And on the basis of the experiments on basic movements of head and neck conducted by Panjabi et al and the experiments on the human volunteer head-neck frontal impact performed by Ewing et al, the effectiveness of the finite model was validated from two aspects of static and dynamic.

(2) Finished the simulation and analysis of the human neck load and injury during the arrested landing. Took the arresting load that the carrier-based aircraft pilots experienced during the arrested landing as the load input and boundary conditions, and utilized the validated finite element model to carry out the simulation. Finally, made the analysis and discussion of the parts that susceptible to injury of the cervical vertebra, according to the mechanical response of vertebras, intervertebral discs and ligaments. Results indicated that disc between C7 and T1, back vertebral arch of C2 in the downside, C3, C4 and C5 transverse process, right side of C6 top articularis, both sides of bottom vertebral arch in C7, as well as both sides in spinous process of T1 bear more stress than close region. These regions may be injured due to long time accumulative effect. Capsular ligament, interspinous and supraspinous ligaments have a greater amount of tensile elongation. Therefore, articular surface and spinous process were likely injured because of the ligament injury. In addition, took the advantage of the dynamic response data obtained in the simulation as well as the NIC and Nij neck injury criterion to make prediction and analysis of injury.

Key words: sustaining overload, arresting load, neck injury, simulation and analysis
The Art of Handoff: Recipient Design and Information Tailoring During End-of-Shift Handoffs

Type: Abstract Oral Presentation
Category: Healthcare

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Human Factors and Ergonomics Domains: Healthcare Ergonomics

Productive sectors and services: Healthcare

Background: Handoff interventions have focused on structured communication but practices vary widely. Thirty-five residents participated in interviews using a handoff as a prompt for in-depth discussions. Six cognitive tasks emerged during handoff preparation: 1) communicating status and care plans; 2) specifying tasks for the incoming night shift resident; 3) anticipating questions and problems likely to arise; 4) streamlining patient care task load for the incoming resident; 5) prioritizing problems by acuity, 6) ensuring that documentation is current. The cognitive tasks identified may help explain why standardization of handoff content has been insufficient and may inform more effective strategies.

Objectives: 1. Describe and identify the potential points of failure and cognitive challenges in between and during key types of patient transitions and appreciate that effective handoff communication is a social interaction where relational factors are balanced against content rather
than a mechanistic process of exchanging information. 2. Consider the complex cognitive and environmental factors that impact patient handoffs between shifts, and different microsystems of care. 3. Describe successful service and physician training interventions that highlight the implicit rules about how handoff information is omitted, customized, or expanded based on perceptions about incoming providers, and considers the important role of feedback to learners that is essential for effective, safe handoffs.

**Methods:** We interviewed residents in training managing cognitive demands associated with anticipating and developing expectations as they prepared for handoffs. The interviews were conducted in 2016-2017 at 3 U.S. Veterans Administration Hospitals using cognitive task analysis (CTA) and the data were entered into NVivo. For this analyses, three analysts independently reviewed the data within the preparation and handoff tool use categories by grouping related data excerpts, identifying themes and insights, and arriving at a consensus on the key themes and findings.

**Results:** Our findings suggest that resident physicians' cognitive preparation for the handoff plays a critical role in promoting system resilience. Residents attempt to reduce coordination errors and safely transfer responsibility for patients to their colleagues while anticipating the complex exchanges between individuals and across teams of clinical providers. Our analyses revealed six key cognitive tasks, or “themes”, that residents engaged in while preparing for end-of-shift handoffs, as well as a description of external resources used to support end-of-shift handoffs. We discovered six key organizing themes for patient handoffs: Theme 1: Communicating status and care plan for each patient. Theme 2: Specifying tasks for the incoming night shift. Theme 3: Anticipating questions and problems likely to arise during the night shift. Theme 4: Streamlining patient care task load for the incoming resident. Theme 5: Prioritizing problems by acuity across the patient census. Theme 6: Ensuring accurate and current documentation.

**Conclusions:** Our research focuses on cognitive preparation for the handoff, activities critical to effective coordination yet easily overlooked because they are not readily observable. The cognitive activities identified point to strategies for cognitive support via improved technology, organizational interventions, and enhanced training. Supporting underlying cognitive tasks will increase the ability of residents to conduct effective handoffs under a wide variety of conditions and clinical contexts, a key tenant of resilience engineering. Our focus on system resilience provides a broader view on potential strategies to standardize handoff content and provides a more realistic (naturalistic) approach to supporting residents (and other providers) in coping with the complexities of end-of-shift handoffs.

**Implications:** Our study advances the understanding of the influence of the cognitive tasks residents engage in as they prepare to handoff patients form day to night shift. Because patient handoffs have been identified as a common point of failure in health systems, they represent an important leverage point for improving patient safety, cost reduction, and system resilience. In fact, care coordination has been identified as an important juncture for improving resilience in complex sociotechnical systems in general, and in healthcare specifically.
The growth in air transport and global phenomena, such as population aging and the increasing number of people with disabilities and of obese people have changed the profile of air travelers. Therefore, knowing air travel users also means knowing passengers requiring special assistance (PNAEs, in Portuguese), a group that has an increasingly important role in air transportation. Due to the increased number of these passengers and the concerns about their safety in air transport, regulatory agencies have been making an effort to set out specific requirements to ensure the provision of adequate assistance to this specific traveling public, protect their physical and moral integrity, and ensure they have equal rights. Despite some actions in terms of laws, studies show that there are gaps and assistance inadequacies, which can be explained by the fact that the services offered to PNAEs result from interactions between different social actors, such as manufacturers, regulatory agencies, airline and airport operators, and air travelers who need special assistance. These social actors have different interests and concerns, which remain little explored and unknown. Therefore, the objective of this study was to discuss through a conceptual model the social actors’ interactions that determine the services offered to passengers requiring special assistance. Interviews with representatives of 7 Brazilian regulatory agencies were conducted during visits, and questionnaires were administered to 377 people who fall into the category of “passengers who require special assistance” and 20 traveling companions. The current air transport accessibility conditions were verified in 3 airlines using a checklist drawn up based on current Brazilian laws. The results showed that air transport accessibility problems are mainly related to the inefficiency of services provided by airline and airport operators, ineffectiveness of aircrafts in terms of passenger needs, or inefficiency of regulations regarding the real needs of the users. Although there are regulations, they often do not help improve the services offered to PNAEs. This fact shows that regulations should be designed with the participation of users to avoid these gaps. Moreover, another aspect that can be evidenced in this study is that in addition to enforcing laws and regulations, regulatory agencies should supervise their compliance. Although the difficulties encountered by air travelers mentioned by the participants were similar to those reported in other studies, the present study differs from others in the literature in that it investigates accessibility issues from a holistic point of view. Therefore in order to solve these problems it is necessary to promote the effective integration among these four social actors, respecting their particularities and limitations, aiming at the provision of more effective services to passengers who require special assistance.
The use of information and communication technologies (ICT) has widely spread in our personal sphere as well as at work. The design of these tools may contribute to increase the productivity of companies. In the service relationship context, the challenge is not only to delivery a service but also to improve customer satisfaction. Becoming a relational brand implies a level of listening, service and responsiveness exemplary across all channels of interaction. In order to deal with these expectations, some airline company have developed some software on digital tablet. This tool should allow station workers, in charge of reception customers at airports, to access to all data relating to them in real time, as their journeys and their luggage for example. This situation underline several issues related the models of task definition and working organization. A study was realized in order to explore these "digitized" environments and especially to understand the adoption' conditions of these technologies by airport reception agents. The goal is to identify the factors that promote, or hinder, usages. The method is based on an field observation of real work activity in order to analysis the effective tasks by using this tool in real life situation. The data collected have been crossed with individual and collective meaning during interviews leading. The usages' key factors were also objectivized through an on-line survey. Results show the contribution of the tablet used, especially the centralized information that allows airport agents to increase responsiveness and performance for the passengers. Otherwise, the agents claim that the tool facilitates the accomplishment of the tasks and increases their ability to act. The development of digital also brings a positive image: one of a modern and reactive company. For the agents, it is essential, they felt that they gain on credibility and that they are valued. Nevertheless, if a majority of the agents integrated the tablet in the daily practices, misappropriations of uses were induced. These adjustments led to a profound change in the work, calling for a re-appropriation of the work of ground handler. The development of digital implies a real challenge to the job, the knowledge and the know-how. Regarding the speed at which technological developments are growing and the major changes that they bring, the question of the links between work, health and use seems important.
Seated whole body vibration and egress performance in Agricultural machines: mitigating the risk of injury by performing recalibration movements

Type: Abstract Oral Presentation
Category: Agriculture

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Farming has been identified as a hazardous occupation worldwide. Despite increased mechanization and task automation, working with agricultural machinery still exposes farm workers to multiple hazards and high injury risks. Falls from a height represent 60.6% of all injury hospitalizations in Canada [1] and are the leading cause of injuries on Saskatchewan farms [2]. Farm machinery operators are particularly at risk of falling while dismounting (also known as egressing).

Egress movements are complex actions “requiring a precise articular movement coordination of the human body” [3]. The risk of slip and fall during egress may arise from step design and environmental factors, such as step surface condition and shoes of the operator and/or drivers’ egress technique (e.g facing out compared to facing in egress strategies). Based on recent human performance studies, exposure to seated whole body vibration (WBV) could be another contributing factor, as it has been shown to affect balance and proprioception. Recalibration movements (voluntary actions and dynamic stretching) immediately after WBV exposure may be a useful strategy to mitigate potential WBV-induced effects [4]. Operating agricultural machinery involves exposure to WBV and, although this exposure is very common, it is not clear how it affects human standing balance performance, egress, and subsequent tasks. The goal of this study was to compare the effects of WBV and recalibration movements on machinery operators’ kinematics and dynamics during egress from agricultural vehicles.

The tractor vibration simulator at the Ergonomics Laboratory at University of Saskatchewan was used to produce seated WBV using acceleration profiles collected during farm-based tractor operation. Twenty healthy, tractor-experienced participants completed trials in three separate experimental sessions over three days. Each session took up to two hours and was prefaced with ample time for participants to become familiar with the test environment and egress task. Participants experienced one of the three test conditions during each experimental sessions: (1) A control task condition with 60 minutes of quiet sitting, (2) A vibration intensity equivalent to vibration of a typical tractor in Saskatchewan farms during operation for 60 min (3) A condition identical to condition 2 followed by 3 min of recalibration movements in the simulator before dismounting. After each condition, participants performed a single egress from the tractor vibration simulator. Following the egress, postural sway was measured using a force plate.

Preliminary findings indicate that seated WBV shows deteriorating effects on participants’ postural sway. We anticipate further analysis will demonstrate that recalibration movements will, in part, mitigate these effects.
In the fields of Ergonomics and Design, the use of graphic styles in the design of digital interfaces has been investigated more intensively in the last ten years, as the number of users with access to mobile digital devices such as tablets, smartphones, smartwatches and others. The development of new information and communication technologies (ICTs) has favored the emergence of new learning and new experiences of users’ interaction with their mobile devices. Such interaction experiences are the subject of a recurrent study for Ergonomics, as well as, these interfaces are the object of study for Design.

The digital graphic design style called Flat has promoted a decisive influence in the creation of digital interfaces and design projects worldwide, mainly from the application of a visual standard initially suggested by international corporations, such as the Microsoft, Google and Apple. That said, it aims to describe the emergence and application of Flat Design as a graphic style for digital projects in mobile applications (Apps). Based on the premise that the use of these applications sometimes makes life easier for users, as far as their personal and professional relationships are concerned, the continued use of Apps leads to the second objective of this study: to demonstrate how they can be evaluated, through the interface. Thus, the analysis and discussion of the results obtained clarifies this theme that required specific investigations and projects new discussions about the proposed interface design languages. The conclusion of the study makes it possible to perceive the influence of Flat Design on the contemporary design of other digital artefacts, or not.
One of the core benefits of electronic medication management (eMM) systems is the ability to provide clinicians with information and guidance at the point of care. Computerised alerts embedded in eMM systems are generated at the point of prescribing and are designed to warn clinicians about possible risks such as patient allergies, dangerous doses or drug-drug interactions. There is good evidence to show that when well designed and targeted, computerised alerts can have positive and often substantial effects on prescribing behaviour. However, accompanying this evidence, are a large number of studies demonstrating that alerts are overridden by users at high rates, along with accounts of user annoyance and frustration. Clinicians override 49%–96% of drug alerts.

Our own research has shown that in certain contexts, doctors do not read the majority of alerts presented. A number of factors could potentially impact on the effectiveness of alerts. This presentation will focus on one factor: alert interface design. The quality of the alert interface (i.e. how the alert appears to the system user) has been shown to influence clinician acceptance of computerised alerts. There is also some evidence to suggest that applying human factors principles to alert design can improve usability and prescribing outcomes. But how is good alert design assessed? This presentation will summarize our attempt to measure human factors compliance of drug alerts in eMM systems currently in use in Australia. It will describe the challenges we encountered when applying the ‘Instrument for Evaluating Human Factors Principles in Medication-Related Decision Support Alerts (I-MeDoSA)’ to assess alert design, and the process we have taken to develop a more user-friendly, useful, and evidence-based tool for alert evaluation.
Airline Cockpit: New Technology, Benefits and Drawbacks

Type: Abstract Oral Presentation
Category: Others
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Abstract: Technology is rapidly encroaching and changing work tasks, both enhancing and detracting from job performance. This research describes the results of a self-assessment survey specifically designed for commercial airline pilots concerning their work while flying. The objective was to assess new technology benefits and drawbacks, and the effects on changes in workload, pilot comfort, and safety as experienced by commercial airline pilots during long-run international flights. Potential cockpit design modifications to remedy potential safety-related problems that new technology has produced will be discussed.
This study aims to contribute to the reflections on planning design, from the analysis of the action process set up around the events - unforeseen facts that characterizes a distance from what was planned - during the maintenance execution phase.

From the situated action, Suchman [1] says that plans are a representation of actions and, therefore, they cannot be reduced to a simple planning execution. However, the proposed analysis is ambiguous, since it seems to hesitate between two options of a plan status [2]. Either it can be considered as a reconstruction itself, in which the necessary knowledge to elaborate the action planning is innumerable and not available a priori, or as a resource capable of guiding the action, but without widely defining it.

If we generalize the idea that the plan cannot fully correspond to reality, we can apply it in the case of these maintenance campaigns planning. Though, given the nature and the scale of these projects, the first plan status does not seem relevant. Carrying out platform large-scale maintenance activities requires a priori large amount of resources coordinating in space and time, for a highly dynamic context with countless sources of variability. This scenario demands plastic environments design, that depend on the actors' capacity to adapt. So, planning should have some flexibility and may provide ways for helping actors in situation [3, 4].

The results show that there is a high level of variability inherent to the offshore environment and to the production process, which can interfere on certain activities performance, and whose anticipation is not trivial. If we analyze these campaigns planning context, Suchman [1] deals with a micro level planning, geared towards a specific action, and that does not concern to the identified reality.

In this case, understanding plan as an object to be conceived, we perceive it through the dynamic of conception as a planning project conduction, which has different levels and that continues in the use [5, 6]. Since the action process set up to deal with real-time events can generate other events and disruptions in planning, the ways to deal with them need to be conceived with workers, so that they can make situated decisions and have visibility of its consequences.

This issue indicates that it is necessary to revisit the planning philosophy, considering its levels and replanning. After all, action accomplishment will have to adjust to the circumstances and the variability, and deal with contingencies [7]. We find here guidelines
for plastic systems design, that allow workers finish it [5, 8, 9, 10]. This guidance deeply changes the project nature. The goal is no longer define the maintenance tasks, but to specify the ways to conduct the maintenance of planning.
Abstract

The centrality of the citizen and the patient in the process of care is an essential precondition in a modern health system interested in effectiveness and efficiency of services offered in terms of quality and safety of care.

Extensive experience implemented at the international level and some Italian initiatives show how solutions detected in partnership between individuals and patient associations can efficaciously improve the quality and safety of healthcare assistance.

Patients and citizens education is the basic premise to share a common ground to develop projects finalized to prevent adverse events and to increase the reliability of our health care system.
Starting from these assumptions, the Centre for Patient Safety of Tuscany (Centre) started a collaboration with the World Alliance Patient for Patient Safety (WHO) by activating a series of initiatives to realize the involvement of citizens in policy promotion and in the development of patient safety. In order to achieve a real participation of citizens in the health service policies and to facilitate the contact and the exchange with the medical-scientific world, the Centre decided to organize a specific course aimed at training citizens and patient association representatives in patient safety and quality issues to empower them as expert-citizens in the evaluation of health care systems. This course is called the “Academy of Citizen”.

The goals of this periodical training is the involvement of representatives of patients in patient safety activities and the creation of an alliance with citizens in order to define strategies in partnership for improving patient safety.

The “Academy of Citizen” is a course organized by the Centre in collaboration with the Laboratory PartecipaSalute of the Research Institute Mario Negri of Milan and it is an education event tailored on patients' representatives needs and point of views, focused to allow the creation of special initiatives dedicated to citizens' engagement. The Academy trained representatives of 38 patients' associations for a total of 100 participants coming from different pathologies and from different Italian regions. The course (three edition: 2008, 2013,2018) focus on an education program related to the topics of patient safety, the evaluation and improvement of healthcare assistance, the identification of shared solutions for improving patient safety, the communication of adverse events. Each training day combined the presentation of knowledge from experts and opportunities for discussion, and work in small groups to develop and to test learning.

The participants to the Academy constituted a group of patients' representatives formally recognized and regularly involved in the basic activities for promoting patient safety (audits on significant events, patient safety walkthrough, definition of policies on patient safety at Tuscany regional level). During the biennium 2010/2011 14 patients' representatives participated to patient safety walkthroughs in fourteen different hospitals, while in 2014/2015 other 15 patients have taken actively part of this kind of visits. The point of view of patients is always an added value to the visit. Furthermore, a dedicated group of patients trained with Academy have contributed in the design of multimedia tools for the training of health operators (also participating as actors) and in the development of eight cartoons intended to promote the education of citizens for the prevention of the most diffused risks (prevention of infections, prevention of falls, handover).
Packed, sealed, delivered and unable to open: Australian nurses views on hospital food and beverage packaging and older users

Type: Abstract Oral Presentation
Category: Healthcare

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Abstract:
Food and beverage packaging is the default food service format in NSW hospitals and is increasingly used in a range of care settings. Older users have difficulty opening these items and as older people now represent 50% of hospital inpatients, it is essential to review the efficacy of this type of food service. As nurses are the main caregivers in the hospital setting, this research explores the views of nursing staff in relation to food and beverage pack provision for older people. Findings indicate that nurses are concerned about the packed food service. Many nurses find it difficult to open a range of packs themselves; they suggest that packaging promotes dependence rather than independence; and opening packs for patients is difficult to fit into their busy schedule of medication rounds at meal times.

Summary:
Public hospitals in NSW Australia have outsourced food service with food production managed in centralised locations around the state, transporting pre-prepared meals to hospitals (Rechbauer 2013). Hospitals then supplement these meals with individually packed and sealed food and beverage items. Previous research (Bell 2013) has found that hospitalised older people have particular ‘openability’ issues with the products served in NSW public hospitals. Half of all hospital patients in NSW are over 65 years, though they represent 15% of the total population (Australian Institute of Health and Welfare 2017). This over-representation of older people in hospital will increase rapidly as our ageing population rises. Older people experience much
higher rates of malnutrition compared to younger people, with hospitalised older adults five times more likely to be at risk of malnutrition (Lazarus 2005, Banks 2007, Vivanti 2008). Clearly, hospital food service has an important role to play in providing adequate nutrition to enhance recovery. Hence, there has been a series of studies of older people interacting with this packaging to review the openability of the packs from the patient’s perspective (Bell 2013, Bell 2016, Bell 2016, Bell 2017); and usability of food packaging generally (Yoxall 2010, Rowson 2011, Rowson 2014).

As nurses are integral to the provision of patient care, it is also relevant to gain their views on the food and beverage packs supplied in hospital food service. Three focus groups were conducted with 15 experienced renal nurses at the Wollongong Hospital in regional NSW, Australia. Nurses expressed
their concern and frustration with the packed food service, highlighting poor pack openability leading to food and nutrition waste; as well as a number of infection control issues due to patients using teeth, scissors or cutlery to access packs. Nurses reported difficulties themselves opening packs with one commenting: ‘The lids are on so tight that you really need to go to the gym and work out to get them off.’

Older hospitalised adults are vulnerable users of packed products within the hospital food service system. Previous research has shown that both well and hospitalised older adults have difficulty opening these packs. This research highlights the concern and difficulty with the provision of packaged products used in hospital food service from the nurses’ perspective, indicating that both the design and provision of packed food and beverage items in hospital requires further scrutiny.

References:


An action research to study and support the transition to a comprehensive Electronic Patient Record in acute care

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Background
In the last twenty years, health organizations have started the gradual shift from paper-based information systems to digital systems for recording internal and external communication (1,2,3). This is an epochal change, which is going through all the productive systems, yet in the health systems this passage is particularly prolonged and difficult (4), mainly due to the complexity of the clinical and care activities (5), the variety of organizations that produce services (6) and a hyper-regulated institutional context (7). On the other hand, the intrinsic quality of IT products for healthcare is sometimes poor, both in terms of functionality, and above all of ergonomics and systems integration (8).

Objectives
To describe the critical issues and the elements of good practice in the current process of implementation of the electronic patient record, to support the working groups responsible for the digitization processes to integrate in the developments the return of experience from the operators, so to prevent the main risks associated with the transition from paper to bits

Methods
Being a descriptive and intervention study, it involves the joint use of field observations, semi-structured interviews, cognitive walkthrough sessions, analysis of official documents, participation in some meetings of the working groups that have responsibility for the development of EPR and in some sessions of staff training. Settings are medical and surgical wards at three urban hospitals. An expert ergonomist collects field data with shadowing technique of doctors and nurses, sampling one morning shift one week before and 2 weeks after the implementation of EPR at each ward. EPR product “C7” is being developed in-house on the basis of a 15 years program carried out at the FTGM hospitals. The collected notes were then subjected to thematic analysis, which was
associated with an analysis of the times and methods of the sampled activities. Indicators used are the time for each administration, time per patient during the round, number of critical issues, strengths and workarounds.

**Results**

To date, four field observation sessions were conducted in a medical and surgical ward of the first hospital, for a total of 28 hours of observation and ethnographic interviews, half of which before and half after the implementation of C7, to which 4 hours of observation of the training course were added.

After the introduction of C7, a reduction of the time for single administration of 10.8% and of the times for the visit to a patient of 6.2% was observed. The criticalities were reduced by 53% and 8 elements of good practice emerged in the interactions mediated by the EPR, of which previously no trace was found.

Even if to a limited extent, from 6 in the pre- to 3 in the post-implementation stage of C7, there remain some workarounds, some of which are explicitly adopted to meet some limits of digitization, such as the persistence of informal paper supports, whose functions also according to operators could be integrated into C7.

**Discussion**

The transition to EPR has improved efficiency of care, thanks above all to the better organization of the information, ease of access and sharing of data between the various actors involved in the process. Information safety is also improved, thanks to the elimination of manual transcriptions, the clarity of writing and reading on screen and the possibility of solving any inconsistencies in real time.

There remain some critical issues related to the consistency between what is shown in the folder and what actually performed on patients, as well as due to a partial awareness of how to use the tool, to be clarified through the preparation of a business manual and the reinforcement of training.

**References**

An action research for patient safety and service quality in long term care

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Background
Care of the elderly is the main public health challenge for the next decades. Up until now, service quality and patient safety in long term care is not a hot topic in the political and research agenda. The approval of the Italian law 24/2017 for patient safety requires a quick shift, given its emphasis on the integration of risk prevention between health and social-health services.

Objectives
To study and redesign quality and safety of care in nursing homes, through a participatory approach based on human factors and ergonomics principles and techniques.

Methods
This is an action research in a complex environment. We started with an in-depth qualitative analysis of daily practices in 4 nursing homes, selected on the basis of their performance (good and bad) and location (urban and rural). Then we performed on-site observations and ethnographic interviews with workers and patients. To conduct the explicit, non-participant observations, an original grid was developed, inspired by the definition and dimensions of quality (1, 2). The grid declines for each dimension one or more specific themes within the context of nursing homes, for each of which sensitizing themes and observation units have been identified, according to literature (3) and accreditation requirements. Observational notes were collected in real time through the use of a free application available on smartphones for writing, automatic saving and synchronization of notes. The crude notes were subsequently re-aggregated on the grid by themes and dimensions of
the observation scheme, then subjected to an expert review, by 6 nurses and 2 social workers who evaluated weaknesses and strengths. On the basis of the elaboration of data, we then designed a multidimensional intervention encompassing interactive training sessions, scenario based redesign of weak care processes, supervision and feedback to front-line workers and management.

Results

Eight observational sessions in 4 nursing homes of an average duration of 8 hours and 30 minutes were conducted by the two observers with background in human factors, for a total of 134 hours of observation. A total of 52 pages (standard A4 format) of observational notes were collected and then classified with the thematic analysis into the grid. The observation scheme resulted appropriate to encompass most of the notes, with the exception of management of behavioural disorders. According to experts' review, the most relevant safety related themes are infections and falls prevention. Quality of nutrition is a crucial theme belonging to the dimension of patient centredness, while the emergent theme of behavioural disorders can be classified within the dimension of effectiveness and paired with management of emergencies, given that a weak management of behavioural disorder can result in an emergency. The intervention is currently in progress, during the interactive training session we facilitated the discussion about the weaknesses and strengths of the nursing home, guiding the group to report cases of good and bad practices related to the 4 themes. Scenarios were then designed on the basis of the case reported and a scheme to redesign care processes was sent to the working groups and to the management of the nursing homes. A follow-up session is scheduled to monitor progress on site and provide feedback, as well as an evaluation of sensitive indicators at the intervention sites compared to the regional benchmark.

Discussion

Thanks to a socio-technical approach, issues related to professional and organizational standards emerged and currently a multidisciplinary team is conducting a participatory intervention to improve individuals and structures capabilities to respond to the increasing needs of patients.

References

A comparison of three different interventions to prevent interruptions in medical wards during medications, handover and transfusions

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Background

Interruptions appear to be an integral part of clinical activities, besides evidence suggesting that they can disrupt work processes, negatively affecting efficiency and patient safety (1,2,3). Different interventions to prevent disruptive interruptions have been proposed and tested in studies conducted in hospital wards, with contrasting findings (4). We also know that some activities are more prone to disruptive interruptions, such as medications (5) and handover (6), both in terms of frequency and severity of outcomes, while in some cases of transfusions an interruption resulted in a sentinel event within our health system.

Objectives

To test the effectiveness of different interventions and design a patient safety practice to prevent disruptive interruption in medical wards.

Methods

This is a multicentre pre-post investigation, conducted in 15 medical wards distributed in 5 trusts belonging to the Regional Health Service of Tuscany, chosen according to their availability to join the research program. Both the characteristics of wards in terms of personnel, type of patients and standard of care are comparable, given that they belong to the same health system. The 15 wards were randomly assigned to the three interventions: 1) training on behavioural techniques to anticipate and manage interruptions; 2) training plus free interruptions’ zone within the ward; 3) training plus free interruption zone plus “do not interrupt” communication materials including high visibility tabards.

We targeted three nursing activities at risk of disruptive interruptions: preparation and administration of medications during day shifts, handover at the end of each shift, blood transfusions when prescribed. Objective data were collected during before and after the interventions with 20 hours of observation at each ward with the validated Work Observation Method By Activity Timing (WOMBAT) (7), while subjective data were also collected with a dedicated questionnaire to investigate workers perceptions of interruptions and preventive strategies. Statistical analysis were conducted to evaluate the significance of the differences observed before and after the interventions in the three ward groups.

Results

We observed a significant decrease of interruptions’ rate in medication and handover before and after the interventions in the three ward groups. In arm 1, the observed reduction is 28.9% in handover, 8.7% in medications, 100% in transfusion; in arm 2 interruptions reduced in handover and medication, respectively of 71% and 37%; in transfusions they increase of 100%; in arm 3 interruptions rate reduced of 46.3% in handover and 36,7% in medication, while in transfusion no post intervention data is available.

Discussion

The main limitation of the study is the lack of a control group, due to financial constraint. Results demonstrate the effectiveness of the interventions, that is stronger when training is combined with
free interruption zones. The additional communication materials do not seem to provide further improvements. Data on transfusions were too few to make any meaningful consideration. Subjective data are still being elaborated and will help to understand how nurses changed their practices.

References


Some people may find it difficult to manage products or interact with systems. This is mostly due to product designed and not to final user. In health the medical devices (DMs) that highlight design flaws can cause operating errors and generate adverse events.

This paper proposes a methodology in support of selection boards, for ergonomics and usability aspects of medical devices. Despite manufactures of medical devices claim that Human Factors have a high priority in their projects, few of these are flawless products from the perspective of design and human-machine interface.

Buyers concerned about safety shall be able to discern among the products with transparent and objective evaluations, not disregarding the public procurement directives and at the same time stimulating improvement.

Ergonomics for design methodologies were used in the context of a negotiated procedure for the supply of anesthesia systems. The gerarchical task analysis was used for evaluating and comparing models proposed by various prospective suppliers.

According to Norman’s model (1988; 2013) about seven stages of action, the method considers the user interface and user cognitive model.

Instead the Gap Analysis has allowed to involve, with a metric of potential errors, a qualitative score in tender evaluation, according to the criteria of the most economically advantageous tender.

The paper presents this experience in which three different anesthesia workstations were compared on the basis of preliminary tasks classified with experienced staff.

The obtained results, in addition to allowing the effectiveness usability levels of product and its components and digital interfaces, shows the inherent mismatch of technology considered as a constitutive component of the latent error as emerged during sampling, namely ex ante to the intensive use in hospitals.

The methodology provides a useful tool to study ergonomics, usability and errors during the use of anesthesia workstations. The methodology allows objectivity and transparency to a critical stage, which is the evaluation of the offers of these devices, but is also transferable to other classes of medical devices.
Many products have been designed and developed to aid and support people in their daily activities. Glasses, in particular, are an accessory that is strongly present in our everyday life: they are designed to aid the human vision, to protect the eyes and also used as a fashion accessory. Many models of eyewear are more akin to fashion accessories and do not fully perform their actual function: sometimes temples can be rigid and tight, too long or too short, and they cannot be sufficiently adjusted or adjusted at all. Eyewear frames are often extremely heavy and they can cause pressure points or even headaches. If eyewear is not adjusted to fit the wearer, its optical traits are no longer correct either. Most people wearing glasses are unaware of this fact. Considering that in contemporary society, the biologically admixed population is increasing, such demographic changes may affect the distribution of anthropometric characteristics, which are incorporated into the design of eyewear. Until now they have proposed the same dimension for the rim, temple length and bridge width for both the female and male wearers and for different race users, but it is very clear now that this product should satisfy the needs and expectations of the plurality of the user’s profiles. At present, the Italian glasses hold a leading position in the fashion accessories market; ‘Made in Italy’ is recognized throughout the world for its excellent quality, its technological innovation in materials and its methods that can improve the ergonomics of frames, but also for its unique style and advanced design, that are making the Italian products gear towards medium-high market segments. Thus Italy can enjoy a leading position in high-end productions and accounts for 25% of the world market.

The purpose of this study was to experiment the use of 3D printers and the impact they may have on the eyewear industry and to create a platform where the user can become an active designer in making his own custom glasses. The paper presents part of the results of the research and experimentation performed by the Florence University Laboratory of Eyewear Design (La.Mo).

Keywords: Ergonomics and anthropometry, Design, Glasses frame, 3D printers.
There is considerable evidence that psychosocial risks are a leading cause of lost-time from work and reduced levels of engagement and productivity due to their influence on mental health and depression, psychological distress and absenteeism. Reports from the EU estimate psychosocial risks to account for as much as 50-60% of all lost time (EU-OHSA), while recent longitudinal research from Australia has provided strong evidence of the high social and economic costs of a poor psychosocial work environment.

Psychosocial risk factors include aspects of work organisation that are a result of human action and have the potential to cause psychological harm. These include job design, the organisation and management of work, and relational factors. Changes in the nature of work arising from technological advancement, globalisation, and a 24/7 culture have potential to increase the risk of psychological harm to workers, while a growing proportion of workers are ageing, on insecure work contracts, or vulnerable due to a range of conditions that influence their susceptibility to psychosocial risk. Research indicates that New Zealand workers are highly vulnerable to psychosocial workplace problems, placing a considerable burden on the economic and social wellbeing of society. Until now, there has been no comprehensive approach to understanding or preventing psychosocial risk in New Zealand.

During 2017, Massey University’s Healthy Work Group developed a programme known as the ‘New Zealand Workplace Barometer’ (NZWB). The NZWB is designed to provide longitudinal monitoring and surveillance of exposure to psychosocial risks among a large representative sample of New Zealand workers. Based on consultation with two WHO Collaborating Centres in Occupational Health, specialising in psychosocial risk, evidence from the published scholarly literature, and findings from recent longitudinal Australian research, the NZWB has been developed to examine the impacts of exposure to psychosocial risk (assessed through the measurement of psychosocial safety climate, alongside specific aspects of psychosocial risk) on important individual and organisational outcomes, notably: depression and mental health, psychological distress, sickness absence, performance and engagement.

The NZWB Programme was implemented via a quantitative on-line survey across a large representative sample of New Zealand workers from a broad range of occupational groups. Initial findings from the NZWB study suggest that the risk of negative individual and organisational outcomes increases as exposure to psychosocial risk increases. The findings from the NZWB will be presented, alongside implications for policy and practice, and a discussion of the role ergonomics and human factors can play in the design of healthy and productive work.
Proxemics deals with the study of the human behavior in relation to his spatial environment where the most important aspects of communication are contemplated and the way each person structures the distances where he develops his daily activities. The growth of the population leads to problems in areas of common interrelation as evidenced in Bucaramanga and its metropolitan area with the use of the Integrated Mass Transport System (Metrolínea) where a high population density is perceived, this leads to questioning the behavior of the users within the system.

Based on this background and with the intention of expanding the information, a survey was conducted to 111 users, to know their perception of the service. From the analysis of the results it was concluded that users of the mass transport system perceive excess of passengers in bus access area, and it is possible that psychosocial factors exist that generate this type of experiences.
One of the objectives of the investigation was to determine if the number of passengers (density) was exceeded in the vehicles of the Metrolínea transport system, understanding the term density as the number of individuals per unit area in the available space. This physical measure should not be confused with the term overcrowding that corresponds to the subjective psychological state created by this situation.

In this order of ideas, we also sought to identify if the number of people taking a Metrolínea bus affected the stress experienced by users, where the sensations of congestion, high levels of discomfort and anxiety experienced during the journey are aspects linked to the perception of overcrowding taking a decisive role in the experience of use for each passenger, linked also to the formal configuration of the buses.

For the methodological development, three stages were proposed, initially a systematic review of the literature was made in the Web of Science database, two questions were posed as a selection filter of the scientific articles, which support the state of the art of the exposed problem. In the two later stages, a quantitative research was conducted, where the corresponding experimentation was carried out through a data collection before and after an "average" route in rush hour (7 pm). The data collected were analyzed using the Chi-Squared statistical method that allowed to conclude on the hypotheses proposed.

It was found that there are changes in the perception and behavior of users after the travel proposed in the experimentation, mainly in aspects related to comfort and perceived safety. Despite this, it was found that 80% of the routes where the test was performed did not exceed the number of passengers set by the IMTS, thus finding a possible relationship with the formal configuration of the vehicles.

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Virtual reality simulation and ergonomics assessment in aviation maintainability

Type: Abstract Oral Presentation
Category: Aerospace

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Abstract in order to submit full paper

Keywords: ergonomics, simulation tools, maintainability, aeronautics

Human performance has been studied since long time in the aeronautical field, especially to face with aircraft accidents [1]. At the beginning of the aviation story, the improvement was focused on the reliability technology improvement [1]. Human factors has started to be considered rapidly during the Second World War, firstly during the pilot training with the very first flight simulator to anticipate plane behaviour and pilot reaction [1, 2], secondly, during the design of the flight deck [1]. During few decades, human factors and ergonomics were mainly focused in the cockpit and the passenger cabin in order to improve safety, comfort and flight experience [3]. However, through the improvement of the accident investigation due to new technologies and theoretical models to understand the cause, it now confirms that some accidents are clearly due to the human errors during the maintenance activity, representing 12% of all accidents [4]. Indeed, the literature and industrial observation has identified few main human errors like omissions, incorrect installations and wrong parts among other [5]. Some other studies precise that 34% [6] of the routines tasks are performed without conformity and 64% of the operators do not follow the standard and recommendation but work by experience [7, 8]. Additionally, few studies in the field, with the exception of those related to human error, question the physical, cognitive, organizational characteristics which are at play when the maintenance operator performs his activity, whereas this activity is defined as long, complex [9], and may even have effects on human health (musculoskeletal disorders, workplace accidents, work stress).

Human factors try to be better integrated very early within the design process in order to anticipate the future activity of operator. To achieve this goal, maintainability engineers, in design office, use their own experience but without specific skills and knowledge in human factor, they focused almost only on physical dimension of human factors [10]. Additionally, simulation tools use currently by design engineers to simulate maintenance activities are also used by human factor experts. The aim of this paper is to compare the gap during a deep ergonomics analysis between the most common simulation tools: virtual reality and physical mock up. Firstly, we will introduce these two kinds of simulations tools and we will detail a protocol to carry out an ergonomics analysis integrating operators, subjective and objective ergonomics assessment tools. Our results will be studied statistically in order to compare the indicators studied on both simulation tools. This study proposes a homogeneous means of improvement to integrate human factors in the design process.
Smartphone shopping applications are receiving growing attention in the current Philippine setting of m-commerce adoption. This momentum flourished over the last decade as the recent acceptance acknowledges its capabilities, accessibility, and functionality. However, even vast opportunities are available for the success of consumerism, very few studies have been conducted that can explain the rise in adoption of m-commerce specifically smartphone shopping application under the implicit understanding of human factors. With that, this study proposes an extended UTAUT2 model that constitute perceived trust and cost-saving orientation to explain the behavioral intention and actual usage of the current consumer pool. A multidisciplinary approach exploring the role of different discipline of communication design factors that influences users’ experiences for adoption. Moreover, aiming to explain security, privacy, information quality, and monetary savings as response to the qualitative researches that explains the increase in adoption of smartphone shopping applications. This is also to address the increasing claims of cybersecurity as a threat and economical implication in discoursing the factors of human in overall adoption behavior. To explain the significance of new constructs, questionnaires were deployed and analyzed using Structural Equation Modelling capturing the current demographic pool of the Filipino consumers. The result revealed that the proposed model has a good explanatory power, confirming its robustness for explanation. Moreover, perceived trust, habit, facilitating conditions, cost-saving orientation are deemed to be the strongest explanatory construct for both behavioral and actual usage. This is followed by social influence, hedonic motivation, and performance expectancy for behavioral intention. This study also reveals that effort expectancy and price value is not significant contributor for explanation. From these results, managerial design recommendation is directed on the strongest explanatory construct to actively communicate to human needs in order to enrich users’ experience in design consumption via behavioral intention and use behavior. More so, theoretical implications is suggested to expand the current limitation of the study.
Smartphone shopping applications are receiving growing attention in the current Philippine setting of m-commerce adoption and is expected to flourish given the worldwide transition towards digital economy. However, transactions over this platform is perceived riskier than buying in conventional stores making its usage more for browsing rather than purchasing thus impeding the goal and growth of the platform. Cybersecurity has been considered as a prime concern to the consumer using the said platform. A key strategy of online vendors to mitigate this is by displaying trust assurances, in form of assurance seals, aiming to deliver persuasive cues to create positive trust outlook. Studies were scored to analyze its effectiveness, most of which demonstrated that the presence of trust assurances do influence consumer behavior but on the different extent depending on the design it inhibits. However, paucity still exists since questions on what brought its effectiveness, how effect is achieved, and the extent of its effect is yet to be explored. Meaning, the process-based reason why such trust assurances is recommended to be understood. This study sought to answer these by the Trust Assurance Design Analysis (TADA) model assessing the effectiveness of each design component in its direct effect to initial trust; extended by understanding the mediation process; and capping by analyzing the effect of consumer character for moderation respectively. Employing Structural Equation Modeling for analysis, this is to be analyzed under the Philippine Setting of M-commerce Adoption. The results suggest that four design factor of seal type, content, position, and phase is significant with the best configuration as third-party seal, featuring claim with data, positioned at the top, and is presented at home or checkout phase. As for the mediation, design component that attained early bottom-up attention and undergone extensive top-down processed attained is recommended. As for the moderation, user with high knowledge and experience attained equally high initial trust for any seal type and content respectively while low trust disposition users attained lower overall initial trust. From the results, managerial recommendations for design is directed fueled by the mediation reasons and moderation effect and theoretical implications is suggested to expand the current limitation of the study.
The manufacturing facility that is the subject of this case study, where around 300 workers work, is organised by department (cutting, sewing, pressing, final testing) and has an incentive system based on the individual performance of each worker, which is calculated with respect to the standard timeframe needed to carry out operations.

The study carried out will analyse how risk indicators pertaining to biomechanical overload of the upper limbs vary in relation to the following factors:

- trends in the individual performance of workers with regard to individual operations
- rotation of personnel through various operations with differing risk indicators
- time that workers are exposed to different operations
- the inverse proportion between worker performance and times during which workers maintain inappropriate posture in each joint area

Due to the way in which all production cycle operations are mapped out, software has been implemented to enable users to manage risk in production departments in a more efficient and effective way.

In particular, via the integration of this system with the management system previously in use at the company, it is possible to obtain data relating to:

- the actual presence of workers in individual workplaces
- performance of workers in individual workplaces

As a result, it is possible to measure an individual worker’s actual exposure to risk during an entire work shift.

Thanks to risk indicators being updated in real time, managing the rotation of personnel in production departments is improved. This also provides the versatility needed to balance times that workers spend carrying out operations with varying levels of risk.
Electrocardiography (ECG) is known to be a reasonable measure of driver fatigue. In this study, we have used a non-contact capacitive coupled ECG (cECG). Ten male volunteers participated in this study. cECG electrodes were placed at the seat back and other cECG electrodes were placed at the seat base. cECG signals were acquired from both seat back and seat base. We have correlated seat back cECG and seat base cECG with conventional one lead ECG systems to validate the cECG system. Based on Magnitude square coherence (MSC) analysis, it was observed that all the ECG signals acquired from different source had good coherence among each other. On progression of driving time, it was observed that the quality of cECG signal acquired from the seat base was getting better as compared to seat back. However, combined cECG from seat back and seat base was better than using a single source for sensor.

Keywords:

Signal correlation; Capacitive ECG; Ubiquitous Monitoring; Simulator driving; HRV.
Creativity at work, human development and organizational resilience

Type: Abstract Oral Presentation

Category: Others

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This paper analyses the differentiated roles granted to creativity in work organizations. Creativity is commonly summoned in productive organizations, however with different aims and expected results.

Creativity is always present in work activity, as a result of human reflexive and manipulative skills. Ergonomics of work activity has established the gap between real work and how it is planned through procedures and instructions. Work activity is the link between the planned tasks and the intrinsic variability of work environment. In a varying environment, the worker adapts his gesture, uses experience-based heuristics, modifies tools and reorganizes his work to produce a stable output.

Creativity at work could be denied or favored according to different organizational models.

Workers creativity is denied by Taylorism, which purpose is to rationalize manufacture through the division of the production process into simple stereotyped operations supposed to take place in a constant environment.

Recognizing the existence of workers knowledge gained from the interaction with the real world in practice, Lean management has developed the systematic tracking of worker’s procedural and practical creativity with the purpose of devising more efficient procedures. These new procedures will later be imposed to work organization. Creativity has been cast into procedures however, reality remains unpredictable, and workers creative activity at work has just moved a step away.

Creativity could be encouraged in new modes of work organization. In the software industry, the trend is to give space to individual and collective creativity, allowing self-organization and autonomy, free use of space and time, even free food and entertainment. Leaving Taylorian principles these forms of organization let the worker express his abilities and develop unguided cooperation, collecting at a higher organizational level the productive output of these autonomous bubbles of human activity.

Creativity appears also to be a need for the resilience of organization faced with destabilization. Non-procedural and creative behavior is required for the stability of organizations exposed to sudden or non-plannable risks. Individual creativity and novel thinking is expected when the organization faces out of procedure events where only the workers experience and ingenuity can prevent the disruption of service or the developing accident.

Creativity is an inseparable part of workers activity. The way it is acknowledged and used by the organization impacts motivation at work. Restrained creativity is a likely source of psychosocial risks.
Flexible Work: Occupational determinants of work-life balance

Type: Abstract Oral Presentation
Category: Others

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Background: Digitization is increasing in working life, which facilitates flexible work, regarding when, where, and how employees perform their work. This autonomy creates opportunities, but even challenges for employees to set boundaries between work and private life. Identifying factors determining whether work-life balance is promoted or threatened in flexible work is important as a basis for developing preventive strategies and effective interventions.

Aim: The aim of this cross-sectional study was to examine the extent to which selected organizational, psychosocial and individual factors are associated with perceived work-life balance among employees with flexible work.

Method: This study was conducted among full-time office workers (n= 2 975, response rate 67%) with flexible work (i.e. flex time or self-regulated work solutions), within the Swedish Transport Administration. They answered a comprehensive questionnaire containing questions about various organizational factors (e.g. perceived organizational prerequisites for work-life balance and opportunity for social activities); psychosocial factors (e.g. work demands, social support, and type of leadership); and individual factors (e.g. working overtime, use of technical devices, and over commitment). Multiple linear regression models were used to determine the association between these factors and the answer to the question “how satisfied are you with your work-life balance?” (scale 0-4). Three separate models were constructed for the organizational, psychosocial and individual levels, with adjustment for possible confounders; i.e. age, gender, level of education, and years of employment.

Results: The organizational factors prerequisites for work-life balance (B= 0.49, CI= 0.45 to 0.54) and opportunity for social activities (B= 0.35, CI= 0.31 to 0.39) were strongly positively associated with work-life balance. At the psychosocial level, flexibility at work (B= 0.16, CI= 0.11 to 0.20), social support from managers (B= 0.13, CI= 0.07 to 0.20), social community at work (B= 0.12, CI= 0.06 to 0.19) and structured oriented leadership behaviors (B= 0.06, CI= 0.01 to 0.12) were positively associated with work-life balance. In contrast, negative associations were found for high work demands (B= -0.33, CI= -0.41 to -0.25), high work rate (B= -0.28, CI= -0.34 to -0.22) and expectations of availability (B= -0.16, CI= -0.21 to -0.10). At the individual level, over commitment (B= -0.83, CI= -0.89 to -0.78) showed the strongest negative association with work-life balance.

Conclusion: We found strong associations with work-life balance for several occupational factors among office employees with flexible work. Further research should address these associations in longitudinal studies as well as studies of interventions at the workplace. It is also important to investigate whether these associations are modified by e.g. gender,
age and the extent of flexible work. Long-term effects of flexible work on work-life balance should also be investigated in relation to stress, health and well-being.

Keywords: Flexible work, work-life balance, occupational determinants.
Comparing emergency department staff interruptions to support the co-creation of provider-centered interventions.

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction: The complex environment of the emergency department (ED) makes it challenging for clinicians to manage multiple patients at varying health levels. As a result, clinicians often times interrupt one another as imaging, testing, and patient issues arise to facilitate the progression of patient care through the ED space. Interruptions in the ED setting have been studied, with minimal understanding of how interruptions vary across clinical roles. Therefore this study aimed to compare the prevalence and characteristics of interruptions experienced by clinicians (i.e. physicians, nurses, and residents) for the purpose of informing and supporting co-created interventions to mitigate the negative impact of interruptions.

Methods: Phase 1: Clinicians were individually observed during the entirety of regularly scheduled work shifts. Researchers observed shifts morning, afternoon, and night to ensure interruptions were identified across the day. Data was collected on interruptions using a validated tablet PC-based tool throughout the clinician workflow. Interruptions were time-stamped and categorized in real time according to type and priority. ANOVAs compared interruption frequency by role.

Phase 2: Following the observations, interventions were identified based on the interruptions data using a series of focus groups. Focus groups for co-creating interventions were conducted for each clinical role (i.e. physicians, nurse, residents) individually. During the focus group, staff members categorized interventions into a sorting matrix based on the elements of the Systems Engineering Initiative for Patient Safety (SEIPS) model. At the completion of the separate focus groups, the research team merged and distilled the separate list of interventions into a conglomerate sorting matrix. The conglomerate matrix of interventions was presented at a final focus group that included all roles where interventions were finalized collectively by ranking the interventions based on impact effect and difficulty of implementation.

Results: Ninety-one shifts (n=28 physicians, n=38 nurses, n=25 residents) were observed. Physicians and residents experienced 11.2 and 12.3 interruptions per hour, respectively, while nurses experienced significantly fewer at 8.8 interruptions per hour (F(2,88)=10.42, p<0.001). Nurses and residents experienced more direct patient care interruptions than physicians (F(2,88)=4.99, p=0.009). Residents were interrupted more by phone calls than the other two roles (F(2,88)=7.47, p=0.001). Clinicians also experienced more face-to-face interruptions by colleagues in their respective roles (i.e. nurses experienced more face-to-face nurse interruptions, etc.) than other roles (p<0.05). From the individual focus groups, 24 interventions were identified and co-created. Following the final focus group, 13 interventions were selected for potential implementation.
Conclusion: Clinician experiences of interruptions varied. Consultants and residents experienced similar rates of interruptions, yet the qualitative nature of the interruptions across the three roles changed as a result of their different responsibilities, tasks, and interactions. Subsequently, the interventions identified and co-created differed by clinical role and will be implemented and examined for sustainability.
This paper discusses the possibility of using collaborative methodologies of Design and Ergonomics, such as Participatory Design, Design Thinking, Management Design, and Macroergonomics, among others, as tools for solving organizational challenges faced by teams that produce educational material in Distance Higher Education. Distance Education can present, thanks to its intrinsic characteristics and cultural issues, difficulties of adoption and implementation by students and professionals. Bejerano (2008) reminds us that, in this type of education, students lack opportunities for academic and social integration. They also need more self-discipline and greater initiative to access, learn, and understand the given educational material. Those new to higher education, especially, may become easily discouraged when faced with particular academic challenges. On the other hand, some teachers miss the interaction with students inside and outside of the classroom. Teachers need more pre-class time and organization to transform and translate the content they teach in a traditional class to another medium.

There is another complicating factor: the new technologies. While it is challenging and costly to keep up with their evolution, the educational institutions cannot ignore them, as they have changed social and educational paradigms. These innovations have made large-scale Open and Distance Education a more complex challenge. The world has seen advances such as smartphones, e-books, and tablets. They increased the need to form and train multidisciplinary teams for the production of educational material. Adapting educational content to different types of media requires specific language and visual resources. It also needs specialized professionals, who work in partnership with the teachers and authors. If all these changes have brought organizational problems to the educational institutions, how can we seek solutions through the collaborative methodologies of Design and Ergonomics that apply to work systems?

This paper contextualizes the multidisciplinary process of creating the educational content, based on the current technological and pedagogical demands. It also points out the importance of choosing the right management options that allow the team to reach their full potential and produce high-quality material. For that, the paper addresses Design and Ergonomics as collaborative approaches to achieve the management guidelines needed to improve the multidisciplinary processes. For these procedures, one could base the designers’ role on what Boland Jr. and Collopy (2004) call a ‘design attitude’ for problem-solving, as the designer plays the role of someone who makes the collaborative processes easier. This paper also asks: what are the differences and similarities between the traditional Management methodologies and these organizational Ergodesign approaches? What new results could they bring to the analysis of multidisciplinary work teams, compared to those conventional methods? Finally, the paper proposes a case study to ascertain the applicability of the theoretical concepts raised.
Introduction - The article shows the academic results of a research developed between 2011 and 2017, connecting the discipline of ergonomics with the theme of sustainable development. The partial results of each phase of the research were gathered and analyzed in light of business decision making process.

Literature - Through corporate sustainability, companies are trying to align their economic-financial goals with other goals that could benefit the society. So, the intention of companies is to create value for their shareholders, but also for other internal and external stakeholders, including employees. In this aspect, corporate sustainability aligns its objectives towards the theme of ergonomics. Both perspectives search to provide well-being for workers, and to recognize the importance of their work. Despite of these intentions, companies face difficulties to introduce effective policies. In this context, the research question of the article is: how can companies improve their decision-making process to increase workers’ well-being through policies integrating corporate sustainability and ergonomics issues?

Methodology - Different methodologies were used during the research period: structured literature reviews, structured information analysis of companies that are declared sustainable, and case studies.

Results: From the making decision process discussion in corporations, different typologies of rationalities can be identified. First of all, companies need to recognize their bounded rationality, and the impossibility of reaching optimal global decisions. Second, decisions should not be introduced in an instrumental way, considering the unique maximization of the economic-financial value. Successively, companies need to make decisions based on a communicative rationality involving their stakeholders in shared discussion and shared decisions. Finally, the companies’ decisions would have to consider the implicit and common values shared between the discipline of ergonomics and the theme of sustainable development. This integration could allow more axiological and substantive decisions.

Relevance: The issue of corporate sustainability is relevant for companies. They recognize the challenge of creating value for their stakeholders and, at the same time, creating economic-financial value for their shareholders. However, for companies it is clear that there is a trade-off: at a given moment, creating more value for the stakeholders could reduce economic-financial value for their shareholder. In the case of the stakeholder "workers", it is especially difficult to optimize total value creation, as they are ones responsible for creating value for the organization.
Gathering 3D body surface scans and anthropometrical data as part of an epidemiological health study – method and results

Type: Abstract Oral Presentation
Category: Others

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Anthropometric datasets can be used to scale Digital Human Modeling (DHM)-systems. But obtaining reliable and up-to-date full datasets of ISO-compliant anthropometric measures is time consuming and expensive. To use synergetic effects an explorative method was tested to use the environment of an existing health study and extend the study design with additional three-dimensional body surface scans (body scans). The Study of Health in Pomerania (SHIP, John et.al. 2001) is an epidemiological health study in north-east Germany conducted by the University Medicine Greifswald. In cooperation with the Federal Institute for Occupational Safety and Health (BAuA) the existing measures were extended with two additional body scans to extract anthropometrical measures according to ISO 7250-1. The scan positions were chosen on the basis of ISO 20685, the data storage according to ISO 15535.

Between 2014 and 2016 3D surface scans from 1,644 participants were collected using the Vitus smart XXL 3D body scanner (Human Solutions, Germany). Each participant was scanned in four positions; about 150 measurements calculated from standard scans were obtained by the proprietary algorithms implemented in the AnthroScan software (Human Solutions, Germany) during examination. In a later reading step additional 34 ISO 7250-1 measures were extracted by manually identifying 44 anatomical landmarks on the 3D images of two scan positions, sitting and standing, respectively. During reading each body scan was examined by the reader to rate the posture and arm position of the participant; the latter having an impact on the quality of several of the ISO parameters. High priority was given to quality and reliability of the data. Therefore standard operating procedures (SOPs) were defined for each part of the examination. To discover time and rater-related effects a continuing certification process for each involved scan-reader was conducted. The certification was performed with 10 body scans. The series of readings was performed twice in random order with at least a reading-free day in-between both series. Mean bias and standard deviation were defined for a passing grade. The reader with the best intrarater reliability was chosen as reference for the interrater evaluation. Bland-Altman plots were used for visualization.

Results obtained in the reading process were evaluated with SHIPs standard quality assurance procedures including extreme and missing value analysis and reader bias. 1,600 out of 1,644 datasets were used within the presented study. The others were excluded due to large numbers of missing values e.g. as a result of medical aids such as a corset. In addition, three manually taken measures (height, waist- and hip-circumference) were compared to the extracted body scan data. The results will be presented within the full paper. A next step will be the verification of all taken ISO 7250-1 body scan measures with manual measures (planned for 2018).
Introduction

Psychosocial and organisational aspects of the work environment are important risk factors in the aetiology of work-related musculoskeletal disorders (MSD)\(^1\). Nurses are at high risk of musculoskeletal injury, ill-health and early retirement\(^1\). In healthcare, psychosocial work demands, the level of organisational support and patient handling systems are considered important determinants of the health and wellbeing of nurses\(^2\). The aim of this study was to investigate the association between work-related psychosocial and organisational risk factors, and the risk of MSD in New Zealand (NZ) nurses.

Methods

A sample (N=201) of NZ nurses from the 2013 NZ Census, completed an online survey in 2016-17 (45% of those eligible). The prevalence of musculoskeletal conditions were measured using a modified version of the Nordic Musculoskeletal Questionnaire, a self-report measure of pain or discomfort during the previous 12 months and 7 days\(^3\). Psychosocial aspects of the work environment (quantitative, cognitive and emotional demands and work pace) were measured using components of The Copenhagen Psychosocial Questionnaire (COPSOQ II)\(^4\). The effective management of patient handling issues were evaluated using components of "The Tool for Risk Outstanding in Patient Handling Interventions (TROPHI)"\(^5\). Logistic regression analysis determined the association between musculoskeletal reporting and psychosocial risk factors.

Results

The majority of respondents were female registered nurses (63%), aged between 26 and 40 years (45%), in full-time employment (71%). They worked primarily in the public health sector (52%) from the four largest populated regions of NZ: Auckland (36%); Canterbury (13%); Wellington (10%); and Waikato (9%). Fifty-eight percent reported musculoskeletal complaints in the last 12 months, and 31% in the last 7 days. A good patient handling work environment was protective against MSDs reported during the previous 12 months (OR=0.561; 95 confidence interval (CI) 0.364-0.866). High perceived quantitative,
cognitive and emotional demands all showed increased risk of MSD reporting in the last 7 days (OR range = 1.801 – 1.884). The highest strength of association was found for work pace and MSDs in the last 7 days (OR=2.035; 95CI=1.331-3.113).

Discussion

Psychosocial components of the work environment were found to be important factors associated with the prevalence of MSD complaints in NZ nurses. The key psychosocial risk factors associated with self-reported MSD were perceptions about the pace of work and the lack of suitable equipment, workspace, skills or knowledge for the provision of patient care. Interventions for the prevention and management of work-related MSD in nurses need to consider organisational aspects of the work environment.
A unique Human Model to simulate various types of seat (dis)comfort

Type: Abstract Oral Presentation

Category: Transport

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Human models combined with virtual prototypes are increasingly used by seat and interior engineers in both automotive and aeronautic industries. Testing virtually a seat design enables to anticipate potential discomfort issues, to compare seat variants through repeatable test procedures and this for a wide range of seat occupants’ anthropometries. As comfort feeling is related to lots of factors, human models used for such virtual seat test must cover not only static comfort, through posture and pressure mapping evaluations, but also body vibration transmission related to external perturbations, and human thermal comfort and sensation.

The present paper will describe the different steps of development of these finite elements human models. It will focus on the initial collaboration with Hong-Ik University, to select the targeted human anthropometries, to develop the first human models, and to validate their capabilities of predicting the static (dis) comfort while seating in a virtual seat prototype. It will then detail the work done to capture also the physical phenomena related to the dynamic comfort, i.e. what happens on the human models when it is submitted to some vibrations. This paper will also present the latest developments which have been performed to include the prediction of thermal comfort, as well as the way those developments have been validated.

The second part of the paper will present industrial applications, from automotive and aeronautic seat suppliers and car manufacturers, using those human models in interaction with virtual seat prototypes, in order to simulate seat (dis)comfort. These customers use cases will illustrate the interest of having a unique human model for prediction in diverse discomfort evaluations, such as static, dynamic and thermal comfort. It will also explain the benefit of chaining simulations between seating and vibrations on one hand, and between seating and thermal loading on the other hand.

This paper will then highlight the influence of human anthropometries and percentiles for the evaluation and comparison of static and dynamic comfort. The scaling capabilities of these human models will be used in the frame of this comparison study.
This study examined the correlation between contrast sensitivity (CS) and military all-terrain drivers' ability to identify targets during off-road night driving. The goal was to evaluate whether selection process of candidates for IDF operational driving can benefit from including a measure of CS. Seventeen male soldiers with a mean age of 19 years (SD=0.83) who had a regular driving experience of 2 years on average participated in this study. Participants had no experience in professional driving. The study included two parts: (1) Vision tests in the Lab. These included a Snellen visual acuity test, a Functional Acuity Contrast Sensitivity Test (FACT) that measured CS for targets ranging in size from 1.5 cycles-per-degree (CPD) to 18 CPD, and an Ishihara color vision test. (2) Field Study. As part of their designated military training, participants are required to drive at night on a Hummer jeep while wearing night vision goggles. For the purpose of this study, a designated off-road desert trail was selected. The route included 10 targets (A4-size cardboards at different colors) with different levels of contrasts relative to the trail were randomly located along the route. Each participant in his turn had to navigate the route and stop the vehicle whenever he identified a target. When the vehicle stopped, the participant had to point out the location of the target and the instructor sitting next to the participant marked the location on the trail. At the end of the route, the experimenter measured the distance from the marker to the target. The results showed that: (1) Participants were more likely to identify targets with higher contrasts. (2) Participants who had the highest CS score on a spatial frequency of 1.5 CPD were more likely to identify a target compared to drivers with lower levels of sensitivity at 1.5 CPD. (3) For spatial frequencies of 1.5 CPD and 12 CPD, participants who had the highest scores in their FACT test identified the targets from a larger distance compared to participants with lower levels of CS. Because the small range of acuities differences and the near-absence of color-vision deficiencies, the correlation between performance on these tests and in-field target detection could not be evaluated. The results reveal the potential of using CS as a potential screening for off-road night driving.
Ad hoc creativity methodology for haptic technologies

Type: Abstract Oral Presentation
Category: ICT

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In many project, ergonomists may find themselves in a situation where engineering teams create a breakthrough technology, without any well-defined use case. This situation is not the one preferred by the ergonomists where prospective ergonomics would rather aim at identifying needs at earlier stage in design projects before finding appropriate technologies (Brangier and Robert, 2012). The intervention described in this paper relates to a new haptic technology and our goal as ergonomists in the project is focused on the possible use cases. We are typically in a techno-push context. The technology considered is about reproducing textures. There are two main difficulties for this kind of technology when considering the use cases. The first one relates to the specificities of the haptic technologies and our ability to discuss on sense of touch. Literature shows that we have difficulties to discuss and that we miss vocabulary to describe our feelings with the sense of touch (Dagman et al., 2010; O’Sullivan and Chang, 2006; Obrist et al., 2013). The other difficulty is the interaction situation that is imposed by the technology. If one wants to feel a texture, he needs to touch the surface while having a lateral movement. The specificities of this interaction situation make it difficult to bring people discuss potential use cases while the context of use is so specific and limited.

In order to generate ideas of use cases two methodologies are used in the project. The first one is a classical focus group lead by expert designers. Here the creativity is based on the group discussion.

The second methodology starts from the technology. The aim is to ask testers of the prototype to reflect upon the possible appropriate use cases. In the context of a perception test of textures on the prototype, we recruited 20 participants to follow our ad hoc methodology. The methodology is in two stages:

- Just after the test, the participants have an interview where they are invited to describe the possible use cases they can identify or imagine. Then there is a recall of the specificities of texture rendering. At the end of the interview, the participants are invited to think about the technology for a couple of days and then have another interview.
- Two days later, the participants are once more contacted to provide possible new use cases.

As a conclusion we can say that both methodologies can be seen as complementary. The ad hoc methodology permitted to have more targeted uses and very specific niches were identified for use cases. The drawback of such methodology is that we miss the group dynamic we can find in focus groups.
This paper continues the human-centered iterative design of a 3D-augmented strategic weather management system (Boulnois & Boy, 2016). This research effort is aligned with strategic weather information presented in both 2D and 3D aiming to provide the National Airspace System air and ground agents with improved weather situation awareness and decision-making. The current research and prototype represent the third design iteration and were based on the human-centered design approach consisting of participatory and iterative design. At this stage of the research, we performed knowledge elicitation with 7 expert pilots and user tests with 5 expert and novice pilots. Their continuous involvement in the design and evaluation process as well as the multidisciplinarity of our team were the key factors of the resulting creative design. We first conducted interviews with the pilots to better understand how they deal with weather during all flight phases. The airborne weather radar they mainly rely on appears to have several significant drawbacks: it experiences attenuation phenomena; the accuracy of the information is limited over a certain range; the line-of-sight due to the Earth curvature limits range capabilities; its current information presentation is not meant to provide them with an efficient 3D weather model. Pilots were concerned with the latter in specific contexts (e.g. at night when they cannot detect the build of storms or during phases when a change in altitude is required). Therefore, we decided to propose 3D-augmented strategic weather information features. We integrated both 2D and 3D weather information coming from ground radars. 2D and 3D weather information was respectively presented in a bird’s eye view and an exocentric view. The choice of combining these 2 views together was based on several works reviewed by Tory et al. (2006) in her research. The 2D bird’s eye view provides pilots with strategic weather situation awareness and allows them to detect weather events along their flight path. However, pilots may encounter situations where the 2D representation of these events is ambiguous. Therefore they are provided with an 3D exocentric view that allows them to better visualize and understand weather information, and solve ambiguities related to the bird’s eye view. Following the previous iterations, we optimized the prototype on an iPad for interaction, flexibility and integration reasons. Preliminary experiments have been conducted with 5 pilots to evaluate the system’s usability and its impact on pilots situation awareness and workload. The system was tested standalone. The overall results are positive; pilots’ feedback is very useful and will be taken into account in the next design iterations. Further experiments with the system integrated in our cockpit simulator are planned in the near future for validating these results and discovering emerging properties and behaviors.
Problems in generating, extracting and using sensible slip resistance data

Slip resistance is an integral element of the wicked problem of falls prevention. Unfortunately, few are prepared to invest in developing responsible slip resistance standards and implementing systems that will enable the specification, installation and informed use of pedestrian surfaces that are most likely to provide economically reasonable safe life cycle performance for specific activities in defined environments.

Falls, particularly of elderly persons, is an emotional topic. Many dedicated researchers are seeking to maintain the health, balance and basic functional capabilities of people as they age, thereby possibly preventing falls due to balance loss, deteriorating eyesight and other biomedical conditions. Although people often use the term ‘slip’ to explain that they have had a sudden baffling mishap that resulted in a fall, the floor surface may be inappropriately held responsible for causing the fall in subsequent statistical analyses.

Architects try to minimise environmentally induced falls by specifying surfaces that will provide greater traction than demanded by the pedestrian. Given that the traction demands of pedestrians vary according to the person, their footwear and subjective influences, there is considerable variation, making it difficult to establish minimum compliance requirements. One must rely upon tribometers to provide an indication of the slip resistance of floor surfaces, but different instruments can give dissimilar results of varying biofidelity.

If we had maps that detailed the wet slip resistance of the built environment according to a single reliable instrument, a study of slip incidents might seem to indicate what level of slip resistance was insufficient. In reality, slip resistance changes with time according to the amount of wear and soiling. There is poor understanding of the relationship between slip induced falls and the design and construction of buildings.

This paper will consider studies that have been discussed at recent IEA STF TC meetings and detail two routes that might enable hard floor surface manufacturers to provide reliable long-term slip resistance data that would minimise the number of falls that are due to worn products lacking sufficient slip resistance. As much as everyone appreciates simple solutions, seemingly intractable problems may require more complex solutions to bespoke situations.
Due to the increasing number of mobile phone users with access to the Internet over the last decade, it has become increasingly necessary to propose usability guidelines that are designed to be applied to projects developed especially for mobile devices. In Brazil, mcommerce is gradually being adopted and in the short term it is likely to reach similar performance numbers as to the traditional ecommerce. However, there are still several website projects that are not designed for mobile devices and do not take into account their characteristics and singularities.

A review of the existing literature on the subject was undertaken to elicit suggested guidelines for the development of digital interfaces. Based on these guidelines the websites of two retail companies were analyzed, one is Brazilian (Dafiti.com.br) and the other one is the Brazilian version of an international company (Alibaba.com.br). The objective of the analysis was to assess what are the impacts on usability caused by uncritical adaptations of complete websites to mobile ones. This evaluation was done bearing in mind the categorization of usability principles developed by Brangier e Barcenilla (2003,) which are:

1) To facilitate learning in the first approach of a system;

2) To facilitate the search, perception, recognition and understanding of the system information, it is divided into 3 subcategories:
   - Principles regarding perception aspects;
   - Principles that aim to understand the data, the meaning of codes, terms and icons; and
   - Principles that address problems associated with memory and workload.

3) Facilitate user control when interacting with the system;

4) Consider the context of use and the type of user of the system.

Additionally, when regarding mobile device some other issues require attention such as:

- Screen size;
- Difficult input of information;
- User behavior; and
- System performance.

Issues such as: confusing translations, lack of consistency, small touch targets, amongst others, were detected on the analyzed websites. This investigation showed it is possible to make changes that would result in websites with improved usability. Mendoza (2014)
points out that your desktop experience is not your mobile experience. The author questions: "if everything about the mobile is different – its screen size, Internet connection, device size and the mindset of the person as they approach the site – why would you take your existing desktop experience and copy it? (MENDOZA, 2014: p.11).

Based on the findings of this study it can be concluded that mobile devices, smartphones in particular, impose a series of limitations that users are not faced with when interacting with a desktop or a laptop (Nielsen & Budiu, 2014). Thus when designing mobile websites or apps care should be taken to ensure that their attributes have been considered.
Ergonomics is considered a design-driven discipline although several challenges hinder the incorporation of ergonomics and human factors aspects into the design processes. Furthermore, articulating the several actors involved in the design of work systems has always proved to be a challenge. In this paper we present and discuss a framework for participatory ergonomics design processes focusing on its validation in three real-life design projects. The development of the framework started from a literature search on participatory methods, participatory ergonomics, ergonomics and design, simulation, quality’s participatory tools and computer tools for work systems’ analysis and design. Existing methods for participatory ergonomics were analyzed, highlighting their shortcomings and positive aspects. From this analysis, seven tools and techniques were selected and structured in a draft of the framework which was then consolidated in the first case and validated in the second and third cases. The first case presented was the redesign of an industrial kitchen which was crucial for consolidating the format of the tools and techniques employed. The second one, carried out in a health care, highlighted the framework’s flexibility in different contexts. Lastly, the third case was the redesign of a sector of a large steel industry further validating the framework from the early stages until physical prototyping and implementation. From the cases, we saw that the framework enabled participants to interact and contribute in different contexts (by themselves, in small groups, collectively) in different stages of the design process (analysis, ideation, concept generation, detailing, implementation) while also allowing for the development of several alternative solutions which can be further explored through simulations. Furthermore, it directs the organization towards concrete changes through the detailing and prioritization of possible solutions and the establishment of a shared view of the planned transformations/implementations. The results achieved from the framework’s validation in different situations show that the tools and techniques when employed in an articulated and integrated way supported the development of conceptual designs from a collaborative perspective. Different ways for interacting and contributing during the design process (from the individuals to small/medium teams and the whole group) were fundamental for enabling actors to actively engage in the design. Also, the Brazilian context in which this framework was developed, presents several other challenges that must be better understood. Although the proposed framework is not the first participatory method for ergonomics incorporation into design projects that is reported in the literature, it tries to address some of the issues present in those. Furthermore, as the Ergonomic Workplace Analysis (Wisner, 1995) provides a structured intervention method, this framework can assist practitioners and researchers to better structure their participatory ergonomics design approach using integrated and efficient methods and techniques.
Anthropometric implications of the global obesity epidemic

Type: Abstract Oral Presentation
Category: No productive sector applicable

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The health consequences of obesity are critically important, but they are not the only societal effects of the spreading obesity epidemic. Makers of products that must accommodate anthropometric variability need to understand the external size and shape of all people, including those who are obese. This is particularly important in safety critical applications such as for medical devices and for promoting the mobility of people with obesity in public spaces. Yet, anthropometric information on this important population segment has been largely absent. To address this absence of data, we undertook an anthropometric survey of people with obesity at 4 locations in the U.S. In the course of this work, we uncovered a number of challenges, such as:

Measurement techniques: Most measurement definitions for traditional anthropometry require participants to assume a standardized posture, with heels together. This posture is impossible for some obese participants, and standing for long periods of time can be fatiguing.

Sample definition: We chose to limit our sample to individuals with a Body Mass Index (BMI) of 30 or greater. However, BMI is a continuous variable, and we could as easily have defined the sample at 35 or 40. Each different definition of the sample will produce different summary data.

Sample acquisition: Many people with extreme obesity are house-bound. For convenience and to minimize cost, we chose to measure people who presented at bariatric weight-loss centers. This provided access to the sample, but necessarily limits the full range of variability in our data set.

Summary data analysis: Traditional anthropometric surveys are reported with summary statistics, such as the mean, standard deviation and selected percentiles. Yet, all these statistics assume a normal distribution. By choosing a BMI of 30 as our lower sample limit, we do not have a normal distribution. Instead, our distribution skews to the right (with most people at BMI=30, and fewer as BMI increases).

Data interpretation and application: If designing the opening for an MRI machine using a traditional anthropometric survey, setting the width of the opening at the 95th percentile of body width would provide some assurance that 95% of the population would pass easily through (adjusting for clothing, curvature of the opening, and so on). In the current sample, one could only say that 95 percent of our sample could pass through the opening, since our sample is not normally distributed with respect to those dimensions most affected by obesity. Engineers and designers of medical and safety equipment need to know the outer limits of the design space to safely and comfortably accommodate this.
population. We consider creating body models and design criteria, recognizing that any such target is subject to a number of limitations.
Biomechanical risk factors such as heavy loads and awkward trunk postures have been associated with occupational low back pain. Those same risk factors are commonly experienced among workers handling beer kegs. Small breweries in the U.S surged from 1,500 to 5,000 businesses between 2006 and 2016. Many of the breweries are small and lack resources for materials handling equipment. These limitations cause much work, including keg handling, to be done manually.

One risk factor associated with low back pain is occupational lifting. Indirect costs associated with occupational low back pain are estimated to exceed 100 billion U.S dollars. Measuring worker motions may help with job design to reduce risk factors associated with lifting. Kinematics (displacement, velocity, acceleration) are variables used to measure worker motion. Low back motions have been historically evaluated using observation techniques and bulky devices which are oftentimes most practical in a lab. The technological development of wireless inertial measurement units (IMUs) for human motion provides detailed information related to whole body kinematics, including low back. These small, wireless, self-contained instruments make studying worker motion more convenient and accessible in the actual environment.

The present study used a 3-dimensional motion capture system as a tool to investigate the low back biomechanics during keg handling at a brewery in northern Colorado. Specifically, six workers transferred spent kegs from a pallet to a conveyor to be filled with beer. Workers were suited with 17 IMUs. Data was collected during the portion of the shift workers handled kegs. Low back angular displacements were assessed during keg handling at two heights. Kegs originated from a high or low position and were defined as high or low lifts. Kinematic data from the study was used to estimate compressive and shear forces at the lumbosacral joint. Repeated measures analyses were performed with each low back angular displacement variable as a function of lift condition.

Differences in low back biomechanics between lift conditions were identified. During low lifts, torso flexion was significantly greater than high lifts. The magnitudes of flexion achieved during low lifts significantly exceeded those of high lifts. A broader range of angular displacements was observed in high lifts. In both conditions, estimated kinetics exceeded recommended action limits, potentially putting workers at an increased risk for developing low back pain.

Data collection was feasible during operational hours due to the portability and small design of IMUs. Data collected from experienced workers provided researchers with information directly applicable to keg handling in small breweries. Low back kinematic data established a baseline assessment and can be used to assess workplace design intervention effectiveness. Results from the study can help improve workplace design in a craft brewery, reduce risk, and create safer work.
Lessons learned from crisis situation simulations for the shift manager

Violaine Bringaud, Pierre Le Bot – EDF R&D, Paris-Saclay Lab, Human and Organizational Factors Group

In the post-Fukushima context, the senior management of EDF’s Nuclear Plant Pool took measures to strengthen its crisis organisation to manage extreme situations (like “Fukushima”) that could impact multiple reactors on the same site and isolate the nuclear power plant from the exterior environment. As part of this programme of actions, a multidisciplinary R&D team (made up of ergonomics specialists and human reliability engineers) was asked to lead a campaign made up of multiple trials conducted in collaboration with the plant operator, the engineering department, and the company’s training department. These trials involved the organisation of multiple situational training sessions that included two operating teams on two on-site full-scale simulators, along with part of the national crisis organisation team. Conducted over several years (2014 – 2017), the goal of these trials was to test the development options initiated, in organisational terms as well as from the point of view of team functioning, in order to observe crisis organisation resilience.

In the situations being considered, the nuclear power plant is isolated, which means that for a certain amount of time (several hours), only the shift personnel, who operate the reactors, are present locally on the site, support being offered by national on-call teams that are available and mobilised. In fact, we presume that local on-call support teams, who are part of local crisis organisation, cannot access the nuclear power plant.

This document will focus on the control room command role, which is the only local crisis organisation role to be present in the nuclear power plant; the main activity of control room command support, collecting data (as part of crisis organisation), is, however, taken into account in this situation and can be performed by a member of the operating team. The control room command is also the shift manager within the team for which he is responsible. He ensures the link between the reactor operating teams and the national crisis organisation team via satellite phone.
After a presentation of the framework of R&D's actions, we will specify the missions of the shift manager within the scope of the crisis organisation tested. We will describe the testing system implemented as well as the methodology of the study, which rests on continuous observations of each actor contributing to the management of the situation. Using a few examples, we will then present the main lessons learned from analysing the activity of the shift manager from the point of view of their contribution towards crisis organisation resilience, to which they, in our opinion, bring added value in terms of learning.
Current product and production development tends to become more complex where principal design decisions are made in very early development phases when product data only exist in virtual formats. To support this virtual product realisation process there exist a number of tools and technologies. To consider ergonomics and human factors in an increasingly complex process with often complex tools requires competent people able to handle multidisciplinary development challenges in a proactive manner. Therefore, to answer the need for educational programs to cover these issues the School of Engineering at University of Skövde has developed a new master (second cycle) program in Virtual Ergonomics and Design. The aim with the program is to give students and future product and production developers, necessary knowledge and skills to effectively use virtual tools for analysis, development, and verification of ergonomics and integrate ergonomics and user aspects into the product realization process. A central part is being able to use digital tools to evaluate physical ergonomics but also adapt technology and information based on the cognitive abilities and limitations of different users.

The educational program is tightly connected to the research carried out by the User Centred Product Design (UCPD) research group at the School of Engineering Science where we study how the virtual product realization process can be improved by using digital tools and how companies can consider ergonomics and user aspects, especially in early development phases. The research is carried out in tight collaboration with industry which also enables realistic and valuable cases for the education. One intent of the program is that an increased number of engineers and designers with competence in ergonomics and human factors will affect the design and development processes of future products resulting in an enhanced consideration and prioritisation of ergonomics, human factors, inclusive design and social sustainability.

**Keywords:** Master program, virtual, ergonomics, design, product realisation
Emotional attributes of urban furniture

Type: Abstract Oral Presentation
Category: Building and Construction

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Introduction

Traditionally, research on urban furniture under the Ergonomics and Design perspective focuses on its practical function and some do not consider its context of use (i.e., either in the public or private space). This article presents a research on emotions which emerge from the interaction among user, urban furniture and its use setting, which end up in guidelines for planning and evaluating public urban furniture, considering its emotional appeal. The objective was a framework for supporting the decision making of authorities responsible for the planning, evaluation and maintenance of urban furniture and public spaces. Therefore, this research aimed to: i) investigate how products for collective use have been considered in the Design and Emotion literature; ii) identify and characterize emotional reactions (either positive or negative) raised from the interaction among users, urban furniture and public space; iii) evaluate one positive emotion (pleasantness) and a negative one (fear) raised from the use of public urban furniture and; iv) propose guidelines for the design and evaluation of public urban furniture.

Method

Research was based on 4 field studies. The first one carried out on a touristic town involved 53 users (27 men and 26 women): one classified as primary user (people in service and production), 12 intermediate users (people involved in logistics and maintenance) and 40 final users (the consumers). The second study focused on the perception of safety and pleasantness of 12 users (6 men and 6 women, 17 - 24 years old) of 2 types of bus shelters of the public transportation system. The third and fourth studies evaluated the sense of unsafety and fear of 20 playgrounds’ users (10 men and 10 women, 20 - 60 years old) and other 20 users (10 men and 10 women, 20 - 60 years old) of gymnastics equipment in public parks.

Results

Regardless of the gender, the most mentioned positive emotion was the pleasantness associated to the environment security (practical function) and aesthetics, provided by the attributes vegetation and curved products made with natural local material. Fear was the main negative mentioned emotion, pointed out as a drawback in the use of public spaces.

Conclusion

Based on the field studies, it was possible to evaluate: (i) positive and negative emotions in the interactions among user, urban furniture and urban context; (ii) product attributes listed by the users, which were related to the identified emotions; and, (iii) relations traced between these attributes and the functions that any product must fulfill (practical, aesthetic,
symbolic and ecological). Projectual guidelines were drawn focusing on pleasentness and safety, considering 8 components: i) users; ii) urban furniture; iii) activities performed in the public space; iv) buildings; v) accessibility; vi) privacy; vii) vegetation; viii) maintenance.
Effect of shift work on health and performance of the workers - comparison between Turkey and Czech Republic

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Shift work and especially night work can have a negative impact on health and well-being of the workers. There are several areas where we can usually see the negative impact of the shift work (Costa, 1996).

A – The physical aspects – Due to disturbance of normal circadian cycle shift work negatively influence the sleeping routines, eating habits and have further consequences in fatigue, digestive problems, obesity or cardiovascular functions.

B – The psychological aspects – Disturbance of normal sleeping routine leads also to many neuro-psychical problems like anxiety, depression, hysteria or exaggerated sensitivity.

C – The social aspects – Difficulties in maintaining the usual relationships both at family and social level, with consequent negative influences on marital relations, care of children and social contacts.

D – The performance aspects – Different work performance and efficiency as well as consequent errors and accidents.

Shift work is quite common in service industry and manufacturing due to economic reasons like increasing the productivity and decreasing production costs. Many studies have been also focused on mapping the influence in healthcare e.g. (Camerino et al., 2010) (Yarmohammadi et al., 2016) where the adverse effects may have fatal consequences on patients’ health. Not many researchers focused on relative impact of multiple shift work features on outcomes in different national settings like (Barnes-Farrell et al., 2008) (Tepas et al., 2004).

In the presented research we have focused on two main goals. The first goal is evaluation of the shift work consequences in different sectors and the second goal is evaluation of the national differences. The research was performed in the form of questionnaire survey with further elaboration and evaluation. In case of the Turkey the participants have been working as a ground personal of Turkish Airlines and regarding the Czech Republic the respondents were production employees of machining companies. In both cases the workers have been working in rotating shifts (morning, afternoon, night) as will be explained later. The sample of Turkey was N=109 (males N=49, females N=60) and the sample of Czech Republic was N=45 (only males).

The survey focused on individual perception of following areas:
• The effects of shift work on social life? (family, hobbies)
• The effects of shift work on physical conditions. (eating habits, visage etc.)
• The effects of shift work on psychical conditions. (anger, overreacting, anhedonia etc.)
• The effects of shift work on health. (sick ratio, having a chronic disease, using drug permanently etc.)
• The effects of shift work on sleeping routine and length of sleep.

The statistical evaluation was performed for variables like age, gender and family status. In case of production employees the survey outputs have been also compared with company data regarding scrap ration and productivity in each shift.
Ergonomics in agriculture: critical postures, gestures, and perceived effort in handling foldable Roll-Over Protective Structures (ROPS) fitted on tractors

Type: Abstract Oral Presentation

Category: Agriculture

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Agriculture is one of the most dangerous occupational sectors in both developing and industrialized countries (ILO, 2014), and tractor overturn is the main cause of injuries and fatal accidents. (Abubakar et al., 2010). Rollover Protective Structures (ROPS) showed to be effective in reducing fatalities during tractor overturn (NIOSH, 2009). Foldable ROPS (FROPS) offer greater mobility when working in low overhead clearance zones, such as orchards and animal confinement buildings, and more storage options as opposed to fixed ROPS. However, many fatalities and serious injuries in tractor rollover accidents occur for a misuse of the FROPS (Hoy, 2009). Indeed, previous research showed that after lowering the FROPS to pass an obstacle, many operators prefer to leave it in the folded-down position, since raising and lowering the FROPS is a time-consuming and strenuous process (Khorsandi et al., 2016).

The Organisation for Economic Co-operation and Development (OECD) standard Codes provide a list of requirements to be fulfilled to guarantee a safe and comfortable manual operation of FROPS, for the so called narrow-track wheeled tractors (Code 6 and Code 7; OECD, 2017). Currently, standard tractors, with larger track, mass and dimensions regulated by OECD Codes 4 (2017), are equipped with FROPS. The design and the mass of the structures, the height of the tractor above the ground and the additional obstacles to access the grasping areas ask for a set of requirements specifically addressing the operation of these FROPS.

To develop these requirements, a multidimensional ergonomic approach has been used, considering objective features of the machine as the platform height and the forces required to operate the FROPS, combined with an observation of users’ routine gestures, postures and place to stand adopted to raise and lower the ROPS, and a subjective rating of perceived exertion in real working conditions (Borg’s CR10 scale, Borg, 1998), that allow to understand the most critical issues in use and the solutions spontaneously adopted by the users. In addition, users’ physical and functional characteristics (in terms of height, weight, and hand grip strength) have been evaluated.

The first results of the ongoing project show that participants adopt different patterns of gestures and postures to operate the FROPS. In some cases, the way the roll-bar is handled increases the risk of biomechanical overload or of fall of the operator. At equal weight of the roll-bar and similar tractor heights, participants report different levels of discomfort and perceived exertion. Participants’ height affects these evaluations.
Based on this evidence, a list of user-centered requirements to handle the FROPS will be developed, considering both technical improvements of the machine, and the more safe and comfortable gestures and postures to be adopted, thus facilitating the actual use of the device and preventing accidents.
Neurological patients are characterized by multiple handicaps, including physical, behavioural, and psychological symptoms that are both diverse and fluctuating. They need specialized, multidisciplinary, constant health care, and not only a large amount of hygiene and technical care, but also relational care. The objective of this communication is to present the anticipatory operative strategies used by a team of nurses working in a neurology hospitalization sector and their perceptions regarding the quality of care. The quality of care is studied from the perspective of the ergonomics of the activity: it considers quality as a process constructed in the work situation, which results in the articulation between formal rules of the organization (rule-based quality) and both the individual capacity and the collective of operators, to face unpredictability and natural variability of work (adaptive quality).

The methodology used is based on an exploratory field study using the clinical method of work analysis in ergonomics. Data collection includes fifty hours of observations of real work and semi-structured individual interviews. Six of the twelve nurses in the department of neurology participated in the collection phase. The observation data were analysed qualitatively and quantitatively according to the following categories: displacements, phases of care, actions of care and collective activity. Verbal data from the interviews were recorded and analysed through a manual content analysis. The themes coded for the analysis are: quality of care, anticipation strategies and determinants of the quality of care.

The results show that the constraints related to patient management are different depending on the type of pathology. In caring for Parkinson's patients, nurses spend a great deal of their time administering oral treatments, conducting on-site examinations and coordinating displacements for external examinations in a very short time. The work is characterized by a strong temporal constraint and very limited room for manoeuvre, forcing nurses to spend little time with patients. The management of patients suffering from behavioural disorders entails strong emotional and cognitive demands. We have identified anticipatory strategies common to the observed nurses, which consists in guaranteeing the delivery at the time of the oral treatment to the parkinsonian patients to avoid "blockages", and to avoid the psychological decompensations in the case of the patients suffering from behavioural disorders. These strategies may include changing the order of the tour or reversing the order of care. These results highlight that the contribution of operators to the production of quality is not limited to the execution of a prescription; rather, it is about mobilizing individual and collective resources in order to achieve quality work in a particular care situation.
Digital making as an opportunity for social inclusion of elderly

Type: Abstract Oral Presentation
Category: Education and Training
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Collaborative self-production is an ongoing social innovation phenomena in which people reinvent their ways of living, mainly thanks to ubiquitous digital technologies, connecting people on a global scale (e.g., Internet 2.0) and bringing production closer to consumption (e.g., digital fabrication and distributed systems).

Digital fabrication-based DIY – or digital DIY – is here envisaged as a creative practice through which people may increase their self-confidence and empowerment by developing new skills and knowledge.

Rooted in design and construction, the digital making activities often emphasize the acquisition of problem-solving, critical thinking, creativity, cross-disciplinarity and collaboration.

Among these, creativity and the ability to produce ideas is a key player in representing the intangible substrate for innovation.

The modern concept of competence also comprises a range of personal qualities and the ability to perform adequately and flexibly in well-known and unknown situations.

Within the framework of the EU-funded project ‘Digital Do-It-Yourself (DiDIY), we have explored the dynamics facilitating the acquisition of different competencies in this practice. As design researchers, we have contributed by developing (co)design-driven tools promoting the comprehension of the skilling dynamics through the analysis of digital DIY best practices.

Starting from the results of the Digital DIY project, currently being finalized, has come to light that the developed process can also facilitate inclusivity.

In this specific paper, we will first define such competencies as a result of a comparative study of the literature analysis and then argue how can they develop through digital DIY. Finally, we will conclude with the proposal of transferring the skilling dynamics identified in digital DIY to promote social inclusion.

The analysis of the current scenario of digital DIY as a social innovation phenomenon enabled us to define a model through which it was possible to identify the fundamental dynamics and factors for skilling. The same model can allow the replication and adaptation of such dynamics into a different environment, such as the social inclusion of elderly.

The contemporary phenomenon of “digital making” linked to “make” enabled by digital technologies (e.g., Web 2.0, 3D printers) is a meaningful context for social inclusion through interpersonal productive activities.
To argue and understand this hypothesis, the essential key points are the definition of a DiDIY codesign process and the model we adopted. As previously highlighted, digital DIY has robust sharing and collaborative dimensions itself. Therefore it seems adequate to consider co-design not only as a research approach but also as a mindset to digital DIY practices.

A DiDIY co-design model includes the development of tools that facilitate the involvement of people in the design process. The social empowerment and the individual creativity and self-improvement skills are crucial elements to avoid social exclusion.
Application of Equid methodology and principles of macroergonomics in seat design.

Type: Abstract Oral Presentation
Category: Manufacturing
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It is known that the main concept of Ergonomics consists in the understanding of the adaptation of the jobs to the needs of its users. When dealing with seats should consider several topics this adaptation is of fundamental importance for the perception of comfort of users in relation to their workstations. A Brazilian company located in the south of the country developed a study whose main theme contemplates the application of tools linked to ergonomics to apply concepts that aimed to design a seat that would meet the functional needs of its users, to understand the commercial application beyond its interaction in corporate environments.

Therefore, this work has as general objective to demonstrate the application of macro ergonomics concepts and the Equid / 2008 tool in the design and production of seat and as specific objectives demonstrate the commercial needs, multidisciplinary team involved, as well as evidence the final product result and its relevance in the national and international market.

Methodologically semi-qualitative questionnaires based on the precepts of the tool and macro ergonomics concepts were applied in all stages of the process, involving development team, process and manufacturing, commercialization and users.

It is concluded, therefore, that the Equid tool and Macro Ergonomics concepts have proved effective in the design and definition of the ergonomic and functional characteristics of the product. In addition to fundamental to list the functional needs of the product and the team of workers involved in its manufacture.
Globally there is a pressing need to recruit and train more pilots to cope with the increasing demand for travel (Boeing, 2016). Accordingly, making pilot training more cost effective is a priority. One strategy for this is improving the selection of candidates for pilot training. A range of selection tests are available for identifying the most appropriate candidates, some of which are batteries which comprise general intelligence, psychomotor skills, aviation knowledge, attitude and personality, while others are more individual skills which have been shown to have predictive validity. Extensive validation of selection tests is not always available for industry, and this is a critical gap that affects the consistency and integrity of pilot selection and performance measurement.

This study reports on an ongoing program of testing the validity of selection tools. Two tools are focused on in this presentation: the widely used WOMBAT situation awareness test (Roscoe, Corl & LaRoche, 2001) and a short pencil and paper test of perceptual speed which has been found to be related to improved student pilot performance (Mekhail et al., 2010). WOMBAT incorporates a range of individual tasks that primarily involve target tracking, spatial orientation, pattern recognition and short-term memory. Multiple sources of information and multiple response alternatives are presented, in response to which attention must be prioritised and allocated efficiently. The perceptual speed test takes only 9 minutes (compared to 90 minutes plus extensive instructions for the WOMBAT test) and comprises a matrix of numbers from which participants must locate coordinates and record them using a multiple choice response form.

WOMBAT and perceptual speed test results from 60 ab-initio student pilots will be assessed in relation to flying performance measures, including time to solo and time to licence. WOMBAT was found to predict flying performance, with increases in WOMBAT scores leading to a reduction in time to solo and time to license. Preliminary results with the perceptual speed test did not show a significant relationship with student flying performance measures.

Results will be discussed in terms of their implications for pilot training candidate selection, performance measures available in training, and the use of these tests more widely in industry. The predictive ability of a personnel selection test is the key element of its utility. Establishing and publishing data on the predictive validity of such tests is important for ensuring robust selection decisions, maintaining confidence in the selection process, and ensuring safety.
Understanding the development of skills in pilot training programs is important for supporting learning, responding to the increasing demand for trained pilots, and for safety. While flight data monitoring technologies can now provide a wide range of data for training schools and in GA, knowing which of the available measures to use is a major challenge. This study reports on the development and validation of a taxonomy of safe aviation metrics which can guide users in deciding on the appropriate performance metrics for their purposes.

The taxonomy was developed from a review of training syllabi; techniques used to measure pilot performance such LOSA, NOTECHS, FOQA, automated performance measuring studies; and the National Intercollegiate Flying Association (NIFA) scoring system. As a result of this review it was decided to use the CASA MOS 61 Schedule 2 flight training syllabus as the original basis of the taxonomy. The resulting hundreds of indicators were organised into “domains” of performance within the taxonomy structure (communication; aircraft systems monitoring and management; aircraft operation; aeronautical decision making; navigation and other). Each domain was associated with a series of competencies, elements of competencies and associated performance criteria.

A Delphi study using subject matter experts (SMEs) drawn from the 103 CASA Approved Testing Officers was conducted to validate the structure of the taxonomy, identify the most important competencies and their associated elements and performance criteria. In addition, subject matter experts were asked about how best to index student performance on a range of tasks/skills for which the performance criteria are ill-defined or based on convention. (e.g. safe taxi speed, maximum runway centreline deviation and maximum angle of bank).

Overall, SMEs agreed that the domains of the taxonomy were appropriate, but suggested adding management of technology, self-monitoring/management and SA. The competencies of “control aeroplane in normal flight”, “non-technical skills 1 & 2”, and “manage abnormal situations-single engine aeroplane” were rated as the most important for identifying safe pilots, and “maintain straight and level” and “maintain situation awareness” were among the highest ranked elements contained within those competencies.

Data from the Appareo Vision 1000 system are now being used to cross-validate the taxonomy with student flying performance. Data will be discussed in relation to students’ solo flights, training progression, and instructor ratings. It is envisaged that the TSAM can serve as a guide for researchers and practitioners when seeking metrics of pilot performance in a range of research investigations.
Visual communication

We read almost as often as we breathe and reading is the main communication vehicle. We read to study, work, obtain information, for pleasure, and on all media: from paper to screens...and even road signs.

Reading, like any other human activity, involves the use of energy and if we can't decipher the written word in a fluid and immediate way, reading becomes a struggle and leads to asthenopia. The eye muscles, used first in the process to transform the image into information that can be perceived by the human brain, are strained causing typical clinical symptoms: red, sore or watery eyes, double vision.

The font is the transmission belt between the text and the reader and when it is easy to read all our energy can be spent in understanding the content.

Design for All

The EasyReading font project was originally conceived to make reading easier for people with dyslexia - which affects an estimated 10 percent of the world's population, i.e., about 750 million people. During its development, inspired by the ideas of the maestro Bruno Munari, the concept was transformed as a broader Design for All approach was adopted.

In Design e comunicazione visiva (Design and visual communication) Munari wrote: Visual communication includes all graphic expressions: a character point, the limit of readability of a word, all means to facilitate the reading of a text. The image used must be legible by everyone and for everyone in the same way, otherwise there is no visual communication, indeed there is no communication at all: there is visual clutter.

The difficulties encountered by dyslexic readers were thus seen as an opportunity to design a font that could make reading easier for everyone. Hence it became an inclusive project.

Recognitions
At international level, EasyReading is the only font to have been described by an autonomous and independent scientific study, conducted by Christina Bachmann (Clinical Psychologist and Psychotherapist), as "A valid compensatory tool for readers with dyslexia and a facilitating font for all categories of readers".

It has received a positive opinion from the Italian Dyslexia Association (AID) for its specific graphic characteristics that are useful in facilitating reading by those with dyslexia problems.

For its innovative design, it has been granted financial incentives by the Italian Ministry of Economic Development, through the Italian Value Foundation, Permanent Exhibition of Made in Italy and Italian Design.

**Work in Progress**

In 2018, the new “EasyReading Pro” version will be released which, in addition to the Latin alphabet, will include the Cyrillic, Greek (ancient-modern) and Coptic alphabets.
An organisational disaster can be defined as a low-probability, high impact event with the potential to threaten an organisation’s survival (Duncan et al., 2011). Most organisational disasters have warning signals prior to the event occurring (Wei Choo, 2008), which are increasingly appearing in accident reports. Signals are sensed information regarding emerging events (Ansoff & McDonnell, 1990), and include indicators or cues from the environment (Rasmussen, 1983) which require interpretation and sensemaking (Weick, 1995). Often these signals are weak and vague in nature (Ansoff & McDonnell, 1990). Despite their potential for improving safety, research exploring signals, especially in healthcare, is limited.

The aim of this study was to analyse an example of a healthcare-related organisational disaster using a framework developed for the investigation of weak signals (Carman et al., 2017) and the SEIPS 2.0 model (Holden et al., 2013). The Mid Staffordshire Scandal, that affected the NHS, and the two reports generated by the independent and public inquiries into this event were selected for analysis using thematic analysis (Braun and Clarke, 2006).

In the case of the Mid Staffordshire Scandal, the disaster was not as a result of component failure or human error but rather an organisation that drifted into failure with precursor warning signals being ignored. It has been estimated that between 400 and 1200 patients died as a result of poor care between 2005 and 2008. In addition to this, the inquiries into this scandal have cost approximately £19 million and ultimately have led to the trust being dissolved and services being relocated to other centres.

Signals were present on numerous system levels. At a person level, there were cases of staff trying to make management aware of the problems, as well as the campaign “Cure the NHS” started by bereaved relatives. At an organisational level, examples of missed signals included the decrease in the trust’s star rating due to failure to meet targets, the NHS care regulator voicing concern regarding the unusually high death rates and auditors' reports highlighting concerns regarding risk management. At an external level, examples included negative peer reviews from various external organizations.
As with many organisational disasters, this one highlights the difficulty of recognising weak signals of imminent failure (Wei Choo, 2008). The first step to incorporating weak signals in risk management requires being able to identify where these signals originate from and understanding how they are identified and interpreted. By being sensitive to weak signals, a timely response for corrective actions can be developed (Weick et al., 2005), which furthermore may assist an organisation in improving its reliability (Wei Choo, 2008). In healthcare, this could result in significant benefits with regards to patient safety, but also with regards to organisational aspects.
Redesign of an Airplane Coffee Machines Tests Bench. Ergonomics and Continuous Improvement methodologies. Better together than on their own?

Type: Abstract Oral Presentation
Category: Aerospace

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Keywords: Ergonomics, Continuous Improvement, Aviation Maintenance

Introduction: The fields of Ergonomics and Continuous Improvement have two different disciplines history, and the Health and Safety issues have their own place centered on working conditions improvement. At TAP AIR PORTUGAL, these domains of intervention are organized in such a way that the ergonomics projects are embedded in the Occupational Health and Safety department activities. On the other hand, TAP Maintenance & Engineering which is the TAP Group maintenance unit, a MRO *, develops each year, at least, two Kaizen events named “Continuous Improvement Weeks”, organized by their own, with different teams focus on finding and implementing solutions to improve their working processes. In this context the TAP ergonomist was invited to participate in a multidisciplinary project within a multi-professional team with the goal of redesign a Coffee Machine Tests Bench that needed an update.

Methods: The ergonomist used the appropriate work analysis related tools and the other 4 team members (two engineers and two avionics technicians) used the typical continuous improvement methodology and tools. As a result, a real size model was built and used as a proof of concept simulator. Later on the new workstation concept was built in the shop.

Results: The combination of methods provided a very satisfying result in Quality, Productivity and Ergonomic points of view. The working process was almost totally modified with good results in the process/productivity/cost reduction domain and the new workstation is now more user friendly and the WRMSD** risk is now much lower. In this model of intervention the workers participation was very useful as their knowledge of the process was taken in consideration and incorporated first in the proof of concept and later in the final solution.
Discussion: In this innovative approach, the participation of an ergonomist in the team of continuous improvement project has contributed to improve the final result of the redesign process especially regarding the musculoskeletal disorders risk and the workload. The continuous improvement projects can be a very interesting opportunity for the ergonomists to gain a “seat at the table” and demonstrate how ergonomics interventions can be very useful to achieve company’s goals.

*Maintenance, Repair & Overhaul

** Work-Related Musculoskeletal Disorders
Music is important in video games. It has to be considered more than just an environmental stimulus. However, the role of music in user experience in video games has received little attention in the literature. In particular, there is still a need for investigation of the effects of self-selected music and the arousal level of music on player experience. An experiment was designed to study the effects of these music characteristics on player performance and player experience in different genres of games. Although no significant effect on performance was observed, results showed that the type of music displayed when playing has an impact on players’ affective enjoyment and music perception. Moreover, further analyses revealed significant interactions between the genre of game and the type of music presented on player experience. Overall, these findings suggest that music should be better taken in account in video game design to optimize player experience.
Abstract:
The rapid pace of technical innovation highlights the issues of the relationship between
users, digital objects and environments, and, in the context of graphical interfaces, shows
the existence of Visual-Digital Literacy. The digital medium, built by the intersection of
different media that mix distinct visual genres, requires people to have a specific set of skills,
since the instability of digital interactions defines a unique dynamic between designers,
platforms and users. Hence, it becomes of the utmost importance to research on the
different skills and processes of literacy developed by technology users when interacting in
the digital sphere. This paper proposes as an overall intention to investigate the impact of
Visual Literacy, through the acquisition of repertoires, in users' access to mobile devices.
To that effect, the research hypothesis is that a limited visual repertoire is a direct cause of
users' deficiency in Digital Literacy skills. For a theoretical basis, the evolution of
technologies and graphical user interfaces (GUIs) were raised; as well as outlined the
concepts of Visual and Digital Literacy. Succeeding this review, two evaluation techniques
were defined, an Iconographic Comprehension Test and a Usability Test. The convergence
of both techniques sought to answer the following research questions: Considering the
definition of Visual Literacy, how does it relate to users' digital proficiency? And what is the
impact of Visual-Digital Literacy in user interaction with devices? First, the Iconographic
Comprehension Test was applied to detect the proper understanding of symbols, there is,
to measure users' ability to interpret visual elements. The test proposed the classification of
the participants in two extremes of Visual Literacy. Afterwards, the participants framed at
these extremes were recruited to participate in a Usability Test. The purpose of such test
was to assess the impact that Visual Literacy has on Digital Literacy, thus measuring the
performance of participants from the Comprehension Test while performing tasks on a
smartphone. Three methods were used to measure users' task completion rates, number of
screen touches during task and overall interaction strategies. They were: Student's ?²-test
and Pearson Correlation Coefficient, followed by a Retrospective Think Aloud (RTA)
protocol. The final results of this research methodology showed that Visual Literacy does
influence on the performance of users in the interaction with devices, proving that Digital
Literacy relates to people' visual repertoires.
MANAGEMENT OF PSYCHOSOCIAL WORK ENVIRONMENT: OUTLINE OF A MULTIDISCIPLINARY PREVENTIVE INTERVENTION IN A LARGE NORTH ITALIAN MUNICIPALITY

Type: Abstract Oral Presentation
Category: Healthcare
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Background: there is a need of evidence-based multidisciplinary intervention studies to prevent work-related stress in municipality workforces.

Objectives: to evaluate risk assessment, health surveillance and management of psychosocial risk factors in a municipality; to design a multidisciplinary preventive intervention.

Methods: the study was carried out in a municipality employing 1730 workers. A steering committee of 2 occupational physicians and a psychologist designed the intervention, consisting of: preliminary meetings with management and human resources personnel; data collection over 2012-2016, regarding: risk assessment; health surveillance; assessments from professionals (psychologists, educators, mediators); training activities; collection of sentinel events (e.g., physical or verbal attacks, transfer requests, disciplinary actions); data from focus groups; qualitative and quantitative data analysis to identify critical points and propose a comprehensive intervention. Results: the 1730 workers are employed in 7 areas, 32 sectors and 74 services. The organization underwent 4 major renovations over the last 5 years and 3 changes of general manager. Psychosocial risk assessment was carried out by means of a questionnaire developed by national (INAIL) and international (HSE) bodies for objective measures; subjective assessment was evaluated by OSO. Overall, risk assessment identified critical areas and sectors and needs update. Low response rate and non-comparability of data were critical issues. Health surveillance often reported stress related problems, but no structured intervention or integration with other municipality functions were noted. Internal transfer and mobility were critical issues too. Data on wellness were outdated, generic and not relevant. Psychologists and consultant evaluated many cases and often suggested operative solutions. Focus groups were few, with no clear participation rate. Communication between colleagues and with superiors, training and work organization were also relevant and shared issues. Lack of an overview of the work organization and difficulty in perceiving the meaning of one’s work, with consequent demotivation, were relevant in determining high level of work stress. No systematic analyses were carried out, as well as no overall appraisal of the work related stress impact on the municipality, using common scientific indicators.
Discussion and Conclusion: overall, the data collected allow to design a preventive intervention, with the following scheme: establish a formal municipality policy for work-related stress with a clear implementation strategy; create a multidisciplinary working group, managed by a psychologist, involving occupational physicians and consultants for work related stress, with dedicated space and time and a commitment to evaluate single cases and general issues, as well as to elaborate, adopt and monitor specific interventions, using evidence based indicators; use of evidence based risk assessment and health surveillance tools; adopt strategies to improve participation and response rate, involvement of area managers, workers and their representatives; implementation of good practice in transfer and mobility management.
Ergonomics in Portugal started around 32 years ago. During this period, the education of ergonomists and the profession have been developed and consolidated. The labour market has been progressively opened, helped by the creation of the Portuguese Ergonomics Association (APERGO), in 1992, together with its affiliation at the IEA and at the Federation of the European Ergonomics Societies.

Ergonomics as an university course in Portugal was started in 1985, as an undergraduate course, with five years long, at the Faculty of Human Kinetics (FMH) from the former Technical University of Lisbon (now University of Lisbon). During the 32 years, some changes have been introduced regarding the length of the course: in 1992 there was a reduction to four years but, in 1999, it returned to five years. The major change was introduced in 2007, following the Bologna Agreement with a reduction to three years long. The main consequences were the rearrangement of the contents, over some and the elimination of one year of full time training at an external organization corresponding to the 5th year, that has been moved to the master in Ergonomics, starting in 2009. However, in the new curriculum was created a unit of Training and Project was created involving the permanence in the work only once per week to allow a minimum experience. This undergraduate course is quite unique around the world since most of the Ergonomics courses are postgraduate. A similar exception is an undergraduate course in Ergonomics from the Loughborough University that recently has been called User Centred Design. At this university there is also a master in Ergonomics (Human Factors).

Aiming to characterize the profession, two questionnaires were applied to ergonomists. The first questionnaire was applied by FMH to a sample of 39 ergonomists, 14 males and 25 females, aged between 25 and 52 years old with average age of 38 years. Fourteen have finished only the undergraduate course (35.9%), 22 have the master in Ergonomics (56.4%), and only one has a PhD. Regarding a question about the need of more ergonomists in Portugal, 32 individuals have said “yes” (82.1%) and only 7 have said “no” (17.9%).

The second questionnaire was applied by APERGO to 43 ergonomists, 13 males (31.2%) and 30 females (68.8%), with an average age of 38 years. Fourteen have finished only the undergraduate course (32.6%) and 29 have the master in Ergonomics (67.4%). Most of them work in Ergonomics (60.47%) and/or Health and Safety at work (55.8%), mainly in the sectors of Services (53.5) or Industry (30.2%).

During these years of economic crisis the training of ergonomists in Portugal has been questioned based on its costs. However, now that the country starts improving the future seems more promising.
In June 2014, World Cup soccer season, the city of Natal, Brazil, was hit by 285 mm of rain. The rain caused landslides in the neighborhood of Mãe Luíza, which totally destroyed 26 houses, affected 187 families and formed a crater with 30m depth and 10,000 m² area. The neighborhood of Mãe Luíza is located in the coastal region of the city, has dune terrain and rugged relief. Surrounding them are noble districts, but this neighborhood is occupied by poor families, for the most part. The vulnerability of the neighborhood to disasters is due to several factors. Among them, the disposal of solid waste in the neighborhood of inadequate way. The inability of the public system to collect waste efficiently, makes the accumulation of waste in the neighborhood’s public roads a risk factor of disaster and an aggravating to the damages caused. The objective of this work is identify areas of solid waste disposal in the neighborhood that may affect or affect drainage of rainwater, causing flooding, or that may cause mass movement due to accumulation in sloping areas. After the disaster of 2014, local media surveys and field surveys were conducted in the neighborhood to obtain photographic records and news related to solid waste disposal. In addition, the population affected by the disaster was interviewed regarding solid waste disposal and the relationship with risks and disasters. It was found that a large amount of waste accumulated upstream of the slopes was dragged by landslide to the crater region. Systematic observations during the rainy season have shown the inefficiency of public sanitation policies, specifically the collection and disposal of waste and the cleaning of drainage devices. Despite the daily public waste collecting, even after the disaster, the presence of waste in the streets of the neighborhood is constant. Stationary public buckets have been identified in two neighborhood locations and eleven informal (created by population) waste disposal sites which waste is improperly disposed of. Some of these sites are close to slopes and drainage devices, giving an aggravating potential to disaster risks. There are areas of the neighborhood that are inaccessible to the garbage truck, helping to get the garbage deposited on the doors of residences and public roads to be swept away by the winds and the rains. The decoupling of public policies on solid waste and protection and civil defense at the municipal level is crucial for solid waste to become one of the factors of risks and disasters. The integration of these policies, with the participation and involvement of the population, could make the neighborhood of Mãe Luíza more safe, with respect to disaster risks, and cleaner.
Creativity and performance: a case study in a highly regulated and constrained domain

Type: Abstract Oral Presentation
Category: BUSINESS CASE - Manufacturing

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The outage for maintenance of an energy production plant is a complex domain submitted to numerous stakes and constraints: productivity, safety, security and environmental protection. Outage projects have to manage a set of events of various natures: technical, organizational or human hazards and changes in regulation. Obviously, the Socio-Organisational and Human (SOH) dimensions are essential to overtake these difficulties, reach and maintain the performance of the outage projects in an acceptable cost (human, social, financial).

For several years, the outage projects do not reach the performance target. The various analyses realized by the operator revealed recurring difficulties, such as non-quality of maintenance, insufficient preparation of the maintenance activities or deficiency in the resolution of hazards. Concluding that the organisation would have reach its limits, the operator launched a 3 years R&D project in 2015, aimed at enlightening the mechanisms and the SOH characteristics that contribute to reach and maintain the targeted performance.

The R&D project is divided into 3 phases: the development of an "effective organization model" based on a state-of-the-art review and the completion of several field studies. This model relies on a typology of situations encountered by the outage project teams and three operating regimes (the robustness, adaptability and reconfiguration regime). The general hypothesis is that performance of the organisation relies on its capability to process each regime and to move from one to another according to the situation evolution.

The second project phase is the design of an approach that starts by the diagnosis of the plant organization using the model as a frame of analysis. The third phase is to transmit the model and the approach to the operator.

The final paper will initially present the development process of the model and the main lessons learnt from the field studies. First, collective creativity is needed to manage hazard events even in a highly regulated and constrained domain. The learning process based on experience at individual, collective and organizational levels plays an essential role in promoting this creativity, as some specifics SOH characteristics falling within leadership, collective decision process and relational climate.

In a second step, the paper will present lessons from applying the approach to a production plant. It will showing that this diagnosis and the easy appropriation of the model by the stakeholders stimulate reflection within outage organisation on its own practices, strengths and weaknesses, thus contributing to the development of improvement solutions.
Finally the paper will outline the limitations of both the model and the approach and the issues to be addressed to transmit the approach to the operator.

**Keywords:** resilience, reliability, energy, creativity, performance
Until recent years, ergonomics has been developed within walls or in physically and socially delimited spaces, that is, a good part of research and studies in ergonomics have focused on the activities carried out by individuals in architecturally or physically delimited places, that is, an individual, a task and a technology. In the last decade, the irruption of communication technologies contributed to the emergence of the sphere of ubiquity, that is to say the availability of what is necessary to develop an activity or fulfill a task in any physical point; this modification implies changes in many of the basic ideas of ergonomics. In fact, the work becomes increasingly immaterial and the activities are developed independently of the physical spaces. Therefore, the need to integrate new elements into the processes of ergonomic analysis and intervention, in the interventions and analysis, is required to include concepts such as omnipresence, self-involvement, intensification, liquid work, availability and life at work. Many of these have been treated in philosophy, sociology and psychology; however the link of individual activity to this new reality of work implies new approaches.

In terms of changes in manufacturing and production processes, in the years to come, a transition from manufacturing forms focused on localized production to forms of distributed manufacturing based on networks, manufacturing in a network (Manufacturing Grid), virtual manufacturing, will be progressively observed. Fast manufacturing, in addition to the internet of things, all this supported by the cloud computing, which could generate cloud manufacturing. The work becomes executable anywhere and at any time; this is due to the integration of systems networks with each other and with internet.

According to Putnik [17], a ubiquitous manufacturing system (UMS) is represented by two qualitatively different paradigms. The first UMS paradigm employs ubiquitous computational systems to improve the efficiency of existing manufacturing systems ("traditional manufacturing"), while the second paradigm implements the UMS architecture and organization as a mapping of the ubiquitous computing system concept and does not necessarily use ubiquitous computational systems to improve the efficiency and effectiveness of the manufacturing system.

This study took into account the relevant aspects of the worker's location from a technological, industrial and social perspective. The aim is to develop a new ergonomic approach in the field of embedded systems (software intensive), in particular, an ergonomic analysis model is presented in the productive activities of services.
The SIN-DME questionnaire (Symptoms of Incomfort associated with Muscle Skeletal Disorders)

Type: Abstract Oral Presentation
Category: Manufacturing

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SIN-DME is a web application that works as a means of systematizing information from the worker and seeks to define and characterize the problem of the evocation of pain as an expression of the in-comfort associated with the work situation, the condition of the worker and the complexity of the task, be it derived from the design of the work or the design of the organization. SIN-DME has been developed as a means of self-evaluation in four domains of pain experience related to WMSD.

In the design it is recognized that the experience of a symptom becomes a complex phenomenon where biological, psychological, social and cultural aspects intersect. These may reflect a complex variety of sensations, which may not necessarily be linked or related to an illness or injury. In addition, it should be considered that in general, people handle the symptoms in a private way, without expressing it with their relatives or in their context. Therefore, the design of the questionnaire explores the problem of the symptom is essential to understand "the experience of the symptom, the interpretation of the symptom and its management in daily life".

For the application, a cross-sectional descriptive observational study was carried out in a sample of workers was composed of 502 workers, 387 men and 115 women, with an average length of service of 12.1 years for workers, men and 5.8 years for women. Regarding the presence of in-comfort and presence of pain, 55% declare the existence of this subdomain. According to the segment, there were 101 cases of back pain, 52 of shoulder pain and 48 of wrist pain, among other compromised segments. It was also found that pain is localized in 79 of the cases.

In the same way it is identified that a segment is affected in 182 cases, in 61 two segments and in 21 three segments. The pain is present when performing the work in 28% and all the time 28%, it also highlights the presence of pain at the end of the day in 60% of cases. Regarding the presence, it is indicated that 130 cases have been more than 12 months and in 40 six months, the discomfort lasts more than 24 hours in 140 cases and of 1-7 days in 43 of the cases.

The questionnaire allowed locating workers who were in the process of developing a DME, and that by conducting a thorough evaluation of their health conditions and work situation could determine the lines of action in terms of prevention.
Currently, the use of ultrasound as a therapeutic element in the physiotherapist's practice has been widely recognized. To carry out this therapy is necessary to use specialized equipment, which are directed to specialists in physical therapy. However, because of the diversity of models and brands, there are many differences in design, which can modify the interaction between the user and the product. The objective of this research is to compare the usability of two therapeutic ultrasound equipment used in an University of the Metropolitan Zone of Guadalajara to identify which of these generate a better interaction with the user. In this study 24 students of physical therapy from the Polytechnic University of the Metropolitan Zone of Guadalajara participated, 12 men and 12 women between 20 to 42 years of age who were studying between the second and third year of their academic program. The tasks that students had to accomplish were video recorded using two digital cameras, one in each workstation, in order to record every participant while completing the activity. The tasks that had to enter in each ultrasound equipment were the following: turn on the equipment (identifying the switch and activating it), modulating the power to 12W / cm², intensity to 3MHz, the frequency cycle to 50% and the time to 10 minutes. All participants were video recorded while programming the equipment, in order to evaluate the efficiency and efficacy, the first one, from the time recorded and the number of errors at the end of the task; and the second one, taking into account the amount of parameters that they reached to program, including the ignition of the equipment. At the end of the indicated activities, the students were asked to answer a printed version of the SUS (System Usability Scale) usability evaluation questionnaire (Brooke, 1996). According to the results obtained, it was observed that both equipments obtained a similar result in the registered time and the number of errors. In the case of the number of participants who managed to complete the task correctly, it was higher in the use of the SONICATOR equipment, thus being able to qualify it as the most effective. The scores obtained in the SUS questionnaire were also higher in the SONICATOR, indicating that participants were more satisfied with its use. In general, regarding the aspects that qualify usability in its different variables (efficiency, efficacy and satisfaction), the SONICATOR 740 team obtained the most favorable scores in comparison with those obtained in the use of the ULTRACORMAT ULT-134 model equipment when performing the tasks and parameters indicated.
The field of exoskeleton research has rapidly enlarged in the last few years. There have been many studies carried out and several are still in progress. Many exoskeletons that target the industrial use case are under development at a prototype phase and yet not ready to go into production. Development requires active support from potential customers.

In industry, workers are often subject to repetitive activities where the potential for long-term medical conditions is noteworthy. Physical stressors during work are associated with an increased risk of muscular-skeletal disorders. In the case of manual material handling, the aim of an exoskeleton should be to reduce the compression forces in the spinal discs and vertebrae when leaning or lifting loads. While exoskeletons that support the lower limbs could reduce the physical fatigue associated to frequent and repetitive standing work.

The paper describes the laboratory tests carried out on two passive exoskeletons commercially available: an exoskeleton for the lower limbs and an exoskeleton for the back. Tests were carried out with FCA workers who volunteered for the study and were based on a repeated measure type experimental design, including within-subject comparisons of without and with exoskeleton use.

At a second step, virtual modelling of a few static postures was carried out, reproducing the main anthropometry of the worker and the postural angles of the worker while using the exoskeleton. A main output of the model is the estimate of what forces are exchanged between the subject and the exoskeleton.

In the case of the lower limb exoskeleton, an important parameter to consider is the percentage of the subject’s weight that is sustained by the exoskeleton frame. The higher is this percentage, the lower will be the strain on the subject’s lower limbs.

First comparison between experimental and simulated results showed good agreement and auspicious advantages of exoskeletons in relieving the strain on workers.
Passive Upper Limb Exoskeletons: an Experimental Campaign with Workers

Type: Abstract Oral Presentation
Category: Automotive

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Wearable exoskeletons, or frames worn on the outside of the human body, are being widely explored by engineers as a form of aid towards the needs of workers on the factory floor. In industrial settings, exoskeletons could be useful when other preventive measures are not feasible or effective to lower worker’s fatigue, thus leading to increased worker's alertness, productivity and work quality, to support experienced personnel in the work force for longer, and to reduce work related musculoskeletal disorders.

Passive upper limbs exoskeletons target gravity compensation through mechanical passive elements like springs that are generally ineffective when the arm is in a neutral position and progressively increase the support as the arm is raised. Main desirable system characteristics are a minimal weight and a wearable, robust and compact design.

The paper presents the results of an experimental campaign carried out on a passive upper limbs exoskeleton. The campaign involved FCA workers who volunteered for the study and includes laboratory tests as well as assessments at the assembly line.

The exoskeleton assisted work tasks were devised to point out possible advantages in the use of the exoskeleton with respect to a reduced physical strain in holding demanding postures with raised arms and/or having to lift and hold small work tools while completing tasks as mounting the clips of brake hoses underbody or sealing underbody using a sealing gun. The testing protocols based on repeated measure type experimental design, including within-subject comparison of without and with exoskeleton use.
Push and Pull – Force measurement updates, interpretation of measurements and modes, peculiarities (curves, steps, etc.). Multi-task analysis

Type: Abstract Oral Presentation
Category: Manufacturing

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Push and Pull measurement using conventional instruments such as mechanical dynamometers, does not allow to fully appreciate the peculiarities of a path with curves, gradients or variations in the terrain.

High-sampling digital dynamometers allow to accurately observe the performance of the force during push and pull activities.

In particular by performing the measures in accordance with the International Standard ISO11228-2 it’s possible to identify:

- The Initial Force by recording the peak in the initial phase of the movement;
- The sustained force by recording the entire phase after the peak: in this case, the value should be processed as a 50th, 75th or 90th percentile of the sample of data recorded, because the percentile concept approximates the classical interpretation of the sustained force, according to proposed criteria by Stover H. Snook and Vincent M. Ciriello, authors of the benchmarks for the push and pull activities of the International Standard ISO 11228-2.
- The maximum force recorded after the initial force (not required by ISO11228-2): in some cases there may be steps or imperfections in the floor that generate peaks in the initial phase and in the next stage of handling that are difficult to observe with the traditional methodologies of evaluation. Through high data sampling dynamometers (eg 1000 sampling per second or more) it’s possible to measure these peaks and compare them with the limits proposed by the ISO11228-2 standard for initial forces.
- The stopping force (not required by ISO11228-2) which in particular cases may be comparable or superior to the initial force.

In various measurement experiences carried out in working environments such as urban waste management, hospital departments, or manufacturing departments, it has been observed that sustained force is not constant, but also varies rapidly. These variations are intrinsic to any handling activity, but introduce a further difficulty in defining the value of this factor.

Through many analytical measurements made up of so many samples, it’s possible to establish a percentile (50th, 75th or 90th) which is the best approximation of the measurement value with the classical criteria.

Moreover, in every workplace handling activities are different by types. For example, in urban waste collection, two-wheeled and four-wheeled carts with different volumes and flow rates, on different types of terrain.
During the shift operators are exposed to multiple handling tasks: it's important to set up a multitask analysis push and pull activities.

Curves, steps and gradients introduce additional variables to the Multitask analysis.

The analysis of the various situations allows to create a database of useful data to map the risk in advance.
Slip initiation has been the critical instant that most of the mechanical measurement devices attempt to duplicate. However, the common practices have been to use a snapshot of slip events to represent slip initiation with a fixed normal force, sliding speed and heel (foot) and floor angle. Although strong correlations have been reported between the coefficient of friction measured with these devices and slip outcomes, different conditions adapted by different devices could produce different values, making it very difficult to compare these values with the friction demand measured from human subject experiments. Therefore, there is a need to identify the critical period of slip initiations. A glass force plate was used to observe the contact interface between shoe and floor under slippery conditions. The force plate surface was covered with 70% glycerol. The movement of shoe heel was quantified. The forward movement starts soon after heel strike. However, as heel accelerates, the forward speed really picks up at the instant when the front edge of the heel in contact with the liquid contaminant. Therefore, the period between these two instants is the critical instants that the mechanical devices should try to duplicate. Compared with the conditions currently adapted by these devices, the normal force and forward sliding are not constant. More importantly the foot angle is not constant, but it has a high angular velocity.
E-health appears to be both an economic solution and a way to overcome the increase in health needs due to the aging of the population and the increase of diseases. Our project aims at developing individualized monitoring of patients who undergone surgery supported by a medical information system and by connected devices. These connected systems have many benefits for healthcare system, but they also have currently disadvantages. These emerging technologies indeed encounter obstacles related to the complexity of their use, the reliability and security of data and the resulting socio-economic transformations (Kjeldskov, 2003).

End-users of the health information technologies must be able to familiarize themselves with these tools readily. According to Borycki and Kushniruk (2005), the ergonomics evaluation should be mandatory. Designers have an important responsibility and face a crucial challenge. They indeed have to build devices that can be manipulated by specific segments of the population, such as the elderly who are often novice in technology and with particular cognitive and motor characteristics. The users (patients and health professionals) have to be confident, engaged and motivated in the use of these products / services.

Watbled et al. (2010) explained that the medical devices must be evaluated at several dimensions: the effect on the patient and on the public health, the impact on the quality of healthcare and on the uses. These tools related with health issues are also highly dependent on the field of application. Their evaluation must be done in a real work situation with health professionals with different patient profiles (age, needs, skills, literacy, pathology, expert/novice in technologies ...) in their usual environment. It is essential to have a user-centred perspective during the design process and the evaluation of these technologies. The aim of our work is to take into account all these dimensions through a multidisciplinary approach, both ergonomic and cognitive.

In ergonomics, the design and evaluation of these technologies take into account four dimensions: utility (Loup-Escande et al., 2013), utilisability (Baccino & Colombi, 2005), acceptability (Bobillier-Chaumont & Dubois, 2009) and user-experience (Hassenzahl, 2011).

Cognitive psychology can contribute in design of health products through studies of learning, understanding of procedural documents, trust, commitment, metacognition while taking into account the characteristics of the users. For example, cognitive psychology can help in design of the instruction (Garnier, 2016) and can complement the ergonomic approach in the study of the relationship between understanding of instructions and ergonomic dimensions given above.
Thus, these two joint approaches can contribute to greater acceptance and use of these devices in all the sphere of the health (patients, caregivers, family careers).
By Convention No. 138 specifies the minimum age for working children which it must not be lower than the age of completing compulsory education and lower than 15 years old. The allowable work for working children must not be harmful to children’s health, must be safe and not against good morals. Manual material handling is common tasks can be found in many conditions of working children aged 15 to less than 18 years old, especially lifting tasks. The lifting tasks may exceed the children’s capacity and may lead them to problems of accumulative fatigue, musculoskeletal disorders and other health effects in the future. This study is conducted to determine what maximum weight is accepted by the children and whether the accepted maximum weight exceeds their physiological capacity and muscle strength or not. This research experiment get permission or approval from Thammasat University Research Ethics Subcommittee. The study of lifting tasks by simulating works in laboratory and applying psychophysical, physiological and biomechanical safety criteria shows that the maximum acceptable weight is significantly different between boys and girls. Maximum acceptable weight for boys is 10 Kilograms and for girls is 5 Kilograms. In addition, repetitive lifting had a great physiological effect resulting in cumulative fatigue in children and may have negative impact on their health and growth in the long run. Therefore, children shall not be allowed to lift with the frequency greater than 1 pieces per minute. These results are based on lifting posture with a straight back, no bending or twisting in order to reduce risk of injury during lifting.
Identification of Magnetically-disturbed Inertial Measurement Unit Data Segments

Type: Abstract Oral Presentation
Category: Others
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Introduction: Accurately measuring human motion in the workplace is critical in many ergonomics applications. Inertial measurement units (IMUs) are small, solid-state devices used to estimate the spatial orientation of a body segment using a combination of accelerometer, magnetometer, and gyroscope measurements. IMUs are appealing to ergonomists as they allow accurate and repeatable measurement of posture and kinematic information at a lower cost than “gold standard” motion capture systems. The accuracy of IMU-based measurements, however, is adversely affected by magnetic disturbances. Methods to identify and compensate for magnetically-disturbed data collected via IMUs are needed.

Purpose: We compared two methods to identify magnetically-disturbed data segments collected with IMUs. The first method (threshold) operates under the assumption of a uniform magnetic field strength. Disturbed magnetometer measurements will therefore be identified if the measured magnetic field strength is outside of a preselected range. The second method (heading) operates under the assumption that the gyroscope-derived heading measurements will deviate minimally from the magnetometer-derived heading measurements. Disturbed magnetometer measurements will therefore be identified if the gyroscope and magnetometer-derived heading measurements differ substantially. While both methods have been commonly used to identify stable magnetometer measurements in sensor fusion algorithms (e.g., Kalman filters), these methods have not been used previously to identify magnetically-disturbed data segments.

Methods: Thirteen participants performed a simulated work task involving the repetitive transfer of wooden dowel rods from a plastic container located at waist height to an identical plastic container located at shoulder height (and arm’s reach) for a period of one minute. An IMU (APDM Opal, Portland, OR) was placed on the participant’s dominant hand. A set of reflective markers were attached to the top surface of the IMU. The markers were tracked by an optical motion capture system (Optitrack Flex 13, Corvallis, OR). Magnetic disturbance was induced by placing a steel plate under the container located at shoulder height. The threshold and heading-based detection methods were used to record the number of rejected IMU measurements per trial.

Results: Preliminary results suggest that both the thresholding and the heading approaches may be used to identify magnetically-disturbed data segments. The average
heading error with and without the source of magnetic disturbance was 17.0° and 3.4°, respectively. The thresholding method correctly identified all 39 trials with magnetic disturbance (13 participants x 3 trials per participant) and (92%) of the data segments without magnetic disturbance. The heading method correctly identified all 78 trials.

**Practical Implications:** Current IMU hardware can record data for long time periods (e.g. full working shifts) Our preliminary analysis shows that a viable method for using IMUs within its current capability for full-shift data collection is to identify and discard measurements with erroneous magnetometer measurements.
Differences in Visual Attention Performance between Action Game Playing and Non-Playing Children

Type: Abstract Oral Presentation
Category: Education and Training
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Games often act as a teaching tool, but prolonged video game playing may have effects on the cognitive ability of schoolchildren. The present research aims to investigate such effects. The study recruited schoolchildren from grades 1 to 6 as participants to examine differences in attention performance between action game players and non-players. The experiment used the modified UFOV (useful field of view) operated with such factors as distance and clues. The results revealed that the players are significantly superior to the non-players in reaction speed and accuracy, suggesting that the players have better attention in the space and selection realms. In addition, distance also had a significant effect on the participants: increase in distance significantly lowered the accuracy of the non-players, whereas that of the players changed little. The results suggest that video games can strengthen the visual attention of children. It is recommended that the research findings be considered in the design of teaching tools related to attention training. In addition, the task characteristics of the action game content can be incorporated in educational materials to improve the effectiveness of training and assistance.

Keywords: schoolchildren, action games, game players, visual attention
The effects of rotating shift work on knee pain and knee osteoarthritis among retired Chinese workers

Type: Abstract Oral Presentation
Category: Automotive
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Abstracts

Objectives: To evaluate the association between rotating shift work with the risk of knee pain and knee osteoarthritis (KOA), we studied 13,906 retired workers from the Dongfeng-Tongji cohort.

Methods: Physical examinations and face-to-face interviews were performed. Knee pain was diagnosed by self-reported pain or stiffness. Clinical KOA was diagnosed from knee pain complains and clinical X-ray radiographs. Occupation history including work content and rotating shift work experience in each job was collected from questionnaires.

Results: The prevalence of knee pain and clinical KOA was 39.0% and 6.7%, respectively. After adjusting for potential confounders, rotating shift work was independently associated with elevated risk of knee pain (OR 1.24, 95% CI 1.15-1.33) and clinical KOA (1.15, 1.01-1.32). In stratified analyses by age, gender, BMI, work postures, and chronic diseases, the association remained stable in each subgroup. Additionally, in comparison with daytime workers, the risks increased with prolonged duration of rotating shift work, the ORs (95% CI) of knee pain for participants with 1-9 years, 10-19 years, and ≥20 years of rotating shift work were 1.20(1.08-1.33), 1.26(1.14-1.40), and 1.26(1.12-1.40), and ORs (95% CI) of clinical KOA were 1.06(0.87-1.30), 1.15(0.94-1.40), and 1.26(1.02-1.56). The effects on knee gradually reduced when extended duration of leaving from the rotating shift work.

Conclusions: Rotating shift work might be independent risk factor for knee pain and clinical KOA even among the retired workers.
Study on the analysis of traffic accidents using real traffic accident videos

Type: Abstract Oral Presentation
Category: Transport

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There are many factors will result in traffic accidents. The traffic accident rate didn't appear to be effectively reduce even with such great amount of advanced technology in driving assistance today. Take Taiwan for instance, the statistics showed that the total number of traffic accidents increased 89% in 2016 than in 2006. Therefore, by investigating and analyzing 105 traffic accident videos published on the internet(Youtube) to discuss drivers' behavior, traffic situations, road conditions and environments etc. before the accident, this study is hoping to analyze the occurrence of traffic accidents through a structured approach. The result showed that the climate has no significant influence on accidents; The accidents mostly occurred during the day, and those accidents major occurred in the morning, secondly followed by the afternoon; Accidents including speeding, traffic violations and unexpected situations, etc., and most of the reasons are mainly due to the drivers' distractions and irregularities while driving. By the experiment result we can have an understanding in the situation before actual traffic accidents occurred. It is expected that this study will be able to provide as a reference for accident detection, warning and reaction system design for autonomous vehicles in the future.

Keywords: Driver behavior; Youtube; Traffic safe; traffic accident videos
Virtual reality and augmented reality have many applications in the field of virtual try-on technology these days. In this paper, we used an actual try-on situation and two developed virtual try-on systems, augmented virtual try-on system (AR try-on system) and avatar virtual try-on system (VR try-on system), to study the relationship between human behaviour and the environment.

These virtual try-on systems with depth sensing and positioning techniques allowed users to virtually try on various types of shoes and interact with the virtual environment. Augmented virtual try-on system generated virtual shoes to fit on users’ real feet in the actual scene, and users could move their feet to view the try-on effect in real time, which presented by the desktop display. The second simulated system, Avatar virtual try-on system, constructed a three dimensional space in the desktop monitor, which created a human model with only lower body representing the user to try on shoes, and the avatar could follow users’ movement to execute the same action. These highly-interactive systems provide high hedonic values which could evoke intense emotional response and better user experience.

In the previous research, little literature compared the differences in human behavior between real scene, augmented reality and virtual reality. In order to validate the effectiveness and user satisfaction of the virtual try-on systems, this paper aims to use eye tracking system to record eye movements and measure the psychological human responses between actual try-on scenario, AR try-on situation and VR try-on system.

We observed the gaze pattern and fixation duration to investigate if there is any significant differences while user is looking at a virtual model and a pair of real shoes. We also used three kinds of questionnaire to gather subjective data. The first scale, ITC-Sense of Presence Inventory (ITC-SOPI), is a self-report measure measuring “presence” while users are interacting with the virtual try-on system, and present how physically and involved users would feel toward try-on effect in the virtual environment. The second and third questionnaires are System Usability Scale (SUS) and User Experience Questionnaire (UEQ), measuring if users could control the system and have a good time using the systems.

We started a within-subject-design experiment, concerning eye tracking data, presence, and evaluate their impact on the usability and the user experience of a shoes try-on task. We provided three types of sneakers and their highly realistic models, and participants were assigned to use the system randomly. Participants finally have to give a rating for each try-on system. The experiment is still in progress, and we are looking forward to knowing that to what extent virtual try-on techniques could be an alternative to actual try-on scenario for online shopping or new retail market.
Assessment of Muscular Strength Recovery for Backpacking Tasks

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Abstract

Backpacking tasks are common. Back carrying, like many other manual materials handling (MMH) tasks, could result in muscular fatigue. Assessment of muscular strength recovery upon muscular fatigue is helpful to control musculoskeletal injuries and rest allowance management of workplace. This research investigated back and leg muscular fatigue for backpacking tasks of different loads via analyses of muscular strength decrease, recover, and subjective rating of physical exertion. Twelve adult participants (6 males and 6 females) were requested to carry a bag with 0, 12.5%, and 25% of their body weights on the back and walked on treadmill until they could no longer walk under three different speeds (2, 4, and 6 km/hour) and two different ramp angles (0 and 10°). After the walk, the back and leg strength were measured. In addition, the subjective rating on body fatigue were measured using the Borg RPE. After a one-hour break, the back and leg strength and the subjective rating on body fatigue were measured again to indicate their recovery. It was found that both back and leg strength decreased after the carrying tasks and increased after the one-hour recover. The RPE results after the one-hour break were consistent with those of the muscular strength data.

Keywords: Manual materials handling (MMH); musculoskeletal injury; muscular fatigue; muscular recovery; subjective rating
To increase the labor force, participate rate of women already become a prior issue for many authorities. Researchers have pointed out that work stress could cause poor sleep quality (Knudsen, Ducharme & Roman, 2007). Many women with menopause symptoms complained about couldn’t fall asleep, easy to wake up and difficult to stay asleep (Hachul et. al., 2009). The prior studies also indicated that the sleep quality of women is much worse than man and the situation will get more serious with aging. Long term poor sleep quality not only affects concentration, responsiveness, and memory but also leads to a decline in cognitive abilities such as memory, learning, reasoning, counting, expressing complex languages, and making decisions (Nebes et. al., 2009). The cognitive ability is a very critical factor influencing job performance (Dobbin et. al. 1991). Therefore, without quality sleep, the job performance could be decreased (Kuppermanne et. al., 1995, Eriksen et. al. 2001) and further affect the life satisfaction negatively. However, the prior studies of job stress and sleep quality did not focus on menopause women. And the discussions about sleep quality, job stress and job performance is rare.

The study adopts questionnaires associating job stress, sleep quality and job performance to understand the relationship between those factors. The “Job Stress Scale” is a tool for assessing the job stress of local worker developed by The Labor Safety and Health Institute of the Labor in Taiwan, which includes the assessments of work load, autonomy, satisfaction, interpersonal relationship, and health status. Subjective sleep rating method is a way of sleep evaluation by questionnaire which is used by many researchers in the past. Among all the questionnaires, the Pittsburgh Sleep Quality Index (PSQI) was used by most scholars (Qiu Xiaoyan and Qiu Yifen, 2000). The PSQI scale was developed by Buysse et al. (1989) and includes seven self-rated sleep quality; sleep latency, sleep duration, sleep efficiency, sleep disturbances, sleep deprivation and the use of sleeping pills. Self-rated job performance is considered as an efficient way to evaluate the job performance (laffaldano, 1985).

The results of this study are not only to understand the relationship between sleep quality, job stress and job performance, but also able to be use as a reference while establishing polices to improve menopause women’s working intension.
Evaluation of the remote control affordance of medicalized bed for people with mental disabilities getting older (PDO)

Type: Abstract Oral Presentation
Category: Healthcare

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Thanks to the progress of medicine, the life expectancy for people with mental disorder has increased. Their expectancy life is getting closer and closer of general population (Patja, 2000; Whalley, 2001; Bittles 2002; Yang, 2002; Glasson 2002; Azema & Martinez, 2005). This population needs more care than the rest of the population (DREES, 2011; OMS, 2011, Lengagne & al, 2015). But they have more difficulties to access to care (Jacob, 2013). One of the reasons to explain these difficulties is the lack of accessibility in medical devices (Chibaudel & al, 2016). The aim of this article is to evaluate the accessibility to medical devices and especially the remote control affordance of medicalized bed for PDO and professional caregivers.

Based on field analysis, 5 personas of PDO were proposed (Chibaudel & al, 2017). With these 5 personas, we selected different medical devices. In this study, we will focus on a medicalized bed. Based on the personas, a user test was proposed for medicalized bed. These tests were realized in 2017, in Aquitaine (France). 11 PDO participated. The average age is 65 years old. Quantitative and qualitative data were collected and concerned user experience and usability measures.

PDO have difficulties to use the remote control of a medicalized bed. 4 of them have stopped the tests because they did not know how to use it. In other cases, they thought that all the buttons were used only “to lower the bed” because they use the remote control just for that. In some others cases, resident knew they were asked to lower the bed. But they pressed the wrong button: the bed was climbing. They did not know what they were doing wrong and how they could fix it. As a consequence, PDO do not know how to use the remote control to adjust their bed as they want. Yet, they would like to realize this action by their own but it is “too difficult” for them and they need to ask for help. It is “a complicated game” and they do not know how to solve the problem.

We have shown that, for medicalized bed, there is a need to simplify and adapt the remote control interface for PDO. First, PDO use it for four main actions: lower and raise the bed; lower and raise the bust. As a consequence, remote control must allow only these four actions. To do that, we can work on three main axis: suggest an ergonomic improvement of the remote control; propose simplified instruction manuals; train PDO and caregivers to use the remote control. We would like to improve the remote control affordance by simplifying the accessibility in its use.
Using computer for work became necessary in the day to day office activities. The prevalence of musculoskeletal discomfort/injury of office employees is becoming more common in Hong Kong. Employers have legal responsibilities to protect their employees’ health and safety at work. The Occupational Safety and Health (Display Screen Equipment) Regulation (Cap 509B) was enacted in Hong Kong in 2003 which aims at protecting the health and safety of employees who use computer for prolonged period of time.

For consolidated period of 2013 to 2014, 91% of employees who reported musculoskeletal symptoms for at least one body region. 23.7% and 28.6% of employees who reported two body regions and three body regions suffered from musculoskeletal discomfort or injuries. The paper reports the updated statistics of recent musculoskeletal health condition of office employees in Hong Kong for 2015 to 2017. It also summarizes the prevalence rate of musculoskeletal symptoms of office ergonomics in Hong Kong and analyse the musculoskeletal health conditions in the past decade.

Chim’s Ergonomics and Safety Limited conducted 2,281 individual ergonomics workstation assessments for 35 companies between 2011 and 2017 in Hong Kong. During the year of 2015 to 2017, the most common report discomfort body region was Shoulder – both sides and second highest reported body region musculoskeletal symptoms was Neck. The third highest report body region with musculoskeletal symptoms was Lower Back.

In conclusion, the reported rate of musculoskeletal discomfort among office employees had been increasing significantly in the past 10 years. Although the Occupational Safety and Health (Display Screen Equipment) Regulation enacted in 2003 in Hong Kong, further promotion of healthy computing should be enhanced. Employers are suggested to run effective office ergonomics program which shall cover the furniture selection and evaluation, individual ergonomics workstation assessment, education and promotion and stretching exercises.
Innovations in Crowd Management: Integration of Visual Closure, Anthropometry, and Computer Vision

Type: Abstract Oral Presentation
Category: Transport

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Visual closure requires human intelligence (Thurstone and Thurstone, 1941; Botzum, 1951). It demonstrates our ability to see things in part but perceive in whole. This paper reports the application of automated visual closure technique to “insert” anthropometric models into videos for real-time crowd management. It integrates ergonomics, computer vision, decision analytics and artificial intelligence. The system matches and fits anthropometrically customized 3D human models into a 3D space that is dynamically constructed from videos captured by one or more surveillance cameras. Dynamic human movement data are optimally extracted from the video data and used to construct and train a crowd movement profile detector. Artificial intelligence algorithms are developed to detect deviations from the normal profile.

Anthropometry is the science of applying human dimension constraints analytically in the design of products and workplace (Pheasant and Haslegrave, 2005). Although it has been integrated into 3D computer design programs like CATIA (e.g., Kayis and Iskander, 1994), most of the applications had been restricted to human-in-the-loop processes. This is understandable as anthropometry is essential a design tool. With the advances in artificial intelligence algorithms, human-in-the-loop systems can be replaced by automated systems.

Automatic video analyses have been the subject of many studies. Feature extractions of human-like figures have been used in many applications. Thanks to the advances in computer hardware, most of these applications can be conducted in real-time. In crowd management applications, however, feature extractions of human-like figures can be expensive in the cost of training and may not be applicable when each human figure consists only of a few pixels and with poor contrast. This is not uncommon when the video is captured by a normal surveillance camera with a wide field-of-view and under poor lighting. Our design and approach apply feature extraction not to individual human figure but to the static background information. In order words, each scene is analyzed to extract foreground that is moving and the background that remains static (Figures 1 and 2). Once the areas are identified, the area will be filled with the optimal number of 3D anthropometric models scaled to the correct perspective (Figure 3). This process is repeated for each frame. Results of validation studies show that the 3D anthropometric models moved in a smooth and natural way. This is remarkable as each frame was processed independently. This suggests that the procedure is robust even if there is no specific correlation processing across adjacent frames. Correlation analyses are then performed to match each model in adjacent frames so that their movement profiles can be extracted. Using these normal data as baseline, crowd or individual human movement deviates from the baseline can be detected.
Enhancing the Usability of a Mobile App for Process Evaluation in a Participatory Ergonomics Healthcare Intervention

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction

Mobile applications ("apps") are an emerging data collection medium for research, especially for frequent real-time tracking. Tracking and monitoring ongoing intervention processes can identify factors that lead to intervention success or failure. A mobile app was developed to collect process evaluation metrics for the "Safety and Health through Integrated, Facilitated Teams" (SHIFT) research study, an evaluation of the CPH-NEW Healthy Workplace Participatory Program (HWPP) in six public sector healthcare institutions. Participants are workers involved in joint labor-management health and safety committees, committee co-facilitators, internal program champions and other key managers. Usability testing helps to ensure that the product meets the needs and capabilities of both the end-user and the researcher. The aims of this study are to describe a user-centered approach to developing a process evaluation mobile app and to examine participants’ usage of the product.

Method

An agile approach was utilized to develop a mobile application for both iOS and Android platforms. The app records four "functions:" meetings held, attendance and attendee feedback; project-related chats; and time spent on project activities. Post-meeting feedback surveys cover participant engagement, group dynamics, and usefulness of the intervention at each step. Reminder push notifications are sent in advance for meetings, and afterwards for incomplete surveys. Co-facilitators may upload meeting minutes and agendas. Incoming data are encrypted and sent to a password-protected server hosted at UML, accessible to researchers via an accompanying website.

A working prototype was developed and pilot-tested by university staff and students, and then by selected end-users before full deployment. Each individual carried out mock use cases and reported on ease of completing a scenario, whether errors were encountered, and whether a more effective method could be used. Usability was rated with the System Usability Scale (SUS). Thematic analysis will be carried out for task scenario responses, with feedback categorized by Nielsen’s usability heuristics. Where suggestions identified could not be implemented by the developer due to time-constraints, alternative solutions proposed by the research team will be documented.

IT security restrictions in two SHIFT study sites facilities delayed app deployment, necessitating paper meeting surveys at project start-up. Frequency of post-meeting
surveys will be compared between sites using the app and hard copy. Other function use per person will be compared among groups.

Results

Pilot tests revealed issues regarding inability to update meeting details, unreliable meeting and survey notifications, incomplete data transmission between the mobile app and web, asynchronous loading of upcoming meetings or surveys due to server delay, and inconsistent time formats between functions. Testimonies from pilot testers and end-users provided insight on problems to fix before deployment.

Discussion

Development and testing of a mobile app requires substantial effort which may not be apparent at the start of the project.
This study aims to evaluate the range of motion and muscle activity of upper extremity and the propulsion efficiency between hand-rim and leveraged wheelchair. Twelve young adults (averaged age of 23.1±1.4 years old) were voluntary participated in the experiments. All subjects claimed without musculoskeletal illness and signed an informed content. All subjects were asked to use two-type of wheelchair with self-selected comfortable and consistent propulsion speed in a random trail. A wireless Electromyography system (TELEmyo DTS / Noraxon Inc. , USA) was used to measure both side muscle activities comprising of Extension Carpi Radialis, Triceps Brachii, Posterior Deltoid and Anterior Deltoid (unit: sEA%). The wireless 3D motion capture system (Myomotion capture / Noraxon Inc. , USA) was applied to calculate seven joint range of motion (ROM) including shoulder flexion-extension, shoulder adduction-abduction and shoulder rotation, elbow flexion-extension, wrist flexion-extension, wrist ulnar-radial deviation and forearm pronation-supination (unit: degree). The training computer (RS800CX Pro / Polar Electro Inc. , USA) was used to Physiological load of working heart rate (unit: ΔHR%). The Rated Perceived Exertion Scale (RPE / Borg CR-20) was used to measure both side upper limb of forearm, upper arm, anterior shoulder, posterior shoulder (unit: score). The propulsion efficiency was defined as the averaged self-selected velocity (unit:m/min).

The results of this study showed that muscle activity with leveraged wheelchair displayed less muscle activities than hand-rim wheelchair in both side of Extension Carpi Radialis, Triceps Brachii, Posterior Deltoid (p<.05). The propulsion with leverage wheelchair have greater ROM in shoulder flexion, elbow flexion-extension and less ROM in shoulder extension, external rotation, wrist ulnar-radials deviation (p<.05). The physiological load of working heart rate with leverage wheelchair have less ΔHR%. The RPE score with leveraged wheelchair have lower scores in forearm, upper arm, anterior shoulder and posterior shoulder(p<.05). Moreover, leveraged wheelchair had higher averaged self-selected velocity than hand-rim one (44.4±7.21m/min vs. 36±5.53m/min, p<.05). Base on above results to conclude that different propulsion wheelchairs causes vary influences on the ROM, muscle activity, RPE, HR of upper extremity and efficiency. This study can provide essential information for future references on design and selection of the relevant assistive mobility device.

Keywords: Hand-rim, Leveraged, Joint range of motion, Electromyography, RPE
Objective: This study explores the influence of surface and structural similarity between a problem to solve and a given stimulus on the time efficiency of creative activities.

Background: Across industries, organizations operate in increasingly complex and uncertain environments. To succeed in such environments, creative decisions must be made efficiently with little delay. A number of recent studies have looked into the effects and value of analogical thinking during new product ideation. Surprisingly, little empirical research has examined time efficiency of the whole idea generation process underlying the creation of novel product concepts. The current study is one of the few to track the efficient productivity of creative activities during the time of idea generating.

Method: Participants were asked to solve a design problem, having been exposed to various stimuli. All participants were provided with stimuli in random order. Their works were recorded during the ideation process. The quality of their ideas were assessed according to three metrics: divergence, originality, and feasibility.

Results: The results indicate that between close and distant related types of stimuli, there are some differences in the relationship between the number of good ideas generated and the time used for generating ideas. The lower the similarity between the problem and the stimulus, the later the peak of ideation performance appears.

Conclusion: Our findings suggest that similarity between problem and stimuli affects the efficient productivity of idea generation.

Application: The conceptual model of time efficiency of creative activities could support the development of the theory in the future. The understandings in this paper should provide insights and approaches to promote creativity pursuing time efficiency to gain competitive advantage.
Secular changes in anthropometry for the U.S. Army population since 1988

Type: Abstract Oral Presentation
Category: Military

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Anthropometry provides important information required to design and develop military systems and products that include: clothing and individual equipment (CIE), personal protective equipment (PPE), workstation, and vehicles. Once such systems and products are developed, it is critical to ensure those products fit the current Army personnel. The anthropometric survey of the U.S. Army undertaken in 1988 (ANSUR, Gordon et al, 1989) provided such anthropometric information and was the basis for many current Army systems. At present it is necessary to evaluate whether and how much the anthropometry of the current Army population has changed since 1988.

Prior to the large scale anthropometric survey in 2010-2012 (ANSUR II), a preliminary study, the ANSUR II pilot study (Paquette et al, 2009) was conducted that revealed significant increases in circumference and weight measurements but relatively minimal changes in Stature and length dimensions. Given the results from the preliminary study, the Army performed a service wide anthropometric survey (ANSUR II) (Gordon et al., 2014). Unlike many earlier studies, ANSUR II included Army Reservists and Army National Guard personnel along with members of the Active Duty force. ANSUR II collected data on 8120 males and 3841 females at 12 Army bases in the United States and a subsample of 4082 males and 1986 females were selected using stratified random sampling to create a final working database which is demographically representative of the current Army distribution.

The goal of this paper is to provide comparative analyses on body shape changes among male and female military personnel between 1988 and 2012 as it relates to sizing systems. This follows on from previous analyses on secular changes in body size between 1988 and 2012 (Gordon et al, 2015) where the secular changes on central tendency and variability were confirmed. Given that the average body size of the current U.S. Army is similar to 1988 for Stature and length, but substantially greater in the soft tissue component that influence major circumferential measurements, this study focuses on the comparisons of body shape indicators such as Chest/Waist ratio, Waist/Hip ratio, predicted body fat (%) based on Army regulation, along with BMI between the two populations. The larger increment in Waist Circumference relative to Chest and Buttock Circumference resulted in smaller Chest/Waist ratio, greater Waist/Hip ratio, and the larger increment in weight relative to Stature resulted in greater BMI relative to ANSUR. The different trends on body shape changes between male and female Soldiers will be further discussed. In all, substantial secular changes in body shape of ANSUR II requires validation of the current uniform sizing systems for the U.S. Army.
Introduction and Objective: Users release force when they receive intended external and artificial force such as power-assist devices which are utilized for rehabilitation and physical therapy, usually providing incidental power rather than overall power to users. After the manual force release was induced by the power assist, users might be confused to control their muscle activity for a certain and constant level in response to the external force. The objective of this study is to investigate the effects of time elapsed for the force release on the following phase of constant force, considering the muscle activity of elbow isometric contraction.

Method: An experiment was conducted to simulate the use of power assist, by measuring and visualizing electromyography (EMG) and graphical feedback of exerted force (N) for isometric contraction of biceps brachii and triceps brachii in elbow flexion. Eight adult male participants performed force tracking tasks for three phases of duration: before assist (40% of maximal voluntary contraction (MVC), 7 seconds), force release and full assist (7 seconds). The time for force release was set to one second and five seconds, and each force was linearly released to the phase of full assist, either level of 33% assist or 67% assist for the 40%MVC. From the experimental task, relative percentage difference (RPD) for force tracking task ((target force – measured force) / target force %), force variability of the exerted force (coefficient of variation), and force efficiency (measured %MVC / expected %MVC) were computed. Analysis of variance (ANOVA) was used to analyze the effects of the assistive time and the level of full assist.

Results: The RPD for the phase of full assist was the highest when the assistive time was one second (33% assist: 4.9%, 67% assist: 17.7%). It was partially alleviated when the assistive time was five seconds (33% assist: 2.9%, 67% assist: 6.9%). 67% level of assist showed higher RPD and variability regardless of the assistive time, even if it quantitatively reduced the stress for isometric contraction.

Discussion: Power assist devices presents clear utility for human, but little is known how they can be interacted and adapted by human. The results of this study suggest that controlling assistive time for force release could enhance usability in terms of muscle stability and task accuracy, providing appropriate duration for users to adapt and react the external force. Based on this simulation study for the power assist, future work would contain time-controlling assist device to clarify the actual assistive interaction between human and machine.
Industrial Design Modeling for Smart Jewelry

In recent years, health and fitness awareness is keep increasing among all groups of people, especially the people in developed and also developing countries. They have started to practice healthy and quality lifestyle. Smart jewelry is one of the wearable that supports the users in practising their healthy lifestyle by providing the reading of UV level, step counts and calories burn to the users through their smart phones. By doing so, the users will be able to keep track of their daily activities and take necessary actions to keep themselves fit and well. This paper presents the methodologies and the systematic approaches in the industrial design development process to incorporate aesthetic and affective elements in Smart jewelry.

There are many types of fitness trackers in the market nowadays. Smart jewelry is one of the categories that turns the fitness tracker into a work of art. It combines the technology and fashion elements that makes the jewelry is not just an ornament. In our effort to beautify a fitness tracker, we have taken a step ahead to incorporate human factors and pleasurable emotion in the Smart jewelry design that aims to penetrate into wider women market range and increase further fitness awareness among the women. Contextual inquiry (CI) was conducted at the early stage to gather all the users' inputs and feedback and KJ Analysis was applied to prioritize the voice of customer and hence the customer needs could be identified as our design requirements. Benchmarking and trend analysis were also conducted at the early stage of the industrial design process to establish user requirements. During the design stage, the aesthetic elements were considered in the design such as the shape, color and the texture of the smart jewelry that could re-create the perception of a robust and high technology product besides creating the excitement and impression to the end users. A survey was carried out at the end of this paper to assess the design effectiveness and the results helped the designers to successfully add emotional value to the product and achieved the design goals.

An attractive and affective product associates with the high satisfactory level from the users and will make a successful selling product and stands out in the market.
Contributions of specialists in psychosocial factors in the design of open spaces

Type: Abstract Oral Presentation
Category: Education and Training

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PROBLEM

Despite a large body of scientific literature demonstrating the nuisances of open spaces, many organizations continue to create them. If, historically, it is mostly large specialized architectural firms that take on this sort of assignment, recent consideration for occupational psychosocial, ergonomic and human factors can change this state of affairs. The professions that are usually part of these open space design teams include architects, statisticians, acousticians, air-conditioning specialists, etc. Yet, as specialists of psychosocial factors, we were often recently invited to integrate open space design teams. This presentation outlines the approaches used and some observations.

METHODS USED

Psychosocial risk prevention usually requires identifying the main factors influencing the health of workers (risk and protection factors), and the upstream causal factor network. The next step is defining the intervention plans aiming to influence these causal factors. In the case of open spaces, the main psychosocial factors that are mentioned spontaneously usually deal with the need for concentration, sources of disruption (audio, visual, cognitive, etc.), difficulty in isolating oneself, be it to complete a task requiring silence or the contrary, to be able to make noise without disturbing others around, etc. Yet, as soon as we take some time to discuss these “trivial” issues, other underlying issues, dealing more with the design of the tasks, roles and responsibilities, collaboration between departments, the limits of confidentiality and knowledge sharing, degraded modes of operation, etc. emerge and become a part of the reflection process. Thus, reflection dealing specifically with work space organization justifies an approach for the prevention and management of different psychosocial risks. It is important to note that as a university of applied sciences, we systematically use an intervention approach based on the use of probing data (evidence-based practice) available in scientific literature.

RESULTS

Exploration of the main psychosocial factors influenced by planning an open space allows for broader consideration of the work organization within the institution concerned. This broader reflection can obviously be seen as an opportunity to foster the health and well-being of workers; however, our experience shows that this approach also raises questions that planning based solely on architectural aesthetics, ambient and aerial sound and the occupancy rate of the work spaces fail to raise. In so doing, the open space design work may be slowed down, questioned and eventually changed, through broader consideration for the main psychosocial factors impacted.
[911] Using circular causality networks: a prerequisite for developing a psychosocial risk prevention and management plan

Type: Abstract Oral Presentation
Category: Education and Training

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PROBLEM

In the occupational health and safety field, it is usually recommended to narrow the intervention field before developing an action plan. Yet, one of the characteristics of psychosocial risks is presenting a chain of causality that can be especially complex. For example, a burnout can be caused by an overload, which is itself caused by a shortage of staff, which is caused by a lack of succession, which is caused by a lack of means in the HR budgets, etc. Yet, if numerous scientifically validated questionnaires help to evaluate health, quality of life and workplace wellness determinants (psychosocial factors), very often, the causal factors on which the action plan and intervention should be based, can be hard to identify. This presentation helps to describe a diagnosis process that fosters the identification of the causal factors on which the intervention must be based.

METHODS USED

The approach proposed, used in numerous occupational health interventions for more than 15 years, is based on causal trees used in occupational safety. Nevertheless, given the specific characteristics of psychosocial factors, the approach used builds on the implementation of a circular causality network. This simple and empirical approach allows for collective work with the different protagonists of the situation and fosters the diagnosis and especially the development of a relevant action plan. If the causality network construction can be based on the results of a scientifically validated questionnaire, the design of the action plan can perfectly mobilize existing tools such as the A3 form or X matrix used in Lean initiatives.

RESULTS

In order to illustrate the use of circular causality networks as an action plan diagnosis and development tool, various intervention examples will be described during this presentation.
Proposal for an academic training program in ergonomics that meets the minimum requirements of the CREE and is financially sustainable

Type: Abstract Oral Presentation
Category: Education and Training

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PROBLEM

Switzerland has 8.5 million inhabitants. Despite many quality academic establishments, attempts to implement a training program in ergonomics at the Masters level have all been abandoned for lack of profitability, for many reasons. First, Switzerland is divided into three linguistic areas (French, German and Italian) that are divided into as many distinct markets. Even the approach meant to offer the training program in English fails given that many professionals do not master this language sufficiently. Second, ergonomists have not been traditionally used in Swiss businesses. Professionals specializing in occupational safety and physical, chemical and biological risks (including occupational physicians, hygienists and safety engineers) are widely used; however, specialists in ergonomics, human factors and psychosocial risks are poorly recognized. This aspect is reflected in the legal basis, which fails to recognize these specialists, including ergonomists, as occupational health and safety specialists. Consequently, there are numerous training programs leading to the obtainment of professional titles resembling that of ergonomist (e.g. occupational psychologist, master in job training and analysis, design engineer, etc.) without acquiring such a title. In this context, creating a new training program specific to ergonomics is doomed to fail.

APPROACH USED

A working group composed of ergonomists exercising their profession in the fields of management, engineering, "Fab Labs" and health was created in 2015. The group’s reflection, taking into account the parameters described above, brought it to develop an ergonomic training concept that can meet the CREE’s minimum requirements and is financially sustainable in the long run. Overall, the principle consists in completing an evaluation of the knowledge each training candidate has gained during his or her training path and measuring the gap with the CREE’s minimum requirements. Based on this, a training plan is developed according to the ECTSs required. This training plan describes the different courses required and the Swiss academic institutions that offer them. At the end of this process, the candidate must still complete a Certificate of Advanced Studies (CAS) that includes between 10 and 15 ECTSs and guaranteeing harmonization of the contents. In so doing, the curriculum proposed no longer creates competition with other training institutions, but instead fosters a knowledge broker role on the part of the institution that hosts the training and steers candidates toward other academic institutions.
Visually impaired people face many issues when trying to navigate through variable territory. Especially in cities, these people are dependent on public transportation. While metros, trams and trains are in most instances prepared for barrier free access, the infrastructure of busses runs after. In many cities situations occur, where busses stop at different positions at the platform or they stop behind each other, so that visually impaired have difficulties to find the right bus and to navigate to the bus door. Often these situations are time-critical. Advanced everyday-life technology, e.g. smartphones and wearables can be used to help visually impaired people in these situations.

This paper describes a concept for an electronic orientation aid system to help visually impaired people in specific, critical situations of public transportation. It was developed using user centered design and in an intercultural project and therefore user-context-analyses and evaluations have been carried out in Germany and India.

After setting the system boarders, the usability context and the user demands could be analysed by conducting interviews with blind people and several experts (N=8), who gave important insights in the use of public transportation systems of visually impaired people. Based on this, an overall concept was described and further placement and feedback studies were conducted to generate a specific input for the designing stage. The result of this stage was a prototype wrist band with vibration feedback. A practical evaluation (Wizard of Oz experiment) with blindfolded persons and visually impaired people (N=16) confirmed the general utility of the prototype, but also showed potentials for improvements.
Employing behavioural economics to understand the impact of design on decision making


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Abstract

Behavioral economics have revolutionised the way we examine, understand and influence economic and overall decision making – a trend manifested by two recent Nobel Prizes (Nobelprize.org, 2002, 2017). A major outcome of this intellectual effort is that – contrary to what traditional economists believe – decisions are not stable but actually malleable. Intriguingly, decisions can be affected by the choice architecture and even seemingly irrelevant factors – collectively called “Nudges” (Thaler, & Sunstein, (2009)) - such as the way choices are framed or the saliency of previous experiences.
The built environment could also act as a nudge, due to the fact that is constantly present and is constantly monitored by the human sensory systems. Evolutionary speaking, the major source of information necessary for critical decisions derives from the (physical and artificial) environment (Korpela et al., 2002). We here examine how the design of an office space affects critical decision factors. Specifically, we examine how the presence of a cubicle could affect two important decision-making factors: risk attitudes and temporal discounting.

Risk attitudes refer to preferences over choices that have different levels of risk. Risk is many times perceived as a unitary concept, but, in fact, is a multifaceted concept; the most critical factors are sensitivity to variance, skewness, and ambiguity. Temporal discounting examines how people discount rewards over time, with choices representing a form of impatience. In a series of experiments, we measured all these responses using real monetary rewards across two main conditions, i.e., with or without a surrounding cubicle partition. Results suggest that the presence of a cubicle systematically affects participants' sensitivity to the aforementioned decision parameters.

This study suggests that office design can affect critical aspects of human decision making—risk and time preferences. This is rather critical for workspaces and job functions that heavily rely on high standards of decision making—ranging from trading rooms to control panel workers.

Keywords
Risk, decision making, cubicles, trading, office design, desk design, trading, banks, investing.
Analyses of past events, especially of adverse events (e.g., accidents, incidents, failures, errors, malfunctions) are seen as essential prerequisites to manage safety in organizations. A range of tools (such as causal trees) drawn from fields including human factors, ergonomics and safety science, are used to establish how and why an incident occurred in an attempt to identify how it, and similar problems, might be prevented from happening again. But, over the last few years, a number of limitations of causal analyses of risks and accidents have been pointed out (Lundberg, Rollenhagen, & Hollnagel, 2009).

Based on psychologists’ work (Bruner, 1996; Vygotski, 1997), we believe that a way to progress in the analysis of past events is to leave the causal analysis mode for a more narrative mode (Cuvelier, Bencheckroun, & Morel, 2017). Narrative is a specifically human way of thinking. It allows us to put events in order over time, while keeping room for both those who tell and those who listen (Bruner, 2000). In a variety of situations (schools, companies, vocational training, daily life, etc.), narrative activity can be used to help subjects (students, workers, children, ...) to revisit the steps that allowed them to discover the solution to a problem. Narrative activity is an activity to which insufficient attention has been paid in the ergonomic literature so far (Decortis, 2013). Recent studies are beginning to recognize its importance but only a few are in the field of safety (Beaujouan & Daniellou, 2012; Decortis & Bationo-Tillon, 2014; Marchand & Falzon, 2015).

The ongoing work, which we will present at the IEA congress, aims to explore how, in real situations, narratives of past adverse events are constructed and shared between professionals. We will rely for this on the analysis of safety training situations (debriefing in anesthesia). The observation of real situations and the analysis of collected data (video) are in progress. The results will supply the construction of new security training.
A psycho-ergonomic approach of the street-crossing decision-making: towards pedestrians' interactions with automated vehicles

The good interaction between pedestrians and automated vehicles (AVs) will be a milestone in the acceptability of these new vehicles uses. The automated vehicle should be able to offer the pedestrian a safe and non-uncertain street-crossing. Although the decision to cross the street is well documented, it is necessary to merge the knowledge within a global and representative analysis in a naturalistic environment, taking into account a more detailed conception of the steps of decision-making. A psycho-ergonomic approach is thus well appropriate to study this issue. The aim of the study was to perform an analysis of the activity of street-crossing, focusing on the decision-making in a naturalistic environment.

The study was carried out with a sample of 20 participants aged from 27 to 45 years. They moved in a conventional urban traffic following two defined routes. They received a route map with checkpoints in order to ensure that all of them crossed the street in the same location. A triangulation of Ergonomics methods (explicitation/elicitation interview, video recordings and questionnaires) was conducted. Immediately after each last street-crossing, participants were invited to participate to an elicitation interview. This method allowed, inter alia, to access to the pre-reflective elements of the decision-making, starting from the wish to cross the street to the action of street-crossing. In total, 73 street-crossings were described during 30 hours of interview. Cognitive, perceptive activities and emotional feelings were identified, classified and analyzed. Video recordings were used to validate the verbalizations collected during the elicitation interview and to complete the behavioral elements such as the directions of the gazes and the situational factors. Questionnaires allowed to classify the participants on two groups of profile of behavioral habits: those with a prudent profile and those with a risky profile. Finally, because of its well-known deleterious effects on the decision-making, half of the participants received an induction of time pressure.

First, the results highlight some different patterns of perceptive and cognitive activities between risky and prudent decision-making. It concerns the gaze number and orientation, the reinsurance needs and the anticipation. Second, some factors improving the probability to make a risky decision-making are also highlighted, such as the level of time pressure, the behavioral habits and the presence of other pedestrians. Finally, the reported emotional feelings differ also according to the absence or presence of a risk-taking (anxiety versus anger).

These results shows the complexity of the decision-making that cannot be reduced to a specific moment but constitutes a continuously updated process containing perception, action, cognition and social aspects. In the context of the future interaction between pedestrians and AVs, this study is a first step towards AVs which can anticipate and react appropriately to the street-crossing behavior of the pedestrians.
INTRODUCTION

The assessment of new items within a nation’s Army may not always be undertaken when purchasing off-the-shelf items. This may lead to soldiers being burdened with a rifle that is too heavy to be effective, and an item that may not add any real capability. This pilot study sought to quantify the effects of adding mass (to simulate ancillaries) on muscle fatigue in order to inform the trade-offs associated with weapon-mounted accessories. A secondary aim was to assess the ability of using a static hold as a method of discriminating between weapon configurations.

METHODS

A sample of 18 male rifle users (age 33.1 ± 6.9 years, height 182.0 ± 8.7 cm, mass 92.3 ± 12.0 kg) fired four weapon configurations: baseline (unweighted) M4 carbine and an M4 affixed with a 1 kg mass at three locations on the top rail. For each configuration participants were instructed to hold the M4-mounted laser on a target situated 3.5 m away for as long as they could in a combat shooting posture. As a number of participants were able to hold the pose for an extended time compared with the group mean, only the first 60 seconds was analysed. Muscle activity was collected from the upper torso and limbs at 1500 Hz, processed at one-second intervals via a Fast Fourier Transformation, and the median frequency calculated. Linear regression was used to find the initial and the final frequency, and the percentage change between the two for each of the configurations were assessed via repeated measures ANOVAs with a statistical difference set at p < .05 and effect sizes.

RESULTS

The percentage change in the median frequency was approximately 4.5% more for the each of the weighted configurations compared with baseline for the left anterior deltoid (p<.05; effect size 0.40-0.50). Interestingly, the change was on average 13% less for the mass placed farthest from the participant compared to the other weighted configurations and baseline in the left brachioradialis (p<.05; effect size 0.95-1.91).

CONCLUSIONS

Adding mass to the rifle affected the rate of muscle fatigue in two of the major muscles active during shooting. Results suggest that adding mass to the rifle increases the rate of fatigue in the deltoid but decreased the rate of fatigue in brachioradialis in what should be the most difficult to sustain placement. It is possible that participants utilised a number of strategies for minimising muscle fatigue, such as small postural changes, holding the rifle
differently as the weight was moved further toward the barrel, and recruiting new motor groups as the static hold progressed. Further analysis will be conducted in order to investigate these strategies and determine whether the static-hold assessment is a viable evaluation of weapon design.
Ergonomics analysis of ‘quantified-self technologies’ – An explanation of failure

Type: Abstract Oral Presentation
Category: ICT

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One of the driving principles of the quantified-self (QS) movement is that knowledge is power. To have fine-grained and objective measurements of our body and its functions, and of our routine activities should, in theory, give us better control over them. But what happens when quantification gives us a representation of ourselves that we don’t understand? Do we question the quantified model of self, its objectivity and accuracy, or do we question ourselves? Drawing on the two ergonomic studies of QS inspired technologies, we want to provide some reflection on why there may be a mismatch or misunderstanding between measurement and self-representation.

The technologies considered in this paper are an activity tracker counting the number of steps in a day and a solution for daily commuting estimating the CO2 emissions and costs associated to commuting practices. The methodologies put in place in this studies are interviews, diaries and figures gathered by the trackers. The results depict that the technologies and the information they provide are not fully accepted by the users. The main reason seems to relate to a mismatch between the reductionist way the technologies present potentially complex issues and the users’ understanding and self-perception in isolation.

The activity tracker is essentially a gamified pedometer, which reduces the notion of fitness to a step-count, and the notion of improvement in fitness to the attainment of arbitrary, incremental goals. The use of such trackers may be useful within the context of a health intervention targeted to a user. On its own, however, the activity tracker tends to give users the perception that it provides an “unfair” characterization of their efforts and progress.

As regard commuting practices, the goal was to motivate users toward greener practices by providing metrics on CO2 emissions and costs of alternative modes of transport. One of the problems with it was that the individual CO2 footprint is not only difficult to calculate with accuracy, but may also be counterintuitive when provided in a comparative way across transportation means and provide unexpected feedback to people that are consciously making an effort to reduce their environmental impact. This might actually discourage them from making an effort to reduce CO2 emissions.

Overall we found that with QS technologies, there is a risk of decontextualizing and reducing complex activities to simple calculations which encourages binary true-false thinking on the part of users. This leaves little room for a nuanced understanding of the underlying problem and of the specific circumstances and requirements of any individual user. We would like to propose that quantified-self technologies may benefit from less simplified models, even at the expense of more complexity, but be able to provide more contextual and ultimately understandable quantifications for the users.
The ageing population is a major concern in most countries. According to the UN [1], in 2017 it is estimated that there are 962 million people aged 60 or over, representing 13% of the global population. This is projected to increase to 1.4 billion in 2030 and 2.1 billion in 2050 [1]. Changes in physical capacities associated with ageing (muscle strength, joint range of motion), influence the older person’s ability in ambulation, bed mobility, and bed and chair transfers [2-4]. Mobility, the ability to go where you want to go, when you want to go, is recognised as a core component of healthy ageing [5]. It enables participation in tasks that help maintain independence and health. While mobility is affected by biological, behavioural, social and environmental variables, targeting individual-level issues is not sufficient for improving mobility [6]. Public seating is one of the environmental variables that can facilitate or hamper mobility. While the availability of public seating is considered in planning age-friendly communities [7, 8], features such as seat height, which are key in reducing mobility task demands [9, 10] are typically ignored. Seat height and features such as presence of armrests, depth, and compressibility [11-13] make seating accessible and usable for older people, and can facilitate their participation in the community and social activities.

This study is part of a multi-stage project investigating older peoples’ use, satisfaction and comfort with available public seating. This first stage uses an online survey of older adults (>65 years) who are living independently in the community. Participants were recruited through community organisations (e.g. Probus Clubs), and the study website. Hard copy versions of the survey were also made available at community meetings. They were asked about the places in which they may have experienced discomfort when transferring from public seating, how often this occurs, and the effects this has had on them. Participants were asked to provide further information on the most recent time they had difficulty in transferring, including information about the features of the seat, its location and the impact on their well-being.

Data collection is currently ongoing. Preliminary findings have provided evidence of the nature and extent to which public seating is not optimally designed for the needs of the older person, as well as commentary on the extent of the problem. This study helps inform our understanding of the problems older people experience when using public seating. Further stages of the project will involve biomechanical analysis of transfers from examples of public seating, and interacting with space owners and designers to develop guidelines for improvement.
ABSTRACT

The teaching exercise environment sets the workplace where pedagogic processes are carried out. The negative impact that is the result of the things that happen to the teacher or his educational environment configures the manner people use to interact with each other, considering every classroom of every school with every course is different, the intention is to show which are the dimensions that could impact most in their psyche; psychosocial factors are the influence of the issues inherent in the human condition, on the psyche of people; are those characteristics of working conditions and, above all, of their organization that affect the health of people through psychological and physiological mechanisms.

The aim of the work is to carry out a brief analysis of the psychosocial dimensions that affect the technical school teachers, and contribute to promote the improvement of working conditions in order to protect life, preserve and maintain the psychophysical integrity of workers, considering the experience of teaching as a professional, social and community service, fundamental to life in society. Taking as a case study the technical schools of the city of Morón in the suburbs of Buenos Aires.

It was decided to use the CoPsoQ that is an international instrument for the research, evaluation and prevention of psychosocial risks in its Spanish short version istas 21 inquiry to perform a personal, anonymous and voluntary quiz, considering the 15 psychosocial dimensions proposed by the method.

According to the results we proceed to develop a table of priorities in function of a matrix results to reach an approach of the dimensions that affect the most to education workers, in order to move towards a culture that feels secure through prevention and encourage healthy development of cognitive capacities around contents.
Interaction Options for Wearables and Smart-Devices while walking

Type: Abstract Oral Presentation
Category: ICT
Jessica Conradi\(^1\); Martin Westhoven\(^1\); Thomas Alexander\(^1\)
\(^1\)Fraunhofer FKIE, Bonn, Germany

Ubiquitous usage of mobile IT-devices like smartphones or wearables calls for fast and dependable means of interaction. This is especially important in case of secondary interaction, e.g. to facilitate interaction while navigating in an unfamiliar environment. This includes frequent information exchange with the IT-device, e.g. by extraction information about waypoints or by inserting data concerning the navigation like destination changes. In this kind of interaction, often touch devices are used, which can be operated with a single or with both hands. Two-handed interaction often constrains one hand to a purely supportive task for the device. To avoid this, a common solution is to attach the device to e.g. the forearm or wrist. Alternatively, smart glasses can be used. These googles help to perceive the surroundings visually while interacting with the system. However, in contrast to smartphones which provide a surface which combines in- and output functionality, this kind of device genuinely provides only output functionality and requires an additional interaction metaphor. Feasible options are gestures captured and interpreted by an additional camera-system, voice input or devices operated by hand, like touchpads or haptic controllers. However, pros and cons of this kind of controllers are scarcely known. This is especially true for the condition walking. Although interacting with mobile computers while walking is frequently done, there are few studies focusing on optimizing these devices for this scenario. Therefore, we conducted a study on different interaction styles for mobile devices during walking. We compared interaction capabilities of three different types of touch-based interaction with smartphones. They differed in involvement of left / right / both hands or thumb and a HMD which had an additional haptic input-device. The participants had to fulfill interaction sequences involving a hierarchical menu with 3x3 interaction options. The experimental task was administered in a large-scale virtual reality environment which prompted the participants to keep their attention mainly on the environment by means of a parallel observation task. During the whole study, the participants walked on a treadmill at a speed of 5 km/h. 16 participants (7 female, 9 male; aged 27-33 years) volunteered. Each participant was tested in each condition, resulting in a design with repeated measurements. We found an impact of the different interaction styles on the input performance, time on task proved to be faster with the HMD combined with a haptic input device, but error count increased significantly as well. Using the thumb as input indicator triggered a longer overall observation period for the interaction device. Task load (NASA-TLX) showed only minor differences. All in all, the tested interaction styles are feasible for interaction with wearables while walking, but provide different benefits and drawbacks to consider for the concrete application.
Companies have clearly evolved in the last 40 years within a context of globalisation, greater complexity of work rhythms and the new technology revolution (Eurofound, 2016). Changes have taken place as much in their structure as in their operation, identity and management methods (Zerbe, Härtel, Ashkanasy, 2006). Ergonomics research has tended to show that organisations aim increasingly at optimisation of service quality, constant adaptation to change, ever growing use of new technologies, enhanced performance and efficiency (Zapf, 2008). To fulfil these aims, companies need suitable working conditions and specific capabilities: technical, behavioural and human (Ribert-Van De Weerdt & Baratta, 2016). The challenge is to be able to forge strong relationships between different company stakeholders based on a dynamic of social cohesion and flexibility. It also involves establishing a context that is favourable to relevant decision-making, innovation and performance, while creating conditions of well-being and fulfilment at work.

Driven by ergonomics psychology, the emotional sphere has been widely considered at companies for a number of years. Long overlooked in the world of work, emotions are now the order of the day in terms of research and intervention (Ribert-Van De Weerdt & Baratta, 2016).

The purpose of this communication is to demonstrate the relevance of the ergonomics psychology of emotions to occupational health intervention. It retraces a research intervention conducted in the domestic help sector to provide a theoretical, pragmatic view of the role of emotions in regulating activity and preventing psychosocial risks.

Following its introduction to the concepts specific to the field of emotions, the paper describes the methodology developed. This is based on interlinking interviews of all employees and filmed observations of their activity. The video tool was used as an analysis vector first under real conditions, then via group self-confrontation sessions, during which working conditions and experienced emotions were expressed and discussed. The findings reveal the extent to which certain situations involving high emotional loads have negative repercussions on the health of the people, who live through them. They also show that implementing prevention measures with respect to these risk situations makes it easier to control emotions and are health protective.

Finally, the communication reveals that the emotional component of work plays a fundamental role in employee relationships with their work and their health, and that its consideration can contribute to identifying and preventing psychosocial risks.
The present study was made through the usage of the psychophysical methodology applied to 14 women previously being trained for 4 days making insertion tests with the usage of their thumb finger on time frames of 8 hours for five days to obtain knowledge. Maximum strength level in the insertion of 1 to 4 Push-pins using a thumb splint. During the investigation 14 workstations with push pins involved on the labor operation were selected, more than 90% were above the recommended acceptance limit of strength, which is of 10 lb. from 1–7 push pins and 7 lb. from 8–12 (Longo, 2004). This research evaluates the usage of a thumb plastic guard customized to plant population to implement new protective personal equipment in order to increase the strength of this muscular group in workstation with push pins.

Test was divided into 4 weekly sessions; First is an inclusion per minute with dominant hand, non-dominant and both thumbs per minute, Second: two insertions per minute with dominant hand, non-dominant and both thumbs, Session 3: three insertions per minute with dominant hand, non-dominant and both thumbs, Session 4: four insertions per minute with dominant hand and non-dominant. It showed that performance with splint increase since without this device applied force does not exceed 11 pounds.

The following table shows results of forces applied in pounds of a statistical analysis: mode, media and standard deviation of each session and max/min force in hand dominant, non-dominant and both, in addition to the calculation of percentiles.
We can conclude that the 92.85% of evaluated women exceed the 10 pounds without causing them to fatigue and guarantees greater strength insertion using the splint. 13 of the 14 women showed improvement with the use of the splint by applying forces higher than 10 lb. exceeding the permitted standard which demonstrates that the use of this device increases the applied force reducing risk of injuries caused by this type of operation of the automotive industry.

Due to the high rate of variation of the variables that could increase the force effort of push pins in automotive industry mostly in final assembly area this kind of device provides an effective way to improve the incidence of injuries related to the thumb usage. This will benefit the entire population of workers while also providing important information to companies to avoid or reduce injuries costs, improve productivity performance and quality defects related to thumb exertions.

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The THEMIS (disTributed Emergency Management Intelligent System) project is an undergoing R&D initiative launched to design and implement an intelligent system to assist decision-makers and responders in Crisis Response Operations (CRO), namely considering the complex context of international interagency response to major disasters. THEMIS-AR is a sub-project which was developed with the purpose of creating a demonstrator for experimenting and proofing the concept of using Augmented Reality (AR) in support of the deployed response teams, by offering increased situational understanding, namely by increasing the perception of the emergency environment and incidents, as well as response facilities and assets. A User Centered Design (UCD) approach was adopted in this sub-project involving the analysis of usage context, the requirements specification and the development of a solution (the demonstrator) consisting of a mobile application, to be exploited to assess the usage of AR features by emergency responders. This demonstrator runs in smartphones or tablets held by the leaders of emergency teams involved in CRO. The Augmented Reality application assists the user by overlaying georeferenced information to the image captured by the mobile device camera. The application also supports the navigation towards incident or other points of interest sites. The implemented demonstrator version was designed for tablets running Android. This prototype is currently used as testbed to support future developments.

The paper addresses the activities and results achieved in the different steps of the UCD cycle (i.e., context of use characterization, requirements definition, solution implementation, and testing and validation), and provides a brief description of the THEMIS-AR architecture and features. These features include the creation, edition, and visualization of geo-referenced information (e.g., location, characterization) of incidents, points of interest, and other response teams; exchange of operational instructions and reports; as well as advice and support regarding intervention priority or procedures.

It is worth noting that THEMIS-AR exploitation occurs in a very demanding context for users, regarding both the physical and the cognitive and emotional demands. In fact, the specificity of the usage environment imposes special care in addressing the interaction of the users with the system, regarding both the mobile devices technical characteristics and the workload.

The paper also describes the usability testing setup and script adopted while performing field tests; and the results obtained, namely regarding the application of the User Experience Questionnaire as methodology to assess six parameters (Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty) and to benchmark the evaluation in comparison with a set of previous evaluations made with this
method. Finally, the paper summarizes and discusses the results obtained with the initial set of users and addresses the way ahead of this project.
In ergonomic practices, user testing is a central method to get feedbacks from users regarding usability. In the last decade, new design methods have emerged like agile method, design thinking, lean startup, etc. These methods aim at achieving user's satisfaction and therefore they are iterative. Most of them are looking for direct user's feedback. In this context, in 2013 we published a book "user centered agile method". The goal was to propose a method which enables to have continuous user's feedbacks during the entire life circle of a project integrating agile development. Instead of having user testing only at the end of the development project, our approach was to take advantage of agile method to apply user testing also during development that is, during each agile iteration. We call this kind of user testing, applying around five participants, "mini-user testing". Four years later, we wanted to evaluate the usage of "mini user testing" during agile development, into our ergonomists community and what it could imply regarding the evolution of these community's practices. To answer these questions, we built a questionnaire which was filled by two survey populations. The first was sent to Orange user centric specialists. The second one was sent to a French national user centric specialists' community. Globally, 142 people filled the survey in totality. The main results show that since 2013 there is a huge increase of knowledge and usage of mini-user testing. Currently, this practice is begun obvious. The participants who apply user testing do more mini-user testing than conventional user testing.

During this survey, we also collected from participants some feedbacks regarding their practice of mini-user testing. Most main issues they face stay the same as those we identified and described in our book. For example, user centric specialist is not completely considered as a member of the agile team. He has to comply with agile method rules at the expense of his own user centric specialist needs. In addition, his user centric and usability recommendations are not considered as important as technical and functional evolutions.

Another example is the question of so few participants for one testing which seems to be still carried on, even though Nielsen (2000), into several articles, has described the advantages of testing with five users iteratively.

During this oral presentation, we will present all the results of the survey (numerical results, positive and negative verbatim) and the analysis we reached.

Every year several workers suffer accidents with machines and equipment of varied nature and severity. These are in many cases avoidable and practically all of them have as main cause the access to different danger zones of the machines and equipments operations beyond the organization of the work. In this context, the problem of obsolete and unsafe machinery and equipments and poor organization of work is highlighted and accounts for a large proportion of the serious and disabling work-related accidents reported.

Given this scenario, the Social Service of Industry (SESI) of the State of Bahia, Brazil, developed a methodology to assist Brazilian companies, as well as to provide technical advice to companies in the industrial sector. The methodology consists of managing the risks with the objective of identifying the mechanical hazards in the operation of the machines and equipments, as well as to adapt them. However, it was observed the need to include a method to analyze ergonomic hazards in order to adapt not only the machines and equipments, but also the entire work environment taking into account the physical, cognitive and organizational aspects, to ensure better performance and suitability of the work conditions.

Through the integration of methodologies, the industry today has a consultancy specialized in the development of various actions that contribute to the management of ergonomic hazards and in the operation of machines and equipments, in order to prevent accidents and improve the working condition. In this way, the company can map the main risks existing through the application of methodologies and introduce changes in the production process. Such changes are in order of severity of risks, taking into account that the activities that have the highest risk also have the highest characterization for injury.

Therefore, the adjustments are to minimize or eliminate the possibility of the worker engaging in a situation of risk or serious injury. With the implementation of the actions established by SESI-BA, the professionals of the companies work to reduce the number of mechanical and ergonomic risks, avoiding accidents with machines and equipment, improving conditions and working environment.
Key Words: Equipments, Machinery; Work Organization, Accidents; Ergonomics.
[2555] Working time profiles of hypermarket workers

Type: Abstract Oral Presentation
Category: Others

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Introduction

The retail sector accounts for a considerable share of the EU economy (Eurofound, 2012). This sector consists of a variety of shop size and formats, but in this study we were focused on a hypermarket, located in the city centre. Increasing liberalization of the sector, especially in opening hours with extended days and Sundays opening augmented working times in unsocial hours (Eurofound, 2012) and irregular schedules. This study aims at characterizing the profile of hypermarket workers based on working time.

Methodology

A cross-sectional questionnaire was applied between November 2016 and January 2017. It integrated the sociodemographic characteristics, as well as the variables related to working time, such as sleep duration, quality of sleep, satisfaction with the schedules and sleepiness. The sample consisted of 293 workers, corresponding to a response rate of 71.3%.

Results

Our sample showed an average age of 38 years (sd=10), with 39.5% below the 35 years old. There were a higher percentage of women (70.5%), married (47.4%) and 63.5% did not practice exercise regularly. Regarding the circadian type, 67.8% were morning and 14.8% evening type. Concerning the duration of work, 70.1% worked 40h/week. The different schedules were mostly fixed with 13.6% starting working at 4:00-6:30hrs, 14.9% at 7:00-7:30hrs, 15.5% at 8:00-9:30hrs, 7.3% at 10:00-13:00hrs, 13.2% at 15:00-16:00hrs, 7.3% at 17:00-18:00hrs, 5.9% at 22:00-24:00hrs and 22.2% with rotating shifts. When analysing the median age by schedule, the youngest group worked mainly in the afternoon and night shifts (Figure1).
Moreover, 46.7% were satisfied/very satisfied with the working schedules. After the shift, the median of hours of sleep was lower for the early morning and night shifts: 6 hours for the shifts starting from 4:00hrs to 7:30hrs and from 22:00hrs to 24:00hrs (Figure2).

The perception of sleepiness was not high, but appeared to be more frequent/very frequent among those with the early morning shift (16.6%), night shift (29.4%) and those starting working at 10:00-13:00hrs (22.8%) (Figure3).

The perception of work-family conflict as an adverse factor showed higher percentages among those with early morning shifts and 15:00-16:00hrs shifts (Figure4).
In Portugal, almost a third of retail workers (30.2%) were working in shifts in 2010 (Eurofound, 2012). Our sample showed a mean age of 38 years old what is in line with the European retail sector. Liberalisation in opening hours has been introduced in Portugal since 2011 with an allowed opening period from 6am to 12pm, that impacted the working times. Our results show that the youngest groups are working mainly in the afternoon and night shifts. In the early morning shifts the perception of work-family conflict is higher.

**Conclusion**

In Portugal, almost a third of retail workers (30.2%) were working in shifts in 2010 (Eurofound, 2012). Our sample showed a mean age of 38 years old what is in line with the European retail sector. Liberalisation in opening hours has been introduced in Portugal since 2011 with an allowed opening period from 6am to 12pm, that impacted the working times. Our results show that the youngest groups are working mainly in the afternoon and night shifts. In the early morning shifts the perception of work-family conflict is higher.
Brazil is one of the main exporters of chicken meat since 2004. Since most of the Brazilian chicken meat exported is in the form of cuts. Thus, most of the chicken meat produced in Brazil is processed by means of hand tools (knives) or specific machines (chainsaws). However, improvements in the working conditions in this sector have not grown at the same rate as production increases. The slaughterhouse workers are exposed to biomechanical risk factors that contribute to the development of work-related musculoskeletal disorders of the upper limbs (UL-WMSDs) such as repetitiveness, high-frequency of technical actions, excessive force, awkward postures, insufficient time for recovery, use of tools and exposure to cold. Thus, the aim of this study was to evaluate the risks associated with repetitive movements of the upper limbs in different meat processing tasks in a poultry slaughterhouse, using the OCRA checklist. The study was conducted in a poultry slaughterhouse with 3,500 workers in which 300,000 chickens were hoovered daily. In order to evaluate the risks associated with repetitive movements of the upper limbs, 10% of the workforce was evaluated while carrying out their work tasks, using the checklist proposed by OCRA method. Descriptive statistics was used, as well as the Student t-test, in order to compare the risk between left and right side of the body (p≤0.05). The 15 work activities analyzed were from the following sectors: cutting (7); packing (3); freezing tunnels (2); reception (1) and scalding (2). The average of occupational repetitive actions performed by workers was 64.7±13.3 per minute, representing 9 points in the OCRA scale (0 to 10 points scale). The average score of OCRA checklist was 19.5±2.5 (moderate risk). The scores for the right upper limb (20.0±3.0 - moderate risk) were significantly higher (p=0.024) than the contralateral limb (17.7±2.8 - moderate risk).

Considering the five risk categories proposed by the OCRA method, one work task was considered high risk (7%) and 14 presented moderate risk (93%). Due to predominant highly repeatable movements of the upper limbs in poultry slaughterhouses, and previous studies suggesting the reduction in working pace to prevent UL-WMSDs, simulations of reduced working pace to achieve very low risk levels were performed utilizing the OCRA checklist. Through simulations, it was possible to reduce the risk of UL-WMSDs to very low levels by reducing only the activity working pace (-48.5±11.8%). From these results, it is suggested that poultry processing tasks classified as high (7%) and moderate risk (93%) predispose workers to a greater probability of developing upper limb work-related musculoskeletal disorders (>21.5% probability for high risk and 10.8 to 21.5% for moderate risk). Simulations of reducing the working pace showed the effectiveness of this organizational measure to reduce the risk of UL-WMSDs.
Systematic approach to develop a flexible adaptive human-machine system

Type: Abstract Oral Presentation
Category: Manufacturing

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Modern automatic machines in production have been becoming more and more complex within the recent years. Thus, human-machine interfaces (HMIs) reflect the high amount of functionality within the information provided to such an extent that these machines may not effectively be used by any operator. Moreover, human capabilities are diverse and individually limited, leading to barriers in self-reliant machine operation. An approach to improve such systems and offer a system that is effectively usable, even for workers with low experience, education or elderly employees, is to reverse the paradigm from “learning to operate the machine” to “adapting the machine to human capabilities”. This can be realised by adjusting the HMI to the operator's characteristics and complementing her/his individual skills and capabilities, supporting her/him in self-reliant machine operation.

Following this approach, a flexible working environment for any operator can be created, according to her/his e.g. skills, age, culture or competences. In cooperation with producing companies it could be shown that common human-machine interfaces can overstrain operators due to complex operations and a multitude of information provided. Moreover, human information processing depends on individual resources, which makes it an individual process that as a consequence causes different levels of strain, making it difficult to generalize. Hence, an innovative system is required that is able to identify the individual operator's strain and reacts towards the actual strain level. Thus, deeper knowledge of the corresponding processes perception, cognition and action is required. In this paper, we propose a methodological approach for modelling human capabilities that can cause barriers in human-machine interaction and cause challenging experiences for the operator. Based on ergonomic concepts of information processing and strain, we present a systematic approach for human capabilities that have an impact on individual performance whilst informatory work tasks on HMIs. Furthermore, the approach can be used as a basis to develop flexible adaptive human-machine system, able to react towards the operator’s needs in real-time.
Autopsy as an Outcome and Performance Measure: three years of hospital autopsy as an instrument of clinical audit

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An extensive literature documents a high prevalence of errors in clinical diagnosis discovered at autopsy. Multiple studies have suggested no significant decrease in these errors over time. Despite these findings, autopsies have dramatically decreased in frequency in the United States and many other countries. In 1994, the last year for which national U.S. data exist, the autopsy rate for all non-forensic deaths fell below 6%. The marked decline in autopsy rates from previous rates of 40-50% undoubtedly reflects various factors, including reimbursement issues, the attitudes of clinicians regarding the utility of autopsies in the setting of other diagnostic advances, and general unfamiliarity with the autopsy and techniques for requesting it, especially among physicians-in-training. The autopsy is valuable for its role in undergraduate and graduate medical education, the identification and characterization of new diseases, and contributions to the understanding of disease pathogenesis. Although extensive, these benefits are difficult to quantify. This review of the last three years of hospital autopsy in Lucca studied the more easily quantifiable benefits of the autopsy as a tool in performance measurement and improvement. Such benefits largely relate to the role of the autopsy in detecting errors in clinical diagnosis and unsuspected complications of treatment. It is hoped that characterizing the extent to which the autopsy provides data relevant to clinical performance measurement and improvement will help inform strategies for preserving the benefits of routinely obtained autopsies and for considering its wider use as an instrument for quality improvement.
With the need for workers to find new sources of income, new possibilities for organizing work and the disposition of the working class emerged in Brazil at the end of the twentieth century. In this context, the solidarity economy, as a guide for the construction of self-management models in companies, influenced the creation of cooperatives based on socialist concepts, fostering cooperativism. Concern over the efficiency and productivity of different productive chains induces cooperatives to continuously reassess their goals and methods in order to maximize such indicators. From an applied perspective, the study has become important because it is the main step in a process that can lead to substantial saving of resources, with gains in health, safety, ergonomics, efficiency, and productivity for all types of organizations in competitive environments. These aspects provided the transformation of productive relations through the accelerated development of the forces of production in the way of capitalist modes of production. In the study of organizational management, it is necessary to approach and evaluate factors that influence the survival of the cooperative, including its relation to competitiveness. Social and technological aspects are both significant in determining the productive parameters. Therefore, a holistic examination of an organization's infrastructure, management model, techniques, methods, culture, and routines is often effective in addressing flaws and weaknesses. In this context, ergonomics emerges as a tool to enhance studies of management of operations, people and resources, production scheduling, work organization, and quality management. This process provides opportunities for improvement and application of technical, human, social, and entrepreneurial knowledge. A small enterprise, as an object of study, reveals a rich set of competences to be assimilated and/or improved. Thus, cooperatives of recyclable materials should be encouraged to increase development through the generation of jobs, income, and social inclusion. The economic sector that includes recycling cooperatives, in turn, becomes the target of negative analyses concerning the organization of work, health, safety, and ergonomics, with low indicators of efficiency and productivity. In this way, the level of organization of a cooperative directly influences the achievement of the final productive results of the cooperative. This study addresses the application of ergonomics, in different contexts, to a solid waste recycling and commercialization association located in central Brazil. The use of ergonomic hangers, along with routine follow-up by the cooperative, provided suggestions for improvement that were mainly based on applications of physiology and biomechanics, which are fundamental to an ergonomic analysis of work. It is concluded that several aspects of the cooperative could be improved, requiring its participation in this process of change in order to improve postures, methods, and work dynamics.
Sustainable design calls for in-depth understanding of the design process, factors that should be in place for a regenerative and transfigurative design and also knowing the practical implications and challenges of designing a sustainable product or service. In the present project, SIMS process (Scalable, Interactive, Modular Simulation) will be used and documented during developing a sustainable jewellery design.

Traditional Human factors/Ergonomics approaches define user engagement as the predominant way of enhancing user ownership and to consequently increase the system usability (O’Brien and Toms, 2008). Co-design (Sanders and Stappers, 2008), human centred design (Huang and Chiu, 2016), usability testing and many similar disciplines are at their peak to support better end user engagement and potentially more efficient user interaction. Ideally this will lead into high revenues, more satisfied users and change in consumer culture. However, it seems that these paradigms don’t/can’t provide thorough universalbity (when it is needed), as it appears that these approaches offer piecemeal solutions and lacks a holistic philosophy for design. True sustainability supports
this holistic aspect of user experience over possession and in doing so promises a new type of ownership, equity, and universality while providing at the same time individualism.

SYSTEMATEKS with its methodology of Scalable Interactive Modular Simulation (SIMS) is a design thinking paradigm that has been developed and practiced by the lead author on numerous successful and sustainable design projects for more than two decades. Within SIMS the process of design (although inspired from a top-down approach), explores the bottom-top components of knowing, sharing and believing and thus forms a balanced creation (i.e. a system of systems).

Despite the availability of principles and good practice guides, there are little information about the process (the how) that needs to be followed in order to arrive at a truly sustainable and transfigurative design. As Jégou and Manzini (2008) pointed out identifying a problem does not mean finding a solution and new approaches are needed to support social innovation and design for sustainable development. The SIMS process is developed through systematic review of a number of sustainable design projects and specify the steps and “the how”.

The SIMS process (Ferrara, Dadashi and Giusti, 2017) explored the context to create an archetype, organises various aspects to facilitate new ways of interpretation, visualisation, and to generate new means of interaction. The present project follows the SIMS process to design a sustainable piece of jewellery. The researchers have joined with creative designers and jewellery artists and invited to follow the SIMS process and in doing so, documenting their experience and final designs. The aim is to validate the process and to assess it within a product design realm.

References:
PATIENT SAFETY IN PEDIATRICS: ERGONOMIC SOLUTIONS FOR SAFER CARE OF CHILDREN

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Domain healthcare ergonomics
Sector healthcare
Oral presentation: Giulia Dagliana, Sara Albolino

Objectives

Epidemiological data from the literature are few for patient safety in paediatrics and there is a need for comparing experiences and applied solutions in different contexts. A study published in 2012 underlined that the 79% of adverse events in children happened in intensive care unit, the incidence on admissions is of 6.5% (3640 cases in total). 44.7% of these adverse events are preventable. The promotion of patient safety in paediatrics requires also patient and family programs of information and education to increase knowledge and awareness about risk factors and behaviours to prevent harms. The aim of this implementation-research project is to designing a multidimensional approach to patient safety and to pilot three patient safety practices for paediatrics: preventing children’s falls through the use of the Modify Humpty Dumpty Fall Scale (HDFC-M-ita) validated in Italian, the appropriate transition of care (Handover) and the early evaluation of patient deterioration through the Paediatric Early Warning Score (PEWS). In order to support the spreading of safety practices, a specific project of designing, implementing and evaluating of four cartoon video-vignettes on paediatric patient safety has been developed.

Method

Regarding the HDFC-M-ita, the study aimed at a linguistic and cultural as well as to estimate the sensitivity and specificity. Regarding the Handover, the study aimed at constructing a common ground for the definition of relevant minimum information set for managing patients at the emergency department and taking into consideration the role of parents and caregiver. The introduction of the PEWS aims at defining a set of clinical parameters that together guarantee the early identification of the deteriorating of the patient. Finally, the educational impact of the Cartoon will evaluate with a pre-post intervention questionnaire to be administrate to a group of patients and families.

Results

The analysis of results of the HDFC-M-ita and PEWS pilots will be finalized by the time of the oral presentation. Regarding the Handover from the preliminary data emerged that the organizational
context, influences the handover performance. From observation also emerged that the handover practice has a positive impact on the interaction between participants in the process and interruptions. Safety and continuity of care have been positively influenced as well. As for the Cartoon, preliminary results will be available by the time of the oral presentation.

**Conclusion**

The patient safety in paediatrics is still a challenging area. Tools designed and validated for adults are usually not adequate for children and there is a need for further research in order to get evidences of their effectiveness in paediatrics and to develop adapted solutions for the specific paediatric context. Thus, it will take a long time to have critical mass of data in this field while research interventions are fundamental work to improve knowledge in this field.
WHO Safe Childbirth Checklist: the experience of Kenya according to the WHO African Partnership for Patient Safety.

Type: Abstract Oral Presentation

Category: Healthcare

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WHO Safe Childbirth Checklist: the experience of Kenya according to the WHO African Partnership for Patient Safety.

Domain healthcare ergonomics

Sector healthcare

Oral presentation: Giulia Dagliana

Autori: Giulia Dagliana, Barbara Tomasin, Stefano Zani, Maria Jose Caldes, Silvia Esposito, Francesco Ranzani, Sara Albolino

Introduction

The burden of unsafe care is still very high all around the globe. A study conducted in 2012 in African and Middle Eastern Countries reports that in developing countries the incidence of adverse event is 8.2% and of these 83% are preventable. WHO estimates that about 287,000 are maternal deaths, 1 million fetal deaths during intrapartum period and 3 million deaths of infants during the neonatal period. WHO promoted a campaign for adopting the Safe Childbirth Checklist (SCC), that is an organized list of evidence-based essential birth practices, which targets the major causes of maternal deaths, intrapartum-related stillbirths and neonatal deaths that occur in health-care facilities.

Objectives

The objectives of the project are: introducing the WHO SCC in one hospital of Kenya and evaluating the locally adapted tool in terms of impact on safety and quality and its usability and feasibility.

Methods

The Centre for Clinical Risk Management and Patient Safety, the Centre for Global Health, the University Hospital of Siena the Ruaraka Uhai Neema Hospital undersigned a partnership following the WHO African Partnership for Patient Safety model, a model that emphasizes transfer of knowledge, experience and solutions in patient safety between countries. This 6-steps approach facilitates the identification of needs and gaps related to patient safety, the development of an action plan and the evaluation of results. According to
the gap analyses the program for improvement, jointly developed by Italy and Kenya, focused on specific strategies for implementing safety and quality in the maternal and neonatal area in particular through the use of the WHO SCC. The introduction of the tool foreseen 4 phases: customization; coaching, 6 months' pilot; evaluation in terms of usability and feasibility and in term of safety and quality through a prospective pre-post intervention study, based on clinical records review focused on a set of quality and safety indicators.

Results

The evaluation of the tool in terms of the usability and feasibility shows that: 70% of the midwives consider the checklist easy or very easy to use, the 56% said that the tool has improved significantly their practice around childbirth and the 50% that it has improved significantly communication and teamwork. Results from the prospective pre-post intervention study shown that the introduction of tool has led to a significant increase in:
- the evaluation of heart rate during pre-partum,
- the administration of the antibiotic therapy in case of mother's temperature > 38° or in case of membranes' rupture >24h,
- the administration of antihypertensive treatment in case of diastolic blood pressure >120.

Conclusion

The WHO SCC has been adopted with a positive feedback from midwives. The childbirth checklist has increased the delivery of some essential childbirth-related care practices and the appropriateness during the administration of antibiotic therapy and antihypertensive treatment. The twinning model proposed by WHO has the potential to go far beyond patient safety issue it can advance efforts towards building resilient health systems.
Background

The aim of statutory work-related health examinations (HE’s) is to detect early signs of illness and to identify hazardous work environments. It is of great importance that HE’s lead to improvement measures in the workplace. In Sweden, statutory HE’s are regulated by the Swedish Work Environment Authority (SWEA). The SWEA is presently revising the current provision and is considering introducing HE’s for workers exposed to hand intensive work (HIW). Since knowledge of the application of currently existing HE’s is limited, it is of importance to enhance the understanding of the implementation process so that future HE’s may be well integrated with existing occupational health and safety management system. A methodology for HE’s for workers exposed to hand intensive work (HE-HIW), including risk assessments, health examinations and feedback to employer has been proposed (Fig 1).

Fig.1 The HE-HIW methodology.
The purpose of this, currently on-going, project is to implement the proposed HE-HIW methodology and to evaluate different determinants, e.g. appropriateness and feasibility (benefits and value to employers and employees) as well as outcomes related to work-related ill-health and improved work environment.

Method

This implementation study has an interactive approach. In cooperation with their contracted occupational health services (OHS), 12 companies from different sectors (e.g. assembly, cleaning, meat packing) participate in the study. The methodology is presented in a workshop lead by experts in the field, where each company is represented by a first line manager, a safety representative and an OHS ergonomist. During the workshop each group plan and devise the intervention to fit the demands and conditions in their respective company.

Data is collected using a mixed methodology approach. To acquire information from the employees regarding perceived health and work exposure, a questionnaire is sent out at baseline, as well as six and twelve months after they have taken part in the HE.

To obtain information from managers, safety representatives, and OHS ergonomists interviews are conducted at several occasions in order to follow the implementation process and evaluate different implementation outcomes.

Preliminary findings

Data collection is on-going, however a preliminary analysis of interviews conducted at the completion of the HE-HIW has been made indicating that the methodology is feasible; the HE did not affect production and was not considered to be time consuming. Further, the HE-HIW was value-adding in pinpointing which work tasks that were related to musculoskeletal discomfort and disorders, indicating that the methodology is appropriate to use to identify areas in the work environment that are important to address to decrease harmful exposure.

Further results with regards to the implementation process as well as outcomes for work-related ill-health and improved work environment will be presented and discussed at the conference.
Self-recording of physical workload of the upper arm - precision and accuracy

Type: Abstract Oral Presentation
Category: Healthcare

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Background

Repetitive work and work performed in awkward and constrained postures are known risk factors for developing work-related musculoskeletal disorders (WMSDs). In order to reduce these risks, it is important to do an adequate risk assessment of the workload. There are several methods that can be used, such as self-reporting, observation methods and expert assessments. These methods have some limitations and for example observation methods do not have any common references; they give various results when different methods are used for categorizing the risks for developing WMSDs. An alternative is to use technical methods for the risk assessment since they give exact numerical values for both postures and movements of the workload. With these methods, it is also possible to measure the workload during several days. The general opinion about technical methods has been that they are time-consuming, requires expensive technical equipment and technical expertise to perform and are therefore not suitable for all. However, there are now low-cost sensors available for recording of postures and movements during work. To date, all recordings have been performed by researchers and no one has so far, to our knowledge, asked employees to perform their own recordings.

Aim

The aims were to develop a written protocol with instructions for self-recording of ergonomic workload with a low-cost sensor (inclinometer), and to evaluate if these recordings have the same quality as those performed by professionals.

Methods

28 subjects participated in the study. They started an inclinometer and then attached it to their upper arm according to the instructions in a written protocol. The protocol also contained instructions for a plain reference posture (defining 0° of inclination), that was repeated every morning of the three-day recording. An experimenter instructed the participants to also perform our standardized reference posture. To evaluate the quality of the self-recordings, each recording was analysed twice, once in relation to the plain reference and once in relation to the standardized reference.

Results

The group means of the 50th and the 90th percentiles of the angular distribution in the analysis when the plain reference was used as reference were 30° and 65°, respectively.
Corresponding group means when the standardized reference was used were 30° and 64°. The group means of the absolute difference of the 50th and the 90th percentiles of the angular distribution between the two analyses were for both percentiles 5°.

Discussion

The participants were able to follow the protocol and thereby perform the self-recording. On group level the recordings were fairly equivalent with those that researchers perform. Self-recordings could increase the use of technical methods for risk assessment, and thereby increase the accuracy of them. Such risk assessment in combination with action levels would be an important improvement of prevention.
The ergonomic problem solving process is a uniformly consistent approach to address ergonomic challenges presented in a variety of environments. The steps of ergonomics problem solving include: 1) identification, 2) analysis, 3) brainstorm possible solutions, 4) implementation (prototypes), and 5) evaluation. This process was carried out at a northern Colorado company with less than 200 employees. This company distributed beer (cases and kegs) to liquor stores, convenience stores, restaurants, and bars around northern Colorado. Over the course of an academic semester, the first three steps were carried out with workers in the warehouse and delivery sections. After a month of data collection (observation of delivery and warehouse tasks), employees participated in a two-session workshop.

The first session presented an overview of work design goals (product quality and customer service, efficiency, decrease risk of injury, and improve quality of work life) and how they aligned with the company’s own principles. These concepts were communicated using case studies in an interactive setting. On the second day, groups were separated into the target areas to expand on challenges specific to the warehouse or delivery workers. Videos gathered during the data collection period were shared with workers. The researchers facilitated a brainstorm session to address challenges presented in those videos. Task challenges ranged from errors in building orders in the warehouse and lifting kegs to maneuvering kegs up stairs and tight spaces during delivery. Brainstormed possible solutions varied from shifting individual pick-rates to team-accuracy and standardizing communication policies and procedures with clients.

The first stage of this process covered the identification, analysis, and brainstorming possible solutions components of the ergonomics solution development process. Further collaboration with this company will incorporate prototype, implementation and evaluation steps.
Incorporating Ergonomics into a Construction Safety Management System

Type: Abstract Oral Presentation
Category: Building and Construction
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Background: Musculoskeletal disorders (MSDs) are the leading cause of non-fatal injuries among construction workers, yet ergonomic programs for MSD prevention are rarely integrated into construction safety management systems, which typically focus on reducing acute hazards such as falls and electrocution. The purpose of this project was to design an ergonomics program that filled gaps in a large construction contractor's existing safety management system, deliver the program, and evaluate workers' awareness of MSD prevention efforts.

Methods: A pre-intervention review of contractor documents, project work processes, subcontractor daily assessment forms, and worker surveys (n=233) from three large construction projects revealed many gaps in ergonomic knowledge and work practices. A university researcher worked with a safety team across multiple levels of the contractor to design an ergonomics intervention addressing three primary hazards related to overexertion injuries in construction: heavy lifting, working at floor level, working above head level. The safety team revised all documents and trainings to integrate the new ergonomics program into the existing safety management system. The revised ergonomics program was delivered on two construction projects. Surveys of workers' awareness of the program on these two projects (n=122) was used as an interim evaluation of program implementation.

Results: Review of the contractor's safety management system from the three pre-intervention projects showed overexertion injuries accounted for 21% of all reported injuries, yet ergonomic hazards were identified and recorded on only 1% of site safety audits; ergonomic information was discussed in only 3% of weekly safety toolbox talks over the nine-month projects. Subcontractors identified ergonomic hazards in 44% of daily task assessments, but identified control measures for only 47% of these hazards. Preliminary evaluation comparing worker surveys from the baseline projects to the intervention projects showed positive changes in the frequency ergonomics was discussed during subcontractor meetings (34% baseline vs 62% intervention) and reported on subcontractor daily task assessments (65% vs 80%). There was no change in the proportion of workers recalling ergonomics mentioned during safety briefings (79% vs 85%) or in awareness on signage related to MSD risk reduction (65% versus 69%).

Discussion: Relative to measures aimed at preventing other work hazards, the safety management system of a large construction contractor had relatively little integration of
ergonomics practices into audits, reporting, or training despite a high burden of MSD. Revision to program materials and work processes demonstrated an increase in worker awareness of ergonomics for some but not all areas assessed. These preliminary results will drive additional changes to the program. This ongoing program will also be evaluated by other leading indicators of risk reduction in ergonomic hazards, including a review of daily task assessment documents and observed work practices.
Seat comfort evaluation using facial expression recognition

Type: Abstract Oral Presentation
Category: Aerospace

Flavia Renata Dantas Alves Silva Ciaccia1; Jerusa Barbosa Guarda de Souza1; Alicia Mora2; Maria Pocovi2; Guilhermo Dorado2

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One of the difficulties inherent to comfort assessment is to translate comfort perception into quantifiable variables in order to measure it and use this result to improve seat comfort. Some tools and methods have been investigated to reduce uncertainties of subjective evaluations such as pressure mapping, electromyography, activity analysis and some physiological measures. Therefore, this study describes the opportunities of using facial expressions recognition technology to compare comfort perception of two aircraft seats installed in a representative environment.

Facial expressions are one of the most apparent ways to capture emotions. An emotion is a complex psychological state that involves three distinct components: a subjective experience, a physiological response, and a behavioral or expressive response. Some researchers have tried to identify and classify different types of emotions and discovered that almost everyone can produce and recognize the associated facial expressions of these emotions, what led them to the assumption that emotions are universal (SHIN, WANG; 2015). Psychologist Paul Ekman pointed out that there are six basic emotions which are universal throughout human cultures: fear, disgust, anger, surprise, happiness and sadness (EKMAN, 2003).

This study aimed to investigate which of two seats was the preferred at an emotional level and which characteristics of the seats were the best according to the participants and their emotional responses. Twenty one subjects (18 males and 3 females) participated in this experiment and have their faces recorded while using the seats and being asked some questions. The recordings obtained were posteriorly analyzed by Emotion Research Lab facial recognition technology to obtain an emotional analysis of the facial expressions displayed by the participants during the experiment. The facial expressions recognition software of Emotion Research Lab captures the facial micro expressions and uses them to predict the behavior of the participants through the calculation of different metrics such as activation, engagement, satisfaction, valence, relevance and enjoyment.

The results showed that seat 1 was better rated by participants and also had emotional congruence with their answers. The most important finding was that even subtle differences in seats could be perceived in participants' emotions, suggesting that the use of facial expressions recognition technology to compare comfort perception of aircraft seats is viable and should be better explored during seat development process.

[2157] Noise Exposure on Pediatric Psychiatry Units

Type: Abstract Oral Presentation
Category: Healthcare
Nancy Daraiseh¹; Lin Li¹
¹Cincinnati Children's Hospital, Cincinnati, USA

Background: Excessive noise exposure places healthcare providers at risk for safety events, near-misses, decreased job performance, and fatigue. Noise is particularly a concern in pediatric psychiatric units, where highly-skilled providers and vulnerable patients require a quiet and calm milieu to promote a therapeutic environment. In order to protect patients and health care professionals, noise abatement agencies recommend that sound pressure levels should not exceed 45dBA during the day and 35dBA during the night.

Objective: To measure sound pressure levels and duration on inpatient psychiatric units and explore sources of excessive noise and its effect on health outcomes in nurses and mental health care providers.

Procedure: Randomized psychiatric nurses and mental health specialists (N=24) wore a noise dosimeter and a heart rate monitor to measure noise exposure and heart rate respectively. Observers followed participants, and using a noise log documented the source, location, and activity of noise at five-minute intervals and when noise exceeded 75dB. The 75dB threshold is the limit above which noise abatement agencies consider likely to cause physiological damage. Observations covered 24-hours at four-hour intervals over the course of one week to ensure variability. Participants reported stress levels at baseline and two-hour intervals using a 0-100 scale.

Methods: Descriptive statistics were calculated for noise (level, source, location, and activity), heart rate, and stress. The Pearson correlation coefficient was calculated to analyze the relationship between heart rate and noise. The paired t-test was used to compare the stress levels between the three time points.

Results: The mean noise level was 76.6dB, SD=9.9 and was greater than 75dBA 55.6% of the time. The top sources of noise were due to staff communication (46.4%), in patient rooms (67%), and during employee interactions (31%). Baseline and mean heart rate were 92bpm, SD=20.6 and 89bpm, SD=8.7 respectively. Heart rate was significantly correlated with noise levels (r=.27, p<.0001) and providers spent 8.3% of the time in tachycardia (heart rate >100bpm). Mean stress scores were low at the beginning, mid-point, and end of observation: 37, 30, 18 respectively. Stress was related to the baseline (r=0.32) and mean heart rate (r=0.45) although not statistically significant. The baseline stress level was significantly higher than the mid-stress level (t(23)=1.75, p=0.0943) and the mid-stress level was significantly higher than the post stress level (t(23)=2.37, p=0.0263).

Conclusions: Noise levels in pediatric psychiatric units exceed recommended thresholds and require immediate attention through effective interventions. Low stress levels may be indicative of successful coping strategies or decreased awareness of stress. Although
noise was not associated with stress, a significant correlation with heart rate and nearly 10% of a shift spent in tachycardia indicates that noise may impact health outcomes.
Biomechanical adaptations when lifting in confined spaces

Type: Abstract Oral Presentation
Category: Manufacturing
Kermit Davis¹; Alabdullatif Abdulrahman¹; Susan Kotowski¹
¹University of Cincinnati, Cincinnati, USA

Globally, low back pain is considered one of the most prevalent health problems in many physically demanding industries. For many of these industries, lifting occurs routinely in confined spaces oftentimes under poor lighting conditions. The study's objective was to evaluate how individuals responded biomechanically when lifting boxes within a confined space and under different levels of light. Ten participants (5 females and 5 males) completed a de-palletizing task in a laboratory simulation. The study design included four variables: 1) confined space (high and low), 2) level of light (low, medium, and high), 3) pallet layer (top and bottom), and 4) pallet position (left front, left back, middle, right front, right back). The dependent variables focused on the three-dimensional trunk kinematics (position and velocity) and trunk muscle activity (ten major trunk muscles). Trunk kinematics were not impacted by the level of light but were impacted by height of the confined space. The low confined space height produced more sagittal trunk flexion (about 4 deg) but less trunk twist (about 3 deg). The low confined space condition also had lower sagittal and twist trunk velocity than the high condition (about 8 deg/s and 5 deg/s, respectively). More trunk muscle coactivity was found when the confined space height was at the low level where higher levels of muscle activation was found for the right latissimus dorsi, left erector spinae, right and left rectus abdominus, and right external oblique muscles (1% to 5% MVC). Light increased activation levels in a few muscles: left erector spinae, left rectus abdominus, right and left external oblique, and right internal oblique. An interesting result was that there was a decrease in the three dimensional trunk kinematics when lifting from the bottom layer as compared to the top layer (on average: 4 deg in sagittal and 2 deg in twist and lateral flexion; about 3 deg/s for velocity in all three planes). The study results provided further evidence that lifting in confined spaces was detrimental to the low back since individuals utilized a more flexed forward posture and increased muscle coactivity. Overall, the results indicate that there are biomechanical adaptations that occur during lifting when lifting in confined spaces and to a much lesser light. The next steps will be convert these kinematic and coactivation changes into spine loads to understand the biomechanical impact of confined lifting and illuminance.
Nurses in all regions of the world continue to suffer from frequent musculoskeletal disorders (MSDs). However, the prevalence of specific MSDs may vary across the world depending on many factors such as use of lift equipment, types of medical procedures administered, and other work environment factors. The first step into understanding the nuances across the regions of the world is to identify the prevalence of MSDs. A literature search was completed that identified all studies investigating the MSDs prevalence published prior to December 2017. The outcome variables were the 12-month prevalence of pain in five body regions: 1) low back, 2) neck, 3) shoulder, 4) upper extremity—elbow, arm, hands, and wrist, and 5) lower extremity—knee, leg, ankle, and foot. The inclusion criteria was that the study had to evaluate nurses and MSDs within a 12-month period. There was no quality assessment of the studies with all of them representing cross-sectional surveys, thus relying on similar subjective questionnaires. Most studies utilized well-validated surveys. In total, 100 studies were found to be published that investigated MSD prevalence in nurses with 9 studies in North America, 38 in Europe, 18 in Asia, 9 in Africa, 16 in Middle East, 6 in Australia, Philippines, and New Zealand, and 3 in South America. Table 1 shows the summary of the studies that investigated MSDs for nurses. Across all regions, low back pain was the most prevalent MSDs (51% to 72%) followed by neck pain (37% to 62%), shoulder pain (35% to 50%), lower extremity pain (21% to 49%), and finally upper extremity pain (14% to 44%). The Middle East and the Australia/Philippines/New Zealand regions had the highest prevalence rates across all body regions. North America and Europe had prevalence values on the lower end of the ranges for most body regions. Three major conclusions can be drawn from the review: 1) many regions have few studies investigating specific MSDs (e.g. less than 5 studies), 2) nurses suffer from more than just low back pain worldwide, and 3) geographical regional differences exist with respect to MSDs for specific body regions. Future work needs to identify why these prevalence differences exist between regions and even more specifically the countries within these regions.
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“Ergonomics on the ground”: a case study of service learning in ergonomics education

Type: Abstract Oral Presentation
Category: Education and Training

Jonathan Davy1; Weaver Kim2; Paphitis Sharli3; Todd Andrew1

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Background: Human Factors and Ergonomics (HFE) advocates adopting a systems approach to understanding sociotechnical systems, an idea encapsulated in Wilson’s (2014) fundamental notions of how to “do HFE” properly. These included adopting a systems focus, understanding context, interactions between system components and doing so holistically to understand the system’s emergent properties. This cannot be achieved without embedding in a system. These ideas have implications for ergonomics curricula design.

Traditionally, in the Rhodes University Department of Human Kinetics and Ergonomics, the pedagogical approaches include lectures, readings, discussions, presentations and field trips. These provide a theoretical understanding, but provide limited practical experience. To overcome this, it is important that students experience real work systems. This requires embedding them in a system, an idea supported by Service-learning (SL).

SL, an approach that combines academic learning with community-based service, is a pedagogical method that could bridge the gap between traditional teaching approaches and preparing students to practice. In partnership with the Centre for Biological Control (CBC), we initiated a SL course aimed at providing a practical component for Honours level students. We were interested in how the SL course influenced student understanding of HFE and Wilson’s six notions.

Approach: 12 students worked alongside a group of people with disabilities (PWD) employed at the CBC to mass rear and harvest insects used to control invasive plant species. The students spent four hours a week for four weeks at the CBC mass rearing facility. Thereafter, students responded to questions aimed at exploring: how the SL course impacted their understanding of Wilson’s notions; how it influenced their learning and challenged preconceived ideas about PWD; what they found challenging and enjoyable; what the CBC could do to improve the working conditions. Student responses were subsequently analysed thematically.
**Results:** Two broad themes emerged. Firstly, the experience enhanced the students' discipline-specific knowledge. Students reported an enhanced ability to identify system components, a better understanding of emergence, while highlighting the importance of embedding. Students consistently identified problematic aspects at the CBC and recommended possible interventions. Importantly, the students emphasized that future students should spend more time at the facility and interact with other levels of the CBC to ensure appropriate interventions. The second theme revolved around personal growth. Working with PWD altered student perceptions from pity and sympathy to perceptions of individuals who are able to work and who should and do work as hard as able-bodied individuals.

**Conclusions:** The SL course appears to have enhanced the students' understanding of HFE and its importance in contexts such as the CBC. The experience provided students with opportunities to overcome preconceived perceptions about working alongside PWD and afforded practical insights into how the students could apply their knowledge to improve work systems.
Local lighting control in open-plan offices - the influence of office lay-out

Artificial lighting accounts for a significant fraction of global electrical energy consumption. Linking a light system with occupancy sensors is a cost-effective and easy solution for reducing lighting energy use as they allow the electrical lighting to be switched off when occupants are not present. In multi-occupant office spaces, lighting is used optimally when it is tailored to the individual occupancy patterns; controlling lighting at the desk level can realize this. However, this “local lighting control” strategy should not come at the cost of users’ comfort. In an earlier study, we found that local lighting control distracts some users from their work as it results in frequent lighting changes. It was performed in a European office, which typically does not have any partitions between desks. In North-America, partitions are more common and as they limit occupants’ view over the office space, users might not perceive the lighting changes. Therefore, we replicated the European study in a North-American office, investigating the influence of partitions on employees’ distraction from their work and their satisfaction with the lighting conditions. First, a baseline was created by applying central lighting control for a week, where the lighting was at a constant level. Subsequently, local lighting control was applied for two weeks. During the entire experiment, occupants (N=17) were asked to keep a diary of all distractions they experienced from environmental sources, e.g. noise and temperature. At the end of the experiment, they indicated their satisfaction with the lighting conditions. When comparing the results of the two studies, the workers in the cubicle office were less distracted by local lighting control than the workers in the open-plan offices, suggesting that office lay-out does influence lighting perception.
Prevention of onycholysis during cancer treatment using an active local cooling device: comparison of three different cooling strategies

Onycholysis is a form of nail toxicity where the nail detaches from the nail bed. This medical condition is reported to develop with up to 44% of patients undergoing a systemic cancer treatment that uses chemotherapeutic chemicals such as anthracyclines and taxanes. The use of ice gloves during chemotherapy can be effective in preventing nail toxicity as they enable cold-induced vasoconstriction (CIVC), or reduction of blood flow, and therefore limit the transport of chemotherapeutic agents towards the nail bed. Unfortunately, the use of ice gloves also results in cold-induced vasodilation (CIVD), which increases blood flow and reduces the effectiveness of the preventive treatment. Moreover, the gloves induce pain and additional distress during a cancer treatment. Therefore, alternative solutions should be investigated.

The objective of this article is to examine the usefulness of an active cooling device for controlling blood flow in the fingertips and reducing CIVD, while limiting pain and discomfort.

In this research, an active cooling device is an instrument that allows cooling the palmar side of the distal phalanx of the middle finger. The cooling is induced with two Peltier elements, whereby surface temperature is measured with NTC sensors and controlled by an Arduino controller. Three cooling strategies were evaluated in this research: (1) a linear cooling strategy, in which the Peltier elements are controlled at 2°C during a period of 60 minutes (2) a pulsed cooling strategy, in which two-minute periods of 2°C alternate with two-minute periods of 20°C and (3) a delayed pulsed cooling strategy, in which the Peltier elements are cooled at 2°C during the first 12.5 minutes after which strategy 2 is employed for the remaining 47.5 minutes. In all three strategies, the cooled finger is first controlled at 20°C during 10 minutes prior to the test. The dependent variable is blood flow at the nail bed, quantified as the finger temperature on the dorsal side of the finger. The cooling effectiveness is quantified as the reduction in bloodflow during the cooling strategy as compared to the bloodflow 10 minutes prior to the test.

All three cooling strategies allowed to reduce blood at the nail bed, with a finger temperature reduction between -4.55°C and -3.92°C on average during the 60-minutes trial. No significant differences (P>0.05) were found in average cooling effectiveness between the different cooling strategies. However, during the last 15 minutes, the standard deviation of the linear cooling (0.41°C, SD 0.264) was significantly higher than the one of the pulsed cooling (0.16°C, SD 0.086). The results indicate that pulsed cooling may reduce CIVD, while offering a relatively painless treatment to prevent nail toxicity. In conclusion, an active local cooling device using pulsed cooling is thus a suitable alternative solution.
Defining what is a work situation puts us in front of an issue that concerns the epistemological alignment that we seek. If we stick to what is advocated by certain schools of work organization, such as Taylorism and Fordism, we adopt a point of view that the work situation is a given, something defined previously from choices made by those who designed the production system and defined the division of work, the modality of production, the machines and tools to be used, the procedures to be adopted, the architecture of the physical installations and the network or information system, the physical arrangement of the production areas and support, as well as the configuration of jobs.

Activity centered ergonomics put in evidence that these different aspects are related to the universe of the task, related to the conception of the scenarios where the different workers will act to realize goals.

We can adopt a different point of view, in which a work situation is not a given, it is not something definite. It is a dynamic situation where the different social actors who work in those situations act based on a scenario, only partly defined previously, but which is constantly transformed, which is dynamic. Certainly there are aspects already defined and, in many cases, apparently immutable. However, when we grasp what actually happens in a given work situation, there are always variations, there are always unforeseen interrelationships, there is always a degradation of the state of machines and tools. Dynamic is related to the living work, the work of all who cooperate to achieve the objectives of production.

The processes of treatment of the intrinsic variability of production systems are related to people’s work. This is not given previously; it is not defined in procedures and in the ways in which work is organized. This does not detract from the importance of planning, of conceiving, of designing and developing procedures. Although they are fundamental, it’s not possible to take into account reality; which is dynamic, uncertain and full of emerging phenomena. The question of variability is related to the most varied phenomena linked to the world of things; but variability and, also diversity, concern the world of people, the living world. Actually we cannot consider things and people as resources and as comparable, the risk of reification is always present in different organisational approaches. It is fundamental to consider the dynamics of life and that the subjects of production can not be expected to always act in the same way, always do the same, become things. Otherwise it’s important to put in relation what people do at work dealing with “objects” and also the questions related to interpersonal relationships, like cooperation.
Challenges of Telework in Brazil: A Sociotechnical Analysis

Type: Abstract Oral Presentation
Category: Others

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Amongst several transformations of our society, new paradigms of work emerge, also driven by advances in technology, as in the case of telework. The fact that it is still a recent modality in Brazil raises some concerns about human factors, which is aggravated by the lack of specific legislation and recent changes in labor laws. Telework is related to various aspects that act as influencers or outcomes of the modality. The variety of teleworking factors makes the subject complex and results in sparse and sometimes contradictory studies. In order to integrate these various aspects related to work, a sociotechnical study arises. Sociotechnical systems, objects of study of organizational ergonomics, encompass aspects that can be summarized in the technical, personnel, organizational and environmental subsystems. This study aims to analyze the challenges of telework in Brazil, addressing the various factors that influence it and are influenced by it, based on a sociotechnical approach, seeking to contemplate aspects of Macroergonomics and Organizational Design and Management (ODAM). Through a multidisciplinary literature review, the varied aspects that should be considered in an integrated way in the study of telework were pointed out. In Brazil, telework is studied under different perspectives, such as psychology, law or administration, being predominant the focus given to the organization or to the individual, in an isolated way. It is important to highlight the need to approach telework in Brazil under a sociotechnical bias, seeking to understand the interrelationship between the different subsystems. The environmental subsystem, especially, should be treated carefully, since some authors point out the influence of culture on the outcomes of telework for the workers. It is important that the ergonomic study of telework be done not only in a top-down way, as observed in most of Brazilian studies, but also in a bottom-up and middle-out way, according to sociotechnical principles. It’s expected, with this research, to contribute to the study of telework from organizational ergonomics and sociotechnical systems, serving as a guide for future studies and the practical adoption of telework.

Keywords: telework; sociotechnical systems; organizational ergonomics; organizational design and management
The simulation of extreme situations for the analysis of resilience and reflections on new forms of preparedness for crisis management

Type: Abstract Oral Presentation
Category: Manufacturing

Cecilia De la Garza; Pierre Le Bot; Quentin Baudard

EDF Lab Paris-Saclay, Palaiseau, France

This paper highlights how simulation contributes to study a new crew concept in a crisis context defined as an Extreme Situation (ES) in a nuclear power plant (NPP).

ES means a situation like Fukushima: an isolated NPP, after an earthquake, an accident in at least two reactors; and a single channel of communication with the national command post.

ES simulation makes it possible to consolidate the crisis management process, by identifying the strengths that have to be preserved, and the areas of improvement for the operating crew as for the crisis organization.

A multidisciplinary approach, combining ergonomics and human reliability, has been adapted to the simulation of the crisis organization.

The ES simulation includes the observation of different workplaces: two operating crews in two full-scale simulators, the field operators, a national technical support team and part of the members of the national command post.

A Model of Resilience in Situation has been used for the analysis of favorable/unfavorable factors of the resilience of the socio-technical system. The results, focused on the control room, highlighted three main results:

1) In an ES the crew has to prioritize the field actions taking into account the availability of the field operator and the state of the reactor. This is a new and challenging activity that penalizes even more the supervisor who is very busy in this context, even if workload can be more or less satisfactory regulated by teamwork.

2) The new mission of the Operation supervisor, who applies the safety engineer procedure, in cases where this one cannot access the NPP, seems to work. The results vary depending on the NPP configuration. In the NPP in which the Operation supervisor has to monitor two reactors his workload is higher and he has to share his time between the two reactors, while in the NPP in which he has to supervise only one reactor he can easily discuss with the crews and bring some information to the operators.

3) From the point of view of the technical support team, it appears that the channels of communication are not only limited, but in addition not always efficient. The main difficulty for the technical support team was to understand the requests of the crews, and the management of a multi-reactor accident.

Proposals have been made to strengthen the resilience of the socio-technical system as the proposal of new forms of preparedness for the operating crew, the field operators and the technical support team.

Through these ES simulation, specific requirements in relation with the work activity of each group and missions involved in crisis management have been identified. Thus, it is possible to offer innovative forms of simulation and work tools adapted to the crisis management.
Creative focus group as instrument to evaluate work related stress

Type: Abstract Oral Presentation
Category: BUSINESS CASE - Manufacturing
Silvia Gilotta¹; Francesco Deiana²; Mariangela Ditaranto¹; Massimo Guzzo¹; Cristina Mosso²

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From the literature and the outlines guides, it is possible to find different methodologies to collect data from the practice of occupational stress evaluation. Among these, it emerges the Focus Group that Zammuner (2003) describes as a “method of qualitative data collection, based on a group talk from which emerge data that the researcher is interested on deeply investigating it”. There are several variants of the methodology, that can be used depending on the research purposes. In the case history presented here, there is the need to deal in depth with the aspects concerning the organizational climate and culture. To highlight all the contents, facilitate the sharing of the different points of view, and to ensure the involvement of all participants, it has been chosen a creative alternative inspired by Greenbaum’s “expressive drawing” (1999): it is a “projective technique that can be very helpful in eliciting information that might otherwise not be generated in traditional focus group discussions, and that can also energize the group when it’s necessary”. In practice, it envisages the realization of an artistic artifact in which the operators represent their own perspective, emotional opinion and emotional reaction on topics in question. Compared to a normal “focus group”, this variant allows further structuring of the discussion, encouraging participation and comparisons, facilitating the creation of common meanings. Specifically, the operational layout applied is the following: first of all it has been set a short tutorial session related to the constructs of organizational climate and culture; then, it started a warm up phase followed by a creative moment in which the operators have produced some artifacts through which they have described their perception of organizational climate and culture; finally, it has been set a debate in plenary where the participants have talked about their job and its meaning, with the support of a moderator. The data has been collected as notes and processed according to the following categories, obtained from the literature on the organizational climate and culture (James e Jones 1974-1979; Rousseau,1990; Schein,1990): identity-values-ideologies, communication, leadership, rules and incentive, responsibility and freedom, individualism and sense of team, criteria of success. The results obtained have shown that the focus group, in the proposed variant, represents a valid instrument for this activity: the use of the artistic artifact as a way of transmission and sharing the meaning allows a rich and articulated data collection, ensuring a broad and deep vision of organizational reality.
IWSP education to innovation regarding aging problems

Type: Abstract Oral Presentation
Category: BUSINESS CASE - Education and Training

Pierre-Henri UTC, Université de Technologie de Compiègne, France DEJEAN

For several years (10) we have introduced an original pedagogical process consisting in accompanying multidisciplinary student teams to explore real situations and to propose original solutions demonstrated with a model (cf IEA Las Vegas, Melbourne). Now we have applied IWSP (interdisciplinary workshop to problem solving) three times in the very important question of aging. One was focused on nursing home, an about social habitat, another about services to older people and the new one about hospital/city and city/hospital links. In IEA Melbourne we have heard many interesting papers in aging TC session that confirm some diagnosis, extend our reflections, demonstrate the value of several solutions.

The aim of this paper is to share an overview of problems and solutions in particular technological and design solution, that is the practical and material aspect but also a valorisation of ergonomics participation.

In fact the ergonomics presence is limited: just one teacher is ergonomics and few students have just follow a course of sensitization included in engineering, design, curriculum, but ergonomics presence appears in the goals and objective of the IWSP, and also in the general methodology.

About goal and objective IWPS aim for the wellbeing of the old people but also the wellbeing for all the people who help them in all the task of her living life (nurse, housekeeping, emergency services, family...). Quality management talk about stake older. The bottom up methodology starting from work analysis to prototype test is in ergonomics philosophy spirit. If IWPS have adopted this spirit, in the same time IWPS add design and engineering step. In this way, ergonomics is applied in "real time" in the design process. The benefit of this situation is sensitive in the background of all discipline, the overview of problematic and future of solutions to the old people life, a big push to innovative technologies, and fore sure immediate improvement of actual situations. At the moment we haven’t evaluate the economic benefit, but sure improve autonomy, decrease social outgoing, to promote new devices and services, wide employment and consumer market. IEA Congress Florence would be a fantastic forum to exchange experiences, data, point of view with practitioner around the world.
An international survey of tools and methods used by professional ergonomists

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Dempsey et al. (2005) conducted a survey of Certified Professional Ergonomists (CPEs) in the United States (US) to gather information on the types of basic tools, direct and observational measurement techniques, and software used by practitioners. In order to examine secular trends as well as extend the survey internationally, a revised and updated survey was sent to ergonomics practitioners in the US, Canada (certified by the Canadian College for the Certification of Professional Ergonomists), Australia, New Zealand, United Kingdom, and Ireland via a web survey. Countries that were predominantly English-speaking with a professional certification body were approached to be included. In addition to the previously administered survey questions, respondents were also asked to report use of smart devices (phones and tablet), apps developed for use on smart devices, and tools related to “Total Worker Health” initiatives. The Total Worker Health question was phrased as “tools or guidelines to integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being”. Several tools (e.g. Health and Safety Executive’s (HSE) Manual Handling Assessment Charts (MAC)) were added based on pilot feedback to better reflect tools in use outside the US. The original survey was a postal survey, whereas the current survey was web-based using Survey Monkey.

The invitation successfully reached 1,192 ergonomists. Inviting Canadian ergonomists involved two steps required by Canadian anti-spam law: an e-mail sent to ergonomists asking them if they wanted to opt-in, and, if so, a survey invitation. Due to the small number of New Zealand respondents (n=5), their responses were combined with Australia. There were 405 usable survey responses with 38 from Australia/New Zealand (42.7% response rate), 53 from Canada (22.0%), 10 from the United Kingdom and Ireland (22.7%) and 304 from the US (35.9%). For comparison, Dempsey et al. (2005) reported a 53% response rate by US CPEs. The lower response rate is believed to be due, in part, to the electronic format. The presentation will cover the key data comparisons between the two sets of responses from US CPEs to highlight possible trends in tool use, as well as international trends for more commonly used tools. The use of smart devices and apps will be summarized to give insight into their current use.

Ergonomic Analysis of Labor applied to scaffolders in a shipyard in Brazil

Type: Abstract Oral Presentation
Category: Building and Construction

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Modules of 6 oil and gas platforms are being built at a shipyard in Brazil for operation in the pre-salt area. It was verified that, among the disciplines of construction and assembly (welding, structure, electrical, scaffolding, painting, instrumentation, commissioning, piping and load handling), scaffolders are the workers who are exposed to the greatest amount of unsafe conditions due to the risks inherent to the work at heights and the lack of safety behavior. Scaffolders have the important responsibility of promoting safe access to the other disciplines into the platform. This study aims to analyze the working conditions of scaffolders analyzing their job and applying an innovative tool designed for the whole shipyard safety.

It was used the direct observation of the activity during 8 months and the Ergonomic Analysis of Labor (EAL) were applied to ascertain the diagnosis of the context that covers the working routine of the scaffolders. PAR - Perceiving, Acting and Resolving was implemented as a tool in which the construction and assembly teams were also responsible for identifying the unsafe conditions in order to carry out each other. From the observation it was realized that the physical structure offered to the scaffolders is not ideal and the workers frequently go beyond some limits of the procedure to achieve production goals, putting themselves and the others at risk. PAR registered 599 unsafe conditions that were pointed out and then eliminated in the area of scaffolding, among which the most recurrent are: opening in floor, scaffolding without skirting board, lack of inspection, activity being carried out without issuing a work permission, scaffolding material spread and seat belt not used properly. From the observations it is important to note that it is not always possible to attach the seat belt to a structure other than the scaffold being erected, which is unsafe and requires investment in the structure of the construction site. Another characteristic observed is that couplers, wooden planks and even scaffold tubes are often thrown at the ground. Training and awareness should be improved. The conclusion is that PAR is an effective program against one of the main causes of accident in the construction industry, fall from height accidents, because it transfers responsibilities to all workers and immediately acts on the perception of other risks. Not only who is doing the job is informed about the risk, but they also learn how to perceive it during their activities, as all the others become guardians of the safety in the construction site.
VALIDATION OF A 3D-VISUAL TARGET ACQUISITION SYSTEM FOR EVALUATING THE EFFECT OF HEAD SUPPORTED MASS ON PERFORMANCE

Type: Abstract Oral Presentation

Category: Military

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Introduction: For the Canadian Armed Forces (CAF), the impact of head supported mass (HSM) on neck injury within specific rotary aircrew is reaching epidemic proportions. Currently, over 80% of CH-146 Griffon helicopter pilots present with neck pain [1]. During typical night flying missions Griffon pilots and aircrew are required to wear a helmet mounted with night vision goggles (NVGs) for up to 2.5 hours. Though this equipment was designed to enhance performance and extend operational capabilities by facilitating missions in the cover of night, the induction of these helmeted systems significantly increases biomechanical loading on the head and stress on the neck. To better understand the impact of helmeted systems on performance and neck pain, a 3D-visual target acquisition system (VTAS) [2] was designed to evaluate performance and motor control of the head-neck complex during head directed acquisition of visual targets in 4 different movement trajectories (MTs).

Methods: 15 healthy male participants (22.8 ± 1.9 years) with no history of neck pain and normal color vision performed visual target acquisitions of both 60 mm and 20 mm sized targets for each of the MTs while wearing either a Gentex Helmet (HGU-P/56, Zeeland, MI) with replica NVGs or a GoPro head strap with 3D printed tubes. Participants were required to reciprocally acquire as many targets as possible in 16 seconds. Dependent variables evaluated included mean target acquisition time (TAT), mean time to move off target (TMOT), and error index (EI).

Results: Generally, subjects required longer time to acquire targets with the helmeted-system, particularly for the smaller 20 mm targets and thus were unable to acquire as many targets as compared to the minimal HSM GoPro condition. Mean TAT was smallest for the MT that required horizontal (yaw) head rotations as compared to the sagittal (pitch), or off-axis MTs. Mean TMOT and EI was greater for the helmeted-system compared to the GoPro condition, by 10.6% and 19.5%, respectively. The mean EI or error rate was 16.4% higher for the 20 mm target in comparison to the 60 mm target. Participants, using a 5-point Likert scale, separately indicated that the 3D-VTAS is effective in assessing their neck function (4.5) and visual perception capabilities (4.5).

Discussion and Conclusions: This performance-based paradigm grounded in Fitts' Law is able to distinguish meaningful performance degradations associated with two different configurations of HSM. Before we can begin the conversation of alleviating NVG-related neck pain in the CAF, we need to firmly establish a performance-based research paradigm that highlights the performance degradations or enhancements associated with variations in HSM, center of mass, moment of inertia, and potential mitigating solutions.
Background: Public buses in Kolkata are large road vehicles, and these buses are the backbone of the local transportation for the common man in the city. The objective of the study is to investigate the occupational health and psychological status and their association with the occurrence of accidents.

Methods: The present study was undertaken among 110 randomly selected bus drivers. To assess the conditions the modified Nordic musculoskeletal questionnaire was performed. The accident analysis questionnaire was distributed among the participants and were instructed to complete the same within a month’s time. The associations between individual characteristics, health problems, work organizational and psychological risk factors for accidents were also examined by a $\chi^2$ test and the associations were described by the odds ratio with 95% confidence interval.

Results & Discussion: The results showed that bus drivers spend about 16-18 hours daily for 15-20 days on a continuous basis. From the questionnaire analysis it was found that 10.9% bus drivers reported about MSD throughout the year mainly affecting low back (9.1%), leg (6.3%), neck (4.5%), upper back (2.7%), and arm regions (1.8%) were compared in terms of their discomfort scores, the likelihood of relating their discomfort to bus-driving, the extent to which their daily lives were affected and some time their need for medical help. This study also found a significant association between accidents with MSD (3.7, 1.4-9.9), hearing loss (2.9, 1.1-7.9), prolonged working time (5, 1.5-16.6), inadequate rest periods in between the working days (4.1, 1.3-12.1) and monotonous work (2.7, 1.1-7.7). Among the psychosocial factors dissatisfaction regarding earning (4.0, 1.2-13.5) and poor job satisfaction (4.0, 1.5-10.9) showed a significant effect on the occurrence of accidents. The study provides a fair indication of the causative factors behind the onset of accidents in Kolkata.

Key words: Questionnaire; Musculoskeletal disorder; Psychological; Discomfort; Back pain
The goal of usability testing is to make design decisions based on objective data and user-centred criteria. Iteration in usability testing is key to identify the design decisions that hinder the interaction between users and interfaces, additionally validates the design elements that enhance it. When the usability testing is applied to systems or interfaces related to users’ health issues, such as diabetes, benefits in both in the interaction as well in user welfare are obtained. Diabetes complications can be diminished through the metabolic control of the patient, which is achieved through the implementation of a dietary plan. Based on a review and analysis of ergonomic guidelines, a lexicographical instructive interface was designed in order to ease the execution of a dietary plan, the recipes of this plan were presented through the mentioned user interface. Two usability assessments were carried out during the interface development, this study presents the second iteration of the assessment of the interface redesign based on the results of the first evaluation, the feedback from the participants and the application of the ergonomic guidelines. The same measurement system for food portions of the first usability test was used (Diaz de Leon & Prado, 2017) three dimensions of usability were evaluated: satisfaction, efficiency and effectiveness. The redesign of the interface showed better results in the three dimensions of usability when compared to the first design; participants performed the tasks using less time and fewer looks to the recipe. The use of color in this type of interfaces facilitated the comprehension of the elements but its effect depends on the arrangement of these elements on the interface. The iterative assessment allowed to improve the proposed guidelines for the design of instructional interfaces and when applied in the interface design process, results in a positive effect on its usability; the ergonomic design guidelines presented in this work do not limit its application to only lexicographical interfaces. In addition, the recommendations made by the users of the first test were validated through the iterative testing, making this a user centred process.
According to the information of the International Labor Organization, stress related to work and its consequences on the health of workers has emerged as a matter of great concern. Mobbing, psychological violence and other forms of non-physical violence are presented with some recurrence. These actions identified as psychosocial risk factors (PSRF) have been linked to WMSD and other types of diseases.

The demands of being part of the supply chain through material logistics can be related to the increased presence of PSRF in this type of company. There is a certain relationship between the number of jobs in the final assembly company (OEM) and in the logistics companies, particularly in the automotive industry.

The automotive industry is of great importance for the country. Mexico is the seventh producer of automobiles worldwide and is the second producer of televisions, just to name a few. As a result of industrial economic activity, the number of cases diagnosed as WMSD and mental diseases has gradually increased.

It is important to mention that in Mexico, the federal authority on occupational health makes it mandatory to identify the worker's exposure to the PSRF and to carry out control actions to mitigate or mitigate the risk and its consequences. The questionnaire proposed by the federal authority for the evaluation of the PSRF was used.

This paper shows the results of the questionnaires applied to the workers of two logistic service companies and the potential causes are analyzed and some actions are proposed to mitigate their consequences. At the beginning, workloads and the organization of work stand out. Comparisons are made between different ages, departments and work shifts. At the time of the application of the questionnaires, the two companies worked three shifts per day during the 24 hours. The questionnaire allows establishing inferences about the work environment in the company.

The inclusion of the PSRF in the regulations as an obligation to companies in Mexico, adds a new dimension in health and safety at work. It can be mentioned that the companies have positively received the analysis of the PSRF because in the large manufacturing centers, in the cities with the largest population, there are problems such as labor turnover and absenteeism, it is possible that the study of the PSRF provides valuable information to address this problem as well as the health effects of workers.
Reducing MSDs through ergonomic designs into power tools

Type: Abstract Oral Presentation
Category: Building and Construction
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Milwaukee Tool is an industry-leading manufacturer of heavy-duty power tools, accessories and hand tools for professional users worldwide.

Since the company began in 1924, Milwaukee Tool has led the industry in both durability and performance. With an unwavering commitment to the trades, Milwaukee continues to lead with a focus on providing innovative, trade-specific solutions. Whether it is through their leadership in LITHIUM-ION technology, as seen in the M12™, M18™ & M28™ Systems, time-saving accessories or innovative hand tool products, Milwaukee is dedicated to delivering a steady stream of advanced solutions for the trades that offer increased productivity and unmatched durability.

To do this, Milwaukee takes the time to work side by side with professionals to understand the demands of a constantly changing workplace and how they can best deliver solutions that help the user work both faster and smarter. Milwaukee knows that professional users sweat the small stuff, and so do they. They pay attention to the small details that make a big difference. This user focus not only leads to solutions for real jobsite challenges, but fuels the disruptive innovation seen across all product lines.

This presentation will showcase the why the largest tool company on the planet made a strategic decision to invest in objectively measuring ergonomics through the use of EMG, vibration analysis, dB output, and force monitoring has changed the way power tools are designed.

This presentation will also discuss recommended ways of preparing for tooling tasks to minimize risk for ergonomic injury and identify traits of tools that help you achieve that goal by using cutting-edge scientific measurement equipment to quantify the levels of ergonomic risk of a tool. This is the first time that a tool manufacturer has brought evidence-based ergonomics to the tools industry.
Work Discussion Spaces (WDS) : what contributions for managers and workers’ activities ?

Type: Abstract Oral Presentation
Category: Banking and insurance

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Problem statement – According to the literature, the transformation of organizations and the implementation of new models of production have generated

- an intensification of work that reduces opportunities to discuss compromises made between increased and conflicting objectives;
- a “disembodied” (Dujarier, 2015) and “impeded” (Detchessahar, 2011) management, based on indicators that keep managers away from the reality of work by involving them in numerous meetings or reporting tasks.

Research Objective / Question – In this context, we assume that implementing “Work Discussion Spaces” (WDSs), i.e. meetings devoted to discussing work issues, regularly run by managers for their teams to concretely improve work situations - may improve organizations (promoting subsidiarity logics), managers’ activities (supporting their role of regulating their team’s activity) and workers’ activities as well (concretely improving situations).

Methodology – To test these hypotheses, WDSs were experimented in 3 sites of the French Post Office: a mail sorting platform, a post offices network and a financial center. The field study was carried out in 5 steps: a diagnosis (analyzing work, organization, existing discussion opportunities...); a design step (establishing the WDSs’ principles and adapting them to the situations); a training step (30 managers were instructed on work analysis and animation methods); manager’s support/tutoring and experimentation’s assessment steps. A follow-up study of the WDSs’ effects and evolution after two years of autonomous implementation is ongoing.

Results – In 6 months, 17 WDSs were conducted. Employees were mostly satisfied of having actually expressed their views but waited for the actual implementation of the proposed actions. Some work situations have indeed been improved in terms of work organization, quality of service and resources development. For managers, facilitating WDSs changes team management from bringing solutions to fostering employees’ participation in problem setting and solving. WDSs’ methodology was for some managers a support while others seemed less at ease. Problems and solutions were mostly within the scope of the team or of the local facility: managers tended to reframe the problems or the debates when they touched on more strategic dimensions of work, to be able to actually implement the proposed actions. Finally, WDSs lost their impetus after two years of functioning.

Discussion-conclusion – These results challenge the methodology, the organization and the management modes. More coherence is needed: managers are requested to adopt a “participatory attitude” while another positioning is required the rest of the time.
Furthermore, many other participatory tools (team meetings, working groups, briefs...) compete with WDSs. Managers do not identify their differences and complementarities and have little time to devote to them. The uneasiness of some managers may come from their fear of not having the power to implement the proposed actions. This may discredit them and/or discourage their team’s involvement.
The aim of this paper is to identify the human and information processing factors that need to be addressed in order to improve proactive closed circuit television (CCTV) surveillance effectiveness and to make recommendations regarding interventions. This will be done by contrasting the way in which CCTV is portrayed in popular crime series in the media with the challenges inherent in real world CCTV surveillance systems. The media tend to suggest that CCTV surveillance makes a significant and efficient contribution to identifying perpetrators of crime and terrorism. However, the effectiveness of CCTV surveillance in real life is often very different from its reputation as portrayed in the media. In real life, CCTV is used to protect people and property in a variety of contexts, such as critical infrastructure, and private and public spaces. It is frequently seen as being an important part of security, as demonstrated by the large amounts of money spent on the hardware required in CCTV systems. However, CCTV systems do not always deliver fully on their potential. Numerous factors contribute to this, some of which are highlighted by the differences between CCTV as portrayed in media crime series and real life systems. This paper reviews the literature regarding the cognitive challenges faced by CCTV operators, presents original research on an intervention aimed at enhancing operator effectiveness, and highlights the complexities of conducting research in this area.

While both proactive and reactive surveillance are used in real life and portrayed in the media, there is often an emphasis on reactive surveillance in the media. The information processing requirements of these two types of surveillance are very different, with proactive surveillance arguably placing larger attentional, working memory and mental workload demands on operators. Similarly, knowing what to look for and the related attention sets differ in these types of surveillance. Additional examples of influential aspects include the need for distributed situation awareness which is more pronounced in real life, where the hardware capabilities of the CCTV system have a large impact. The nature of significant events in many real life contexts also creates perceptual and cognitive challenges. Having to observe and operate multiple cameras simultaneously in real time also adds to the cognitive challenges of real time CCTV surveillance.

In addition to outlining the information processing challenges of proactive CCTV surveillance, innovations aimed at improving the performance of operators and system efficacy will be discussed, including the selection and training of operators, aspects of system design and an empirical study on threat image projection.
The influences of the Ergonomic Work Analysis on the activities of an Equotherapy center

Type: Abstract Oral Presentation
Category: Healthcare
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The equotherapy is a method applied for therapeutical with practices utilizing horses and equitation technics, aiming educate, besides the recovery of deficient people. The assistance activities have the therapeutical target according to the needs and diagnostics of the practiser. Those activities are divided into 3 phases, first one “practiser on the horse”; second one “develop the assistance plan” and last “take the practiser out of the horse”. The evaluation objective of each professional of the Equotherapy Center in his main tasks done, denominated as the therapeutical assistance, it has been utilized the ergonomic concepts, with the proposition to identify the damages and constraints on the muscle-skeletal of the professionals. For the analytical support, the procedures has been addressed according to the phases of the Ergonomic Work Analysis (EWA). The information flow was done by a questionary of perception and by the individual observation from each working days, evidenced by films and photos. For the diagnosis it has been applied the tool known as OWAS (Ovaka Working Posture Analysing System), indicator which demonstrate if there will be needs for the correction action plan for the activities by means of postures and the timing of each one. As per the studies of the working activities, it has been observed the presence of ergonomics constraints and it has obtained the correlation between the physical conditions of the practisers and the therapeutical objectives. As the result, it was noticed the presence of multifactors which impact directly the working conditions of the equotherapeuticals. The studies classified the treatments according to the constraints that professionals suffer at the moment of the practisers assistance. Within the results, one of the most important, is for the assistance of the practisers with specials needs who utilizes wheelchair, 50% of the tasks done, have the diagnosis the necessity of corrections, sooner possible or in the near future. The article will provide the results obtained, with the evidences of the working activities description and by the diagnostics by the method OWAS, comparing with the perception questionaries applied to the equotherapeuticals.
Introduction: Family caregivers of children with medical complexity (CMC) report insufficient knowledge, skills, and confidence to provide the care CMC depend upon [1-7]. CMC are children with severe chronic conditions, major functional limitations, and intensive care needs [8]. CMC's caregivers are tasked with delivering sophisticated medical care at home such as operating complex medical devices (e.g., ventilators), and assessing and triaging complicated symptoms (e.g., respiratory distress, seizures). The complexity and workload of managing these procedures in the home often requires caregivers to seek assistance from in-home professional caregivers such as nurses, health aides, and respite workers. In-home professional caregivers can have positive effects on the mental and physical health outcomes of family caregivers and CMC [9-10]. However, positive outcomes may only be possible when barriers to in-home professional are addressed.

The homes of CMC can be conceptualized as a structured work system of interacting elements (people, technologies, tasks, organization, physical environment) resulting in processes that influence both caregiver and CMC outcomes. The addition of in-home professional caregivers to this work system inherently changes system dynamics, affecting the structure, processes, and outcomes. Thus, the objective of this research was to identify work system barriers experienced by family caregivers to accessing in-home professional care for a CMC.

Methods: We conducted in-depth semi-structured interviews using contextual inquiry to explore how caregivers provide daily care to CMC. Interview questions were developed using the Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 model. Thematic analysis was directed by SEIPS 2.0 and focused on how family caregivers recruit, select, train, supervise, and coordinate in-home professional care and what challenges they encounter during this process.

Results: We identified three categories of work system barriers to in-home professional care: 1) privacy concerns, 2) training fatigue, and 3) availability of in-home professional caregivers. Participants described privacy concerns as apprehension about "strangers" being in their home and disrupting family routines. Training fatigue was pervasive across participants and was described as the burden of handling frequent staff turnover and limited in-home professional caregiver availability, which resulted in needing to hire multiple caregivers to meet care needs. Participants often attributed availability barriers to rural locations, low Medicaid reimbursement rates, lack of reliability of in-home professional caregivers, and complexity of CMC.
**Discussion:** We identified key barriers to in-home professional care for CMC, which have implications for future system design. Interventions designed to address privacy issues, solve training challenges, and increase access to in-home professional care may result in more reliable and effective in-home professional caregiving to CMC. For example, a technology-based solution to reduce training barriers could involve adaptable curriculum delivered through an internet-based program. Interventions that address barriers to in-home professional care could increase positive outcomes for both CMC and their families.
A new practical tool for risk assessment of push and pull tasks

Introduction

Pushing and pulling tasks at work are an important risk factor for upper extremity symptoms, specifically for shoulder symptoms (Hoozemans et al., 2014). For the prevention of work-related musculoskeletal disorders employers need valid but simple risk assessment tools. In 2009 the Dutch Ministry of Social affairs and employment started a research program to accommodate companies in their obligation to protect the health and safety of their employees. As part of this program TNO developed several online risk assessment tools for practitioners. This paper describes the development of a new tool for risk assessment of push and pull tasks.

Methods

The development process of the tool included: defining criteria and determine if they are met by existing tools, study of the epidemiological literature on risk factors for pushing and pulling and study of the reliability of two existing tools. Based on the results of these studies we decided to develop a new tool. This tool is based on the psychophysical data for pushing and pulling of Snook and Ciriello (1991). These data reflect the maximum acceptable push and pull forces employees can exert under different conditions without straining themselves or becoming unusually tired, weakened, overheated or out of breath. To perform a risk assessment the tool requires information on the mass that needs to be pushed or pulled (e.g. weight of the trolley and load), force direction, frequency, hand height and distance. From these data the tool calculates the maximum acceptable object weight, both on average as for a peak load. This assessment is based on the Snook and Ciriello data that apply to the specific circumstances and of an empirical relationship between object weight and hand force needed to pull or push the object. In addition to this quantitative assessment, trolley and environment characteristics, e.g. wheel diameter and material and type of flooring, are being qualitatively evaluated to increase or decrease this maximum acceptable weight. Direct feedback is given to the user by emoticons and - if needed - recommendations on how to reduce the risk.

In 2018 we will validate the relationship between object weight and hand force.

Results

This new tool will help companies to estimate if push and pull tasks yield a risk on musculoskeletal disorders and define adequate preventive measures. The tool has been tested in the field before it was made freely available to all occupational health practitioners in the Netherlands on https://www.fysiekebelasting.tno.nl/en/. In 2018 the tool will be available in English as well.
References

Applying ergonomics in an industry in a systemic way can generate benefits and cost savings (NEUBER, 2012), since it contributes to reduce financial losses due to injuries, accidents and absenteeism with consequent increase in productivity (BRIDGER, 2003).

The current assumption considers that managing human aspects is the key to improve the performance of organizations. Then, the application of methodologies based on socio-technical precepts is fundamental for analysis, understanding and interventions of work processes reflecting in the sustainability of productivity, the final quality of the product and the preservation of the health of those involved (BALBINOTTI, 2003 A). To achieve this goal human, technical and organizational aspects should be considered. One of the challenges is to articulate the several actors involved in the development of productivity systems.

The objective of this paper is to present the application of the Human Performance and Productivity Cycle – HPC methodology developed by the Center of Innovation in Ergonomics with the support of TNO ergonomics team.

The development of the framework started from an understanding of the way TNO’s ergonomics team work for analyzing and reducing physical workload. An adaptation was made for Brazilian reality. The HPC methodology was created as a virtuous cycle that underlies five steps to achieve effective solutions in ergonomics. These steps are: 1) understanding of demand, 2) risk assessment, 3) risk reduction measures, 4) implementation and 5) evaluation and adjustments. The method was developed and tested in a wagon workshop of a railway industry located in Minas Gerais, Brazil. The main problem in this company was the physical overload due mainly to the postural demands and the use of sanders.

The actions, in order to reach the solutions, were based on the principles of ergonomics, technical knowledge and adequate human performance. Different tools can be designated for evaluating the risk situations. In this business case was applied, among others,
software (MVN Studio Biomec) to study biomechanical variables and a cost-benefit tool to make decisions about the ergonomics interventions. The strong involvement of the workers and managers, led to assertiveness in understanding the problems and proposing solutions and culminating in the agility of the work process in ergonomics. Co-responsibility for the successful implementation, acceptance and execution of the solutions was achieved.

The framework’s validation at the wagon workshop shows that the tools and techniques should be articulated and integrated. In such way, it can support the development of ergonomics process to manage health, safety and productivity indicators of a sustainable model of prevention.
This paper discusses the important role that cognitive engineers hold in the participatory design process of cognitive artifacts that support the operation of modern work systems. Cognitive Engineers develop an "architecture of knowledge" that expands across diverse scientific domains, e.g. engineering, computer science, management science, ergonomics (Rouse, 2003). In order to avoid the emergence of critical problems in the human-technological system coupling (Mumford, 2006), cognitive engineers should participate in multidisciplinary design teams from the beginning of the projects (Baxter & Sommerville, 2011; Wilson, 2014; Salmon, 2016 a,b) as they:

- are able to detect how workers develop skills and abilities, and can make productive use of this knowledge in design.
- can take advantage of operators' tacit knowledge and their redesign interventions in existing artifacts.
- know how to exploit systems' technological and organizational changes when they are still in progress.
- know which techniques and tools are suitable to extract design knowledge from each system engineering phase.
- know which workers and in what way should participate in each system engineering phase.

In the electricity distribution interface design case, presented in this paper:

- during the ethnographic analysis phase (Crabtree, 1998, 2010), the cognitive engineer used field observations in the control room, structured and unstructured interviews with all workers, and auto-confrontation techniques on operators' activities, to elicit domain knowledge (Drivalou, 2005). Operators' redesigns on existing artifacts, and reported deficiencies of existing procedures indicated critical design dimensions (Drivalou & Marmaras, 2006).
- during the cognitive work analysis phase (Vicente, 1999), the cognitive engineer developed diverse abstraction-decomposition models that present different aspects of domain operation and functionalities, in a systematic way (Drivalou & Marmaras, 2003). These models were used to discuss critical organizational and technological issues with domain stakeholders (operators, engineers, administration) (Drivalou, 2008).
- during the prototype design phase (Grudin & Pruitt, 2002; Frauenberger et al., 2010; Muller & Druin, 2010), the cognitive engineer used different fidelity prototypes (hard-wired, paper, electronic) to receive feedback about the applicability and implications of diverse design solutions, from operators and engineers (Drivalou & Marmaras, 2009).

The proposed paper discusses first the importance of Participatory Design procedures in the design/redesign of work systems. It emphasizes the role of cognitive engineers in multidisciplinary design teams, as well as the importance of their constructive engagement with domain practitioners, in order to develop effective design solutions. It continues presenting in detail what tools and techniques were used, and which stakeholders...
participated at different phases of the interface design cycle (ethnographic analysis, cognitive work analysis, prototype design) to elicit the intended design knowledge, in the electricity distribution interface design case. The paper concludes discussing why is it important to establish the role of cognitive engineers in design teams, in industry.
The truck driver evolved and became a powerful tool of industrial logistics in Brazilian territory. However, with unbalanced politics, highway transport overlapped the other systems, representing nowadays more than 60.0% of products transported in the country [Confederação Nacional do Transporte – CNT1, 2012]. This trend made an overload of the highway grid, creating serious negative impacts directly to truck drivers and indirectly to the society. For this, the research followed a methodological reasoning of basic nature, of qualitative approach and exploratory character. This study shows the analysis between (a) driver/user, (b) vehicle and (c) environment and their relationship with driver performance, preference and perception [BHISE, 2012, p.04], inside the context of transport in Brazil. As attention is focused on driver, the article suggests an evaluation about the outcomes associated to society, considering economic, social and environmental levels.

Before the political-economic crisis in Brazil started in 2015 and according to the National Authority for Terrestrial Transport – ANTT, more than 1,106 million registered highway cargo truck drivers and a total of more than 2,339 million trucks are active and working in Brazil [ANTT1, 2017]. This number may be subdivided in three categories of truck drivers, which are: the registered (17.05% in 2015 and 16.35% in 2007); the autonomous (82.91% and 46.1%); and the ones associated to cooperatives (0.04% in both years), with 99.5% being represented by males [RAMOS1, 2007 e ANTT3, 2012]. About the conditions, there is another rate: more than 53.0% of autonomous truck drivers have never heard about training agencies; 57.0% work 7 days a week; 29.0% have more than 31 years of activity [RAMOS2, 2006].

However, when the evaluation of the truck drivers’ biggest category happens – the autonomous – the average age of the trucks is 19.1 years. For the registered drivers, the average age is 8.4 years, and for the truck drivers associated to cooperatives, the average age of the truck is 13.3 years, which makes the global average age of 13.4 years [ANTT2, 2012].

The difficulties to buy a modern and efficient truck, considering ergonomics facts, performance of engine and fuel consumption are undoubtedly obstacles to the improvement of working conditions. Besides this, there is violence along the highways which represents a loss factor to purchasing power of this professional, in addition to the high stress levels. Robberies are extremely common, especially at night resting periods. Due to the fact that registered drivers have defined timetable, this professional reach the best stops. On the other hand, when the autonomous professional reaches the rest stop, he will not find vacancy for his truck, what forces him to find another stop, expanding the working day and risk situations.
The collective work in the Subsea Integrated Operations Centre: the formation of the ad hoc teams in the solution of unexpected situations

Type: Abstract Oral Presentation
Category: Others
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The construction of new spaces to support more collaborative ways of working have created challenges for the oil companies project teams.

From observations of the operators' work and participations in the design of an integrated operations center, this paper presents the main characteristics of the operators' activities based on the observation of typical work situations.

The used methodology was based on the analysis of pilot projects for the operational integration of the subsea services sector. The main goal of these projects was to improve the planning of the use of vessels and the subsea services response speed.

The work of the team is affected by unforeseen events of different natures: meteoeconomic variations; delays related to the logistics of materials or people; broken tools or equipments; difficulties in the maintenance of some equipment, among others.

The analyses show that the interactions of the operators with external agents happen in accordance with the needs imposed by a specific problem. For each event, a different arrangement of players is formed and may include different professional categories. Also, the actions in response to the service requests are not limited to those prescribed by the organization; it depends on how the teams will act facing the variability that arises in the work situation and on the actions that are possible. Ad hoc teams, composed by operators and external agents, are created and disintegrated as problems are solved. Teams duration, as well as their composition, changes depending on the specific problems and skills required.

The analyses allowed the characterization of the work to be developed in the new collaborative environment, especially its collective and organizational dimension.

The need for immediate actions in response leads the operators to start a search process for information that supports their actions. Information and data may be distributed through technological supports or through the knowledge of several professionals. In this case, the need for information leads to the formation of ad hoc arrangements by the actors (Cuvelier and Falzon, 2015) in order to solve the problem. These arrangements are designed to promote: knowledges exchange, tasks distribution, elaboration of rules for the conduction of the collective activity and the resolution of the faced problem.

In the studied case, everyday or foreseen work situations frequently involve internal arrangements. External arrangements are usually created as a result of complex or unexpected situations.
The work developed in the collaborative environments is close to that described by Engeström (2008) as knotworking: quick collaborations, distributed and partially improvised between role-players, sometimes interconnected in an inconsistent way.

In the analysed environment there is an active combination of people and artefacts, which may constantly reconfigure itself regardless of the time and the space where they are distributed.
An organization has always two faces: 1/an organizational structure which use a universal knowledge allowing to anticipate and organize the production; 2/ daily interactions which require a situated knowledge allowing to take care of work situations as they really are. The confluence between this two kind of knowledge is a main issue for the organization efficiency. In this aim, many organizations are trying to involve their employees in the changes they want to set up as well as in the daily functioning. But what we can see sometimes, is an unwilling of the employees to speak up and to report problems. It means that the managers will manage with an insufficient knowledge of what happen in the reality, and problems will reach them when the situation will be very deteriorated. This silence can also result in a deterioration of how people are experienced their work. A goal of the ergonomics intervention can be to break this vicious circle.

Various mechanisms can be responsible of the organizational silence:

- the hierarchical structure: strong centralization, weak leadership, rigidity with low responsiveness.
- the organizational functioning: organization of the work teams, weak work collectives, no answer to problems raised.
- the organization of the production: high division of labor, no clear vision on the result of the work, maintenance organization.
- the management strategies: strong control logic, weak involvement of the employees, distance of the managers from the field, competition between employees, potential danger of speaking up.

From an ergonomics intervention in an insurance company, we will show how the organizational silence can be constructed by the application of work rules which are not adapted to some situations. When at the same time there is no room or process to discuss the rules from the work reality, people are finally giving up to report problems and are secretly acting “beside the rules”. For the managers, there is no sign that there are any problems, and there is no improvement process of the organization.

As shown by Morrison and Milliken (2000), organizational silence is strong when employees cannot express their concerns without personally coast and if doing so is totally ineffective. A main way to fight against organizational silence is to implement real “areas” for discussion and adjustment about work, between employees and with the managers. Another issue is to openly discuss the allocation of decision-making power in the organization.
A target for the ergonomics intervention is to develop the margins of manoeuvre of the workers to act in situation, as well to make them allowed to take part in the discussion of the rules and decisions regarding their own work.
Falling from height accidents in residential construction projects: Using DEMATEL method for determination of effective factors on the accident

Type: Abstract Oral Presentation
Category: Building and Construction

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Background: In many countries, construction industries are recognized as one of the most risky industry (1). Falling from height is one of the main factors in the occurrence of accidents, rise of the mortality rate, and compensation for employed workers in the construction industry (2).

Material & methods: In this study, 10 construction blocks were selected in Tehran that were under construction. Three groups of organizational, individual and environmental factors and sub-factors were considered as effective factors on the falling from height. Using the experts' opinion, the main factors were divided into three groups, whereas their sub-factors were divided into 15 cases (organizational factors: management commitment, supervision/inspection, culture of safety, size of the organization/project and regulation (3–6); environmental factors: interference, climate condition, work platform height, and level smooth (7,8); individual factors: education, motivation, training hours, personal protective equipment, age/experience and instability (9–11)). Then, DEMATEL method was used to determine the most important factor and its sub-factors influencing the occurrence of accidents falling from height and their relationship. The necessary steps to determine the most important factor and its sub-factors are as follows: calculation of the direct relation matrix (M), calculation of the normal direct relation matrix (N=K×M), calculation of the complete correlation matrix (T), and identification of the internal correlations of sub-criteria

Results: In this study, the matrix of the DEMATEL method (internal communication matrix) shows both the casual relationship between the factors and effectiveness of their sub-factors variables. The results showed that individual factors were considered as the most important factors and their sub-factors had the most effect on the occurrence of falling from height accidents. It can be said that in determining the relationships of sub-factors, three out of six individual sub-factors including motivation, training hours, and age/experience and two out of five organizational sub-factors including management commitment and culture of safety have the most impact on the occurrence of falling from height accidents.
**Conclusion:** Paying attention to safety training and also increasing the motivation of workers can be effective in reducing occupational/psychological stress and accidents of falling from height.

**Keywords:** Falling from height, DEMATEL method, Construction project.
[344] Professionalization of call center workers: the way to give meaning to work

Type: Abstract Oral Presentation
Category: Others

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While the call center activity employs a large contingent of employees – especially those in their first job, the youth, women and populations from peripheral economies – it is one of the economic sectors in which there are harmful consequences to workers, which manifest themselves through the physical and psychological illnesses of agents, high absenteeism and turnover, and the development of defensive cynicism which they might retain throughout their whole professional career.

By favoring economic and financial performance of companies over human development of workers, the organization and management of work have led to those unfavorable situations when they fail to notice the dynamics of customer service cannot be matched to rigid prescription and to economy of scale which privilege quantifiable metrics of time, pace or productivity when assessing production.

The intention to standardize the servicing activity through predetermined scripts disregards the diversity of situations and of the concerned players, the active participation of customers and the use of the worker's intelligence to makes arbitration between the prescriptions (always general) and the demands (always particular), giving rise to a mistaken notion of the activity as something simple and easy.

Changing that dynamics demands doing away with simplifying paradigms, because the customer servicing requires the worker's engagement for it to take place; and that necessarily entails acknowledging the specificity of the servicing relationship, valuing the arbitrations performed, and engaging the worker's subjectivity in this work situation.

The discussion we turn to is how to create situations which favor job enrichment at call centers, arguing that the professional development of employees is the most effective tool for enriching the content and value of work for individuals, as it contributes towards building the identity, health, and citizenship of workers.

Professional development is promoted through improving professional knowledge, achieved through strengthening collectives of work which share and devise the rules of the profession. Sharing experiences and difficulties encountered in the activity, setting up effective channels for communication among workers, setting common goals, jointly devising rules and procedures, and distributing responsibilities among the different players are instruments that might contribute to ascribing meaning to work.

Crafting a model for the organization and management of the work which promotes the search for collective solutions contributes to the achievement of the organization goals, and it also strengthens the value of work in building the subjectivity and wellbeing of people.
Lying means saying something one knows runs counter to truth. The concept of lying has been always linked to human thinking and the use of communication and language; it is, therefore, a manifestation of human intellect.

A number of schemes for systematizing the concept of lying have been put forward throughout Western history; and their approaches have varied according to each social and political reality. In the 4th century A.D., St. Augustine went deep into this issue and came up with a classification of lying into eight different categories arranged according to decreasing degrees of seriousness, based on an analysis of who is harmed by lying and who profits from it. For this author, lying is always an evil, and it manifests when there is an opposition between what one says and what one thinks, and it requires three conditions to take place: (i) falsehood of what is said; (ii) awareness of the falsehood; (iii) intention to deceive.

In a contemporary approach in which universal paradigms of truth are brought into discussion, lying has not been charged an ethical or moral sense by itself as it was by St. Augustine. Lying has been conceptualized as willfully stating something as true when one knows it is false, which means a discord between discourse and knowledge, even when its manifestation takes place without words, with what is unsaid, or hidden.

In a work situation, the use of the artifice of lies can foster the emergence of ethical suffering and which can be potentially harmful to the physical and psychological health of individuals, contribute to the rise of several work-related pathologies, and bring about inefficiency to organizations.

In the work at a call center lying comes up in many moments; and that allows for proposing a typology of lying in such work situations. The proposed classification considers the concept of lying is always associated with human thinking, to its intent and communication, it can be either implicit or explicit, and it does not entail a moral or immoral judgment.

We took into account the players acting in the work situation — the decision makers of work organization and production, the workers and the costumer — and the actions by the players related to the usefulness of lying, organized into three triggering categories: (i) achieving a certain result or benefit, (ii) avoiding losses, and (iii) avoiding mishaps.

Acknowledging the existence of lying in work situations provides clues on system mismatches. Facing those faulty adjustments can be a powerful tool for improving the work, and its effects can consistently benefit all stakeholders.
Pediatric trauma is one of the leading causes of morbidity and mortality in children in the USA. Every year, nearly 10 million children are evaluated in emergency departments (EDs) for traumatic injuries, resulting in 250,000 hospital admissions and, unfortunately, 10,000 deaths annually.

Pediatric trauma care in hospitals is distributed across time and space and involves a large and fluid care team. Prior to arriving to the ED, patients are triaged into trauma levels based on perceived injury severity and mechanism. In this system, level 1 trauma cases are most urgent with potential immediately life-threatening injuries while level 2 trauma cases are still critical but less likely to have life-threatening injuries. Other pediatric trauma cases may not meet leveling criteria but still may require treatment. Depending on the trauma level, several clinical teams (including surgery, emergency medicine and pediatric critical care) converge to help support trauma care in the ER; this co-location in the ER can help to support communication, coordination and cooperation of team members. Level 1 and 2 pediatric trauma cases often need surgery in the operating room (OR) and/or are often admitted to the pediatric intensive care unit (PICU). These transitions can result in loss of information or transfer of incorrect information, which can negatively affect the care a child will receive. Thus, the many roles involved in pediatric trauma care increase the complexity of providing care and can pose challenges to communication, coordination and cooperation.

In this study, we interviewed 18 clinicians involved in pediatric trauma care and asked them questions about communication and coordination during care transitions between the ED, OR and PICU. After the interview was completed, clinicians completed a short version of a questionnaire about patient safety during transitions, adapted from the AHRQ patient safety survey.

Results of our study show that, despite the fact that the many services and units involved in pediatric trauma cooperate well together during trauma cases (89% of respondent agree), “Important patient care information is often lost when transitioning patients between units” (44% of respondents agree) and “Things ‘fall between the cracks’ when transferring patients from one unit to another” (50% of respondents agree). In other words, clinicians at this hospital cooperate well, but communication and information transfer are important issues during care transitions.

To summarize, pediatric trauma care transitions are complex with many different hospital services, units and clinicians involved. To safely manage the transition of this fragile and
complex population, we need to find ways to better manage the information flow during these transitions. In our paper, we will discuss possibilities to improve communication during care transitions.
Objective: To determine the changes in spatio-temporal gait parameters and energy cost of ambulation due to changes in backpack loading and self selected walking speeds (velotype) among primary school children in Nigeria.

Method: A self-controlled cross-over study design with repeated measures of the spatio-temporal gait parameters of primary school children. Participants walked a 10 meter distance at self-selected normal, slow and fast walking speeds (velotypes) on a level floor without backpack, carrying a backpack of 10%, 15%, and 20% of their body weights. Spatio-temporal gait parameters (stride length, number of strides, stride frequency, Stride duration, walking velocity, stance duration, swing duration and Double support duration) were assessed using validated gait equations while energy cost of ambulation was assessed using the Ralston’s equation. Data was analysed using descriptive statistics and repeated measure ANOVA at α = 0.05.

Results: A total of 69 primary school children participated in this study with a female to male ratio of 3:2; mean age, body weight, and normal backpack weight of 11.42 ± 1.35years, 37.4 ± 6.31kg and 2.92 ± 1.38kg respectively. At normal velotype, the gait velocities at the different backpack loadings were significantly different (F = 7.191, p = 0.001) with the lowest velocity at 20% backpack loading phase while other parameters showed no significant difference (p > 0.05). At slower and faster velotypes, all the parameters were significantly different (p < 0.05) with the exception of double support duration at slower velotype (F = 3.191, p = 0.056). Post hoc revealed that the least values in most of the parameters occurred at the 20% backpack loading phase. Also, there was a significant difference in energy cost of ambulation (F = 42.516, p < 0.001) and all the spatio-temporal parameters (p < 0.01) at normal ambulation without a backpack across the three velotypes. Similar significant differences in all the parameters were obtained across the three velotypes for the other backpack loading phases.

Conclusion: Carrying a backpack load of 20% body weight or more significantly increases energy cost of ambulation and affects the spatio-temporal gait parameters of primary school children. Irrespective of backpack weights, energy cost of ambulation and spatio-temporal parameters are best at normal velotype when compared with slower and faster velotypes. Therefore, Nigerian school children should be discouraged from carrying backpacks greater than 20% of their body weight but encouraged to walk at their self selected normal speed.
Key words: Backpack Loading, Velotypes, Spatio-temporal Gait Parameters, Energy Cost of Ambulation, Primary School Children
Objective: To determine the awareness of ergonomic practices, prevalence of musculoskeletal disorders, ergonomically analyse and assess the determinants of postures among building construction workers in Nigeria.

Method: A cross sectional exploratory study and analysis of work postures of forty building construction workers (masons, mason assistance, carpenters, bricklayers, plumbers and iron benders). A self developed questionnaire was used to obtain demographic details and work related data. Posture was assessed using Posture Activity Tool Handling (PATH) method and Rapid Entire Body Assessment (REBA) form. Nordic Musculoskeletal Questionnaire was used to assess Musculoskeletal Disorders (MSDs). Data was analysed using descriptive statistics and Chi-square at α = 0.05.

Results: A total of forty building construction workers participated in this study, most of whom were Mansons/Manson Assistants (42.5%), aged between 36-40 years (35%), had maximum of a secondary school education (70.0%) and habitually consume alcohol (77.5%). Most of the participants worked for over 6 hours/day (80.0%), are not satisfied with their job (72.5%) and have no prior knowledge of Ergonomics (85.0%). Most of the participants had MSDs (89.7%) as well as adopted postures that expose them to medium risk of MSDs (90.0%). Based on PATH analysis, majority of the participants adopted severe forward trunk flexion (81.8%), non-neutral neck posture (100.0%), and bent leg posture (81.8%) while working. There was a significant association between the posture of the neck and each of perceived job satisfaction ($X^2 = 5.06, p = 0.030$), tool’s weight ($X^2 = 16.54, p = 0.005$), and exercise status ($X^2 = 4.04, 0.04$). There was also a significant association between arm posture and tool’s weight ($X^2 = 64.85, p < 0.001$) as well as between trunk posture and type of task ($X^2 = 28.76, p = 0.017$).

Conclusion: There is a poor awareness of ergonomics and a high prevalence of MSDs among Nigerian building construction workers. Perceived job satisfaction, weight of tools, and exercise habits are possible determinants of neck posture while weight of tools and type of task performed are possible determinants of arm and trunk postures respectively among building construction workers in Nigeria.

Key words: Ergonomic Analysis, Building Construction Workers, Posture, PATH method.
DETERMINANTS OF WORK RELATED MUSCULOSKELETAL DISORDERS AMONG NIGERIAN SECONDARY SCHOOL TEACHERS

Type: Abstract Oral Presentation
Category: Education and Training

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OBJECTIVE: To ergonomically assess the working environment and the determinants of work related musculoskeletal disorders among secondary school teachers in Nigeria.

METHODS: An exploratory study of the work environment of 252 teachers from nine randomly selected secondary schools in Enugu, Nigeria. The Rapid Entire Body Assessment (REBA) scale, The Nordic Musculoskeletal Disorder Questionnaire (NMQ), and Job content questionnaire (JCQ) were used to assess the work posture, Work Related Musculoskeletal disorders (WMSDs) and Job strain respectively. A self-designed, close-ended data retrieval (Work Station Analysis) form was developed to assess the participants' workstation. Data was analysed using descriptive statistics and logistic regression at α = 0.05.

RESULTS: A total of 252 secondary school teachers participated in the study with mean age and teaching experience of 40.27±8.36yrs and 12.28±9.14yrs respectively, sat for a mean duration of 5.05±0.75hrs/day. Most (96.4%) of the participants adopted a working posture that could be described as having a medium risk while 45.2% of them had job strain. Majority of the participants had work surface height that was not ideal (68.3%) and had items beyond their reach zones (79.5%). Also, most of the participants sat on seats made of wood (83.7%), without arm-rest (83.7%), without lumbar support (100%), and not padded (74.4%). Most (61.1%) of the participants had WMSD with major prevalence at the low back (20.6%), Neck (17.5%), Upper back (9.5%) and shoulder (9.5%) regions. Being female (OR = 3.28, p = 0.004), BMI (OR = 0.97, p = 0.041), job strain (OR = 2.35, p = 0.020), use of unpadded seat (OR = 2.53, p = 0.031) and an abnormally perceived writing position (OR = 0.35, p = 0.022) were significant predictors of MSD.

CONCLUSION: There is a high prevalence of MSD among Nigerian Secondary School Teachers. The determinants of MSD among Nigerian Secondary School Teachers are female gender, BMI, job strain, use of unpadded seats and abnormal writing position. Ergonomic training on proper gestures and postures as well as furniture design is recommended for this population.
Key words: Determinants, Work Related Musculoskeletal Disorders, Secondary School Teachers
Lean has been implemented in many different organizations and branches. The car industry was pioneers, followed by other types of industry. Later, Lean was implemented in e.g., healthcare, municipalities, authorities and other types of services. In retail, some stores are implementing Lean or Lean-inspired working methods. Reports show both positive and negative examples regarding working conditions. Reduced manning and unsuitable working schemes are on the negative side, and involvement in continuous improvements, visualization and daily meetings are on the positive side. The aim of this paper is to identify different ways of implementing and working with Lean in stores, and to identify and disseminate good examples.

Nine case studies were performed in different types of stores. They were selected as stores that had more than one year of experience of Lean-inspired work. The nine stores were visited and data were collected through several methods. These were observation of working methods and artefacts in the stores, interviews with employees and managers, and a questionnaire to a sample of employees in the stores. In addition, documents were collected, photographs and video films were taken.

Working methods and implementation strategies differed substantially. The experience from working with Lean-inspired changes ranged from two years to over two decades. A few stores had adopted some of the principles of Lean, and other stores had implemented a few Lean tools. There were also examples of stores that had developed statements of the values for the organization that were on display. The two most commonly used tools were continuous improvement and 5S. Visualization and the use of whiteboards and KPIs were also applied in several stores. Further, in a few stores daily meetings where the employees participated were run by the store manager. Waste reduction has been used for a long time in stores handling fresh food. Substantial work has also been performed in order to improve the logistics. These working methods were present in the stores before Lean was introduced. The reaction from the employees ranged from slightly negative to clearly positive.

There are only a few examples of a long-term Lean tradition in shops. Therefore retail largely lacks inspiring forerunners to learn from in this respect. Disseminating good examples that are good for the working conditions of the employees as well as for business could support a more holistic way of working with Lean and therefore improve working conditions in the future.

To conclude, implementation of Lean in stores is under development, and the number of stores that have started to introduce Lean-inspired working methods is increasing. Examples of the tools used are continuous improvement, 5S, customer orientation, visualization, daily whiteboard meetings and waste reduction.
Keywords: Shops, Customer orientation, Work environment, Employees.
A methods framework and an intervention for planning and design processes

Type: Abstract Oral Presentation
Category: Education and Training
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Background

Safety and health engineers and ergonomists are in general not seen as natural partners in the planning process of facilities or acquisition of new equipment, despite their work environment expertise. Consequently these professions are not getting experience of the planning process. To reduce the competence gap, reliable, cost-effective and feasible methods for planning new work environments are needed, as well as creating an incentive for these professions to contact and offer client organisations services within the planning process.

Aims

To (1) construct a method framework giving suggestions of suitable methods, (2) conduct an intervention to improve planning competence, and (3) evaluate the framework and the intervention.

Method

The framework was inspired by project management, product development and research cases. A literature review was conducted to collect methods. New methods were tested in research cases by the researchers. The framework was iteratively developed through feedback from the practitioners.

The intervention was designed with the following steps: (1) invited participants probe for a project (facility improvement or planned change) at their clients, (2) the method framework with a variety of methods is taught, (3) each participant conducts their intervention, and (4) the participants share experiences and evaluate the intervention.

Evaluating questionnaires were distributed immediately after and one year after of the intervention.

Results

The framework divides the planning process into five stages: (1) Change drivers and vision, (2) analysis, (3) conceptualization and visualization, (4) detailed planning, and (5) post-relocation evaluation. The methods are divided into three categories with focus on user involvement, work environment expertise, and communication. In total 45 methods are suggested in the framework.

In total, 39 participants conducted the intervention. Some participants had received several projects. Totally 33 methods were used, and 16 reports were handed in. Of these, 5
reports expressed that a plan was initiated but the project had been delayed, resulting in no intervention after 2 months.

In total, 32 and 16 participants answered the first and second evaluation respectively. The overall impression of the intervention was very good according to all respondents of the first questionnaire. At the one-year follow-up 25 % of the respondents had used the framework and 63 % anticipated to use it in the future. At the one-year follow-up the respondents had on average been involved in 2.3 projects during the year.

Discussion

The intervention was threefold: to conduct work environmental improvements in the client’s planning projects, to increase the practitioners’ competence, and make the clients aware of their competence within the field.

Conclusion

Safety and health engineers’ and ergonomists’ competence regarding the planning and design processes can increase by providing them with feasible methods from the framework, and incentives to contact and participate in clients’ planning processes.
Design methods for the projection of uses for vulnerable people

Type: Abstract Oral Presentation
Category: ICT

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In coming years the aging of the population within industrialized countries will considerably increase. By correlation, the number of loss autonomy people will increase also. This situation will yield economic consequences on society creating the need of available number of places in specialized institutions. To address this societal issue, technological devices dedicated to home support are increasingly emerging. That is the scope of the VOCADOM research project that aims at designing a new technological solution embedding vocal control, and considering the context of use and the specificities of the user. This technology intends to foster the wellness and the autonomy of dependent elderly persons at home, or persons with disabilities (specifically, visually impaired individuals). The user-centered design that we apply must implement methods that fit these profiles.

In this contribution, we will discuss the approach that can be put in place to evaluate the acceptability of this innovative device.

Within ergonomic psychology field, the intention of use and the continuity of use are generally measured with questionnaires of social acceptability such as the UTAUT 2 model which helps prognosticate the attitudes towards technologies, based on different sociocognitive indicators. However, these methods are not suitable for elderly people due to their limited understanding of the measurement scales or social desirability bias.

Moreover, it is difficult for these elderly people to project themselves into the future-probable use of such an innovative device, even though they have no experience with equivalent systems.

Finally, what has been evaluated in terms of acceptability at a given time and under certain conditions (of experimentation, training, awareness) may no longer have value once the device is deployed and used in its actual environment of use: the constraints, the circumstances of life, the psychosocial context can give a different meaning and induce a report / particular needs with the technology. So, social acceptability could not guarantee by itself the final adoption of technologies.

Therefore, we mobilize different complementary innovative methods for promote the prospective use of innovative device in ecological situation. These methods will make it possible to build a framework for the understanding of the ecosystem of the end users in order to define scenarios of uses for the Vocadom device.

We will also adapt or create methods adapted to these specific users (with different disabilities and fragilities) to allow the projection of uses to evaluate the acceptability and usability of such a device.
We are inspired in particular the simulation of activities in the approach of simulation of organization using tangible materials such as models and figurines.

Finally, the methods created must be comprehensible and usable by these people.

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Situation-analysis of scientific teaching on ergonomics in Austria

Type: Abstract Oral Presentation
Category: Education and Training
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Ergonomically designed work places are currently seen as a major component in the prevention of musculoskeletal disorders and in age-based and gender-based operations. In order to be able to benefit from ergonomic advantages for the economy and the humanization of work, the relevant information has to be offered to companies and also to households. In order to integrate prospective ergonomics in the national economy more intensely and in a sustainable way, the first step is to pool and intensify the university education and training in ergonomics in Austria.

The goal of this project study was to identify the quantity and quality of courses in ergonomics offered by scientific institutions in Austria. The selection of the institutions was made according to the current state of knowledge on the internet as well as through additional correspondence with experts. Relevant information regarding the study of ergonomics was obtained by email from fourteen sources. The obtained data were analyzed and described descriptively and analytically in the spreadsheet program Excel as well as in the SAS Enterprise Guide 4.2..

The institutes surveyed offered 33 courses focusing on ergonomics in 22 study programs, which could be assigned to five categories and which differed in the sectoral focus and the portion in ergonomics. Proper recognized training in ergonomics could not be determined. 48.5 % of the courses were taught at universities and 51.5% at technical colleges. They came to 55.5 weekly hours per semester or 72 ECTs, with an average of 2.15 ECTs per course. According to the CREE, five out of 11 fields of knowledge areas were very well covered by the courses offered, and five of these did not exist at all. The main differences between the various courses offered consisted in the types and variants of courses, the ECTs hours per semester week, the degree of commitment, previous knowledge in Bachelor's and Master's studies, the learning outcomes, the qualification level of the lecturers, the prerequisites for attending, the types of examination, the number of examination dates and different online information depending on the institutions.
The use of projective cards to identify the components of management of the cook chefs: a new innovative tool for ergonomists

Type: Abstract Oral Presentation
Category: Education and Training

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Research context: We have observed for several years a strong enthusiasm by the general public for cooking, linked in particular to a strong media coverage. As a result, more and more young people enroll in a cookery school. However, restaurateurs have difficulty recruiting cooks. This trade falls within the criteria of difficulty defined by the Labor Code (Article 4121-3-1): handling, postures, night work, temperatures above 30 degrees. Cooking is one of the 15 most exposed to intense physical constraints (Dares, 2014). This population is prone to psychosocial risks, Musculoskeletal Disorders and dropping out of the trade. We propose in this presentation to focus on the determinants of management.

Methodology: In order to carry out this survey, 20 individual interviews of 45 minutes each were recorded and transcribed. The researcher in occupational psychology and ergonomics moved to the workplace of professionals at the end of the lunchtime. Semi-directional interview was carried out on six dimensions: the activity of chef; the image of the general public regarding the trade of chef; manager as a chef; the collective and possibly collective work of a brigade; the effects of the chef occupation on the health of the respondents; finally, a part on the personal variables of the interviewee. To animate these interviews, we used projective cards from the DIXIT game (Roubira, 2016).

Results: The use of projective cards allowed the chefs to describe their activity and specifically that relating to management. The analysis of our data focuses on the determinants of the profession of chef. Our results show disparities within our population as to the goals that leaders set for themselves on a daily basis. We also observe that this population is poorly trained in management but that there are specific management skills identified by them. Finally, although this job is considered painful (TMS, RPS ...) and difficult to achieve, the existence of a tight team allows leaders to remain in employment.

Discussion: The use of this method is in addition to the methods of analysis of work to be used upstream, during or a posteriori. Thus, these cards are a powerful tool for intervention ergonomists. These projective cards are a support for the expression of chefs, a population that may have difficulty expressing itself. This type of method makes actors interviewees who even anticipate to choose a card when this is not requested. This method is powerful because it is both projective and retrospective. Indeed, it allows chefs to both think about the past, the present and the future. Moreover, this method intrigues in principle the interviewees who compliment its playful aspect, then putting them in confidence to express themselves (Bélisle, 2014).
Experimental study on the effects of air flow from cross-flow fans on thermal comfort in railway vehicles

Type: Abstract Oral Presentation
Category: Transport

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The thermal environment is one of the important factors affecting passengers’ comfort in railway vehicles. In Japan, in addition to air conditioning devices, cross-flow fans are installed as supplementary fans in almost all commuter trains to circulate air in cabins and to provide beneficial cooling to passengers during the hot and humid summer season. Air flow might be one of the most effective and energy-saving methods to provide a comfortable environment in a cabin. To improve not only passengers’ thermal comfort but also energy conservation, better understanding of the effects of air flow from cross-flow fans is needed. However, few studies can be found regarding the effects in railway vehicles. The purpose of this study is to experimentally examine the effects under relatively warm conditions in a railway vehicle.

The experiments were conducted in a commuter vehicle at standstill on August 22nd and 28th, 2017. Thirty-one persons (15 males and 16 females) took part as subjects each day. All subjects wore the same clothing (cotton half-sleeve shirts, trousers, underwear, and socks), and stood near a cross-flow fan. They were exposed to the temperature changing conditions under which temperature increased from about 24°C to 29°C and then decreased to about 24°C. During the temperature changing condition, two air flow conditions (“fan-on” and “fan-off”) and two occupation density conditions (2.8 and 5.7 persons/m²) were conducted: namely, the subjects experienced four environmental conditions. Under the “fan-off” condition, cyclic air flow with peak velocity of about 1.0 m/s and frequency of 0.07 Hz was observed. Under the “fan-off” condition, air flow with mean velocity of about 0.2 m/s was observed. The occupation density of 5.7 persons/m² almost corresponded to the upper limit such that the subjects didn’t contact each other. The subjects answered questionnaires about their thermal sensation and comfort at two minutes intervals in each condition. The relationships between temperature and subjective evaluation of the subjects were examined based on regression analysis.

The results of the study showed (1) Under the “fan-off” and “fan-on” condition, the temperatures at which the subjects felt neutral thermal sensation on average were 24.6°C and 27.5°C, respectively. (2) Under the “fan-off” and “fan-on” condition, the temperatures at which 20% of the subjects felt warm discomfort were 24.0°C and 27.3°C, respectively. (3) The relationships between temperature and subjective evaluation of the subjects under the occupation density of 2.8 persons/m² were almost the same as those under the occupation density of 5.7 persons/m².

In conclusion, the results indicate that air flow from cross-flow fans in the vehicle used in this study have the effect of reducing sensible temperature by about 3°C unless passengers contact each other.
A new approach for reference materials for slip resistance testing

Abstract:
For many methods, implemented for slip resistance testing of floorings and shoes, the use of reference or calibration materials is required or recommended to create a basis for reliable assessment and comparability of the acquired results. This applies not only for the established methods in Europe, summarized in CEN/TS 16165 for slip resistance measurement on pedestrian surfaces (including the ramp method, the measurement of the dynamic coefficient of friction and the pendulum test). It also concerns the DIN EN ISO 13287 on slip resistance of footwear as personal protective equipment, as well as its international counterparts like e.g. ASTM F2913 on Footwear and test surfaces and the ASTM F2508 – 16, which describes the standard practice for validation, calibration, and certification of walkway tribometers.

A well-known, general problem however is the durability and availability of these materials. This has and is leading to elaborate trial-and-error procedures to select, choose and specify new references, especially if the materials are mainly based upon commercially available products, which fail to perform after long-term use and/or are no longer produced. On the other hand the investigations of the transferability of these reference materials between different methods, even on the same flooring materials like ceramic tiles, show critical differences. These can lead to significant differences in the interpretation of the slip risk, dependent on the actual surface characteristics, the overestimation of slip resistance of some tribometers on very smooth surfaces being a known example. In some cases the surfaces addressed in practice are not included in the range of calibration surfaces.

The FGK Forschungsinstitut für Anorganische Werkstoffe-Glas-Keramik-GmbH together with the PFI Prüf- und Forschungsinstitut Pirmasens e.V. from Germany have joint forces in a national project to develop robust, reproducible and controllable reference systems, based upon surface topography characterisation as an objective tool to specify slip
resistance settings, control durability of surfaces and footwear and evaluate application areas for slip measurement methods. The results of this development, the first prototypes of reference systems for different applications, their performance and their potential and will be presented and discussed.
The Use of Design Principles in TRIADIC Game Design for Interactive Learning about Ergonomic Disciplines for Children in Playground

Type: Abstract Oral Presentation
Category: Education and Training

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Abstract

Playing is how children make sense of the world, they need a noisy space to move their bodies, socialize with other children, and invigorate their brains, such as playground in school or public. Playing in playground promotes brain development, motor-skills, social capabilities, and helps lay the neural grid for a successful mind for children. Playground can boost a child’s cognitive, emotional, physical, and social development. Unfortunately, each year about 200,000 children suffer from significant injuries related to playground in public, and most occur at schools. Moreover, one child is injured every 2.5 minutes on public playground in the US. Children age five to nine have higher rates of emergency department visits for playground injuries. On public playgrounds, more injuries occur on climbers than on any other equipment. Therefore, in this research, we purpose a better way to introduce ergonomics design principles to children age five to nine, especially in designing comfort and safety living appliances in playground in the form of a game. A game is one of the learning tools which are needed by every child and are an important childhood activity that helps children masters all developmental needs. We aim to educate children on the importance of safety and comfort with interactive learning in the form of a game. The method used to construct the game is TRIADIC Game Design which helps us to balance the aspect of reality, meaning, and play in the game itself. In designing the game, we will be applying a design principle called ARCS (attention, relevance, confidence, and satisfaction) to model a motivation to facilitate children’s learning. ARCS emphasize the relationship between educational objectives and challenges that the game activities share with the educational tasks being implicitly undertaken. The result shows that a game can boost children’s interest to learn more efficient and effective, we evaluate the effect of this game by using questionnaire. The output of this research contributes to help raise the awareness of safety and comfort for children in playground.
**Keywords:** Children, Playground Injuries, Interactive Learning, Ergonomics, TRIADIC Game
Success factors for development of health-promoting and sustainable leadership in healthcare– Learnings from an intervention study

Type: Abstract Oral Presentation
Category: Healthcare

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Background

Leadership is considered a key condition for organizing more attractive work with beneficial working conditions, employees' health and work engagement. Health care managers in specific need functional support, competence and handling strategies to meet challenges related to working conditions.

Aim

The aim of this study was to map out success factors for interventions aiming at developing health-promoting and sustainable leadership in healthcare.

Material and methods

In this study the implementation of an intervention program based on system theory was evaluated. The program included evidence-based knowledge of key-factors and conditions for improving workers' health, wellbeing and work engagement. 6 groups of 65 managers and organizational key actors were participating in the intervention program. The program was evaluated through interviews (n=44) and questionnaires to managers (n=37) and employees (n=348) before and two times after the intervention program.

Results

The survey results indicated improvements in leadership (p-value 0.00), handling of work environment issues, (p-value 0.00) as well as job satisfaction (p-value 0.04) and vitality (p-value 0.00) at the workplaces where the managers had actively worked according to the leadership program. Improvements of work processes and quality of care were also to higher extent reported (p-value 0.00) at the workplaces actively working according to the program. Multilinear analysis pointed at that opportunities for continuous dialogues on work environment were important pre-conditions for improvements following the interventions. The analysis of the qualitative interviews pointed at that important success factors for concrete actions at workplace level were managers' own delimitation and prioritization of systematic work environment work, dialogue-based intervention methods, inter-organizational collaboration between OHS, HR and managers at different organizational levels and functional collaboration between researchers and organizational stakeholders.
Conclusions

Successful developments of health-promoting and sustainable leadership require that health care organizations set aside time for systematic reflections and dialogues on improvements of the work environment. Social capital is critical resource for successful leadership interventions including improvements of the work environment. Future research and future intervention within healthcare can thus be recommended to explore measures contributing to increased social capital among employees.
The home care sector in Sweden is growing fast and the health of the patients taken care of is continuously deteriorating which puts great strain on nurses and nursing aides working in home care. At the same time as many of the patients need advanced care the nurses and nursing aides work in solitude which puts great both physical and psychological strain on them. Technical systems, in form of ehealth solutions, have been seen as a possible support for the staff working in home care. Still, the pace of ehealth implementation in this sector has, up to now, been rather slow and little has been known about the type of ehealth solutions the staff themselves would see as solutions to their experienced problems.

The overall goal of the research project that we will be presented is to reduce the stress that comes with the working conditions described above.

The research was carried out in three stages or subprojects:

1. Evaluation of existing ehealth services in the chosen municipality.
2. Mapping e-health services for home healthcare staff both nationally and internationally.
3. Workshops with home care staff for discussing their needs and ideas of different ehealth solutions and to concretize these ideas through conceptual design.

We will describe the conceptual design process and its results i. e. the third stage of the project. Together with staff from home care from four municipalities we investigated how ehealth services can improve the work environment. In a series of four workshops we coached the participants in 1) describing their work process and pinpointing the problematic situations in the process, 2) formulating their wishes for an ideal work process, 3) conceptualizing how ehealth solutions can be used to obtain the ideal work process and describing scenarios 4) illustrating the scenarios and the design process on storyboards.

The storyboards describe, amongst other, how support through ehealth systems may be used to: gain access to adequate information; get in touch with other professionals as doctors or other colleagues; prevent medication errors, and to transfer images or physiological data to an expert who can directly provide personal support.

We conclude that through the design process we achieved in-depth information about what does not work in practice, according to the home care staff, as well as an
understanding of how the suggested types of ehealth solutions could actually improve both the work process and the work environment of the home care professionals.
[2801] AEROBIC CAPACITY AND ENERGETIC EXPENDITURE OF PRIMARY CARING WOMEN IN ASSISTANCE OF CHILDREN AND YOUNG PEOPLE WITH SEVERE MOTOR DISABILITY

Type: Abstract Oral Presentation
Category: Healthcare

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AEROBIC CAPACITY AND ENERGETIC EXPENDITURE OF PRIMARY CARING WOMEN IN ASSISTANCE OF CHILDREN AND YOUNG PEOPLE WITH SEVERE MOTOR DISABILITY

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Domain: Healthcare Ergonomics

Productive sector: Healthcare

The tasks related to caregivers are physically demanding especially in manual of loads tasks (transfer of children to the bed and vice versa and to the wheelchairs); Postural overloads (activities of dress and undress; assisted feeding; major and minor hygiene), repetitive movement (cleaning load, teeth) which are common daily living activities. Currently, there is not enough background about the knowledge of aerobic capacities of informal primary caregiver (IPC) so this research pretend to be a baseline to set a necessary precedent for an adequate ergonomics adaptation of the environment and the importance of training in IPC

Objective. Determine the VO2max and the Energy expenditure (EE) of (IPC) during the assistance of activities of: feeding, transfer, dress and undress, major hygiene (bath), up and down stairs, as well as defining the activity of greater demand and comparing the results with mothers with children without disabilities (MCD).

Method. The sample consisted of 12 mother (IPC) who currently participate within the office programs municipal service for persons with disabilities (OMAPED), and as a comparison group, 10 women with children under 18 years old will be selected (MCD). The age ranges in both groups were between 20 to 50 years, none of them record muscle skeletal disorders, neurological, metabolic or cardiopulmonary syndromes: The protocols were approved according to the necessary ethical standards, and all the participants signed an informed consent. The VO2max was obtained by the extrapolation technique by
submitting the IPC to submaximal tests with an indirect calorimeter, likewise the EE was extrapolated with straight line equations from the heart rate obtained by a heart rate monitor Polar® Rs400 during different activities (previously mentioned) registered in participants.

**Results:** The VO2max was significantly higher in the IPC group than in the MCD group (31.6 ml/kg/min in IPC group and 24.7 ml/kg/min in MCD group), likewise the EE exceeded 33% of the physical load recommended by Water et al. (1993) in all activities (heavy work). The EE in METS activities was: in major hygiene in (3.3 ± 0.8), feeding (1.7 ± 1.2), dressed and undressed (2.5 ± 1.1), transfer (3.0 ± 1.1), up and down stairs (3.9 ± 0.5).

**Conclusion:** The IPC group have better VO2max compared to the MSD group. The more demanded of energy activities were hygiene and transfer in the IPC being both activities limiting in time and frequency in the performance of the IPC.

**References**


The objective of the present study was to develop and analyze a new concept of backpack for transport school material. The sample consisted of 24 children (12 boys and 12 girls), between 9 and 12 years old, students of a municipal school in the Santa Maria city - RS. The first stage of the research consisted in carrying out redesign of the school backpack using applied techniques of design and ergonomics. The new backpack was developed from the principle of ergonomics of weight division for load transport, creating two compartments for placement of school material interconnected by two lugs, one in the front of the trunk and the other in the back. The second stage consisted of a kinematic analysis, using the angular analysis of the trunk, hip, knee and ankle during the gait of the children in three situations: no backpack (normal gait); with commercial backpack; and new prototype backpack, called Trunkpack. Seven cameras were used (Vicon) to capture the image and later kinematic analysis of gait. The last step was the usability test, in which a questionnaire was applied to the children after four weeks using the trunkpack. Regarding the usability analysis, there was a great acceptance by the children of using the new product. Of particular note is the 100% acceptance of the children in relation to the size of the compartments and the ease of handling objects in the backpack as well as placing and removing school supplies from it. In addition, most children (83%) considered the new backpack comfortable, easy to wear and undress. In relation to the results of the angular variables during the gait performed in the 3 situations (without a backpack, with a commercial backpack, trunkpack), it was observed that the angle of the trunk presented a greater forward slope (p <0.05) in most of the gait cycle (1 to 40% and 70 to 100%) compared to the other two situations. The hip angle presented greater flexion with the use of the commercial backpack at the beginning (from 1 to 30%) and at the end of the cycle (80 to 100%) compared to the other two situations. The knee joint presented greater flexion with the backpack only at the beginning of the gait cycle (1 and 10%), in the other phases there were no differences between the three situations. These results allow to conclude that a new backpack prototype proves to be a good alternative to transport the school material, both in the response of the users and in the results related to the posture during the gait with it, thus indicating that trunkpack can minimize the effects generated in the vertebral column coming from the incorrect transport of school material.
A Research on Ergonomic Risk Perception of Women Workers in Metal Industries: A Study in Turkey

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Abstract:

Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors. Ergonomic risk factors are those factors which directly or indirectly influence the health and performance of the workers. Participation of women at work is ensured by the laps of globalization. When we look into the role of women in today's world, women are employed in every industry and institute and hold nearly every kind of jobs.

The present study aims at understanding the association between ergonomic risk factors, perceived safety awareness and fatalism of working women in metal industries in Turkey. In this study, researchers try to highlight the importance of the issue in the context of Turkey and more specifically working women in metal industries.

For the present study, 1918 labor women participated from metal industries through simple random sampling method. The data obtained were analyzed with the SPSS 23 package program and the perception of ergonomic risks was assessed using multivariate statistical analysis methods, factor analysis, correlation and multiple regression analysis.

The following measurement tools were used in this study.

- The items in the control lists used by the Ministry of Labor and Social Security in ergonomic risk analyzes were converted to a 5-point Likert scale and subjected to factor analysis. After analysis, 3 factors were obtained. These factors are called
physical risk perception, the perception of musculoskeletal system problems and personal risk perception. (Cronbach Alpha = 0.84)

- "Safety awareness and competency scale" has been used to measure the awareness of safe behavior of women workers. This 5-item scale, taken from by Lin et al (2008), evaluates the employees’ awareness of safety and their competence to deal with safety problems which may arise. (Cronbach alpha = 0.88).

- Fatalism Scale: A seven-item scale from Rundmo and Hale (1999) was used to evaluate employees’ beliefs regarding work accidents and fatalism (Cronbach alpha = 0.82).

The ages of the participants ranged from 17 to 50 years and the mean age of 31.24 ± 7.05 (mean ±SD) and the study year ranged from 1-27 years with an average of 6.09 ± 5.85. When the results are examined, it is understood that the problem that women workers are most aware of is the problems caused by the musculoskeletal system. According to the findings, as the perception of safety awareness and competency increased, the perception of physical risk increased in the same direction. There is a significant positive correlation between fatalism and physical risk perception (r = 0.346; p <0.01) and personal risk perception (r = 0.195, p <0.01). There is a significant positive correlation between perceived musculoskeletal problems and safety awareness and competency (r = 0.531, p <0.01). On the other hand, there is also a positive relationship between safety awareness and competency, perceived physical risk (r = 0.079; p <0.01) and personal risk awareness perception (r = 0.326; p <0.01). The results showed that there is a positive association between ergonomic risk factors, fatalism and safety awareness and competency.

**Key words:** Ergonomics, Risk Factors, Women worker, Metal Industries, Safety Awareness
Post-occupation evaluation of playgrounds in kindergartens: proposal of a methodological tool

Profª. Dra. Mariana Falcão Bormio
Profª. Drª. Renata Cardoso Magagnin

It is inevitable to mention in play when it comes to child. You could say that this is one of their main needs, in the absence of a context set to occur, whether in the simplest day-to-day activities or in the process of learning at school.

In Brazil the first stage of the learning process is the child education, which covers an age range between zero and five years old, this period responsible for building the child's knowledge base as a foundation.

Considering the play and the learning process, defined the focus of the research reported in this article, playground, favorite space at this moment in life, and that can be understood, as well as any other space occupied, as responsible for exerting influence on your user, in this case the student-child, and may be an enabler, making the learning process enjoyable and safe or generate barriers hindering him. Another important aspect is the playfulness, which is responsible for stimulating the development of skills, capabilities and potential, in addition to contributing to the acquisition of culture and integration of physical, emotional, social, cognitive and affective child.

It is also worth mentioning, like education, play is a right for all, but that the way the playgrounds are being designed, often leave aside accessibility, i.e. the possibility of use by children with disabilities.

In this context, this paper reports research in progress, developing an assessment post occupation of playgrounds of infant schools, the cities of Bauru and Treble, São Paulo, Brazil, in order to characterize the way in which these are being designed, deployed and used, focusing on accessibility aspects. For the development of research, were set four steps: literature review on the subject; definition of methodological tool, consisting of spatial accessibility evaluation Checklist, identifying the elements that make up the playgrounds and the solutions or adaptations adopted; Analysis of the linear displacement and use of spaces; Walkthrough-identification, description and tiering of the negative and positive aspects of the environment; and behavioral-Map and record users’ activities, identifying the uses, spatial arrangements and/or layouts, flows and spatial relations.

For protocol validation, identifying your effectiveness when used, was developed a first case study on EMEI Thereza Perni Yvoneti Teacher, defined by having students with different disabilities, including physical and intellect. Considering the results obtained to date, it can be observed that the methodology is playing the role expected, requiring only minor adjustments to the application study in your entirety.
Cooperative and transversal approach to improve the making of prescriptions in a High Reliability Organization: a constructive ergonomics approach

Type: Abstract Oral Presentation

Category: BUSINESS CASE - Manufacturing

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Introduction: This communication presents a part of an action research conducted in a French Electrical Power Generation company. In this company, numerous prescriptive documents are designed through an organizational documentary process intended to ensure the quality of prescriptive documents. Our organisational diagnosis outlines the complexity of the documentary process: it involves many actors within the organization and requires a joint collective activity, i.e. a set of local activities coordinated in order to produce a result[1] (Lorino, 2009; Thomas, 2014). This joint collective activity needs to be cooperative – to coordinate the local activities – and transversal – through all entities. In order to support this cooperative and transversal work, we set up a constructive ergonomics approach (Falzon, 2014); this approach aims at enabling the actors of the process to discuss and to question the organization of the documentary process and to redesign this organization.

Methodology: Our cooperative and transversal approach includes 6 1-day workshops, which were recorded and transcribed. It involves a set of methods (explanation of problem-situation, formulation of solutions, creation of organizational scenarios, organizational simulations, identification of implementation conditions of the solutions and of the approach). These were performed with 14 individuals coming from 7 different entities of the company. The data processing aims on the one hand at identifying what the individuals need to explain and to understand the organization of the process and their respective part within; on the other hand at suggesting changes of the process organization.

Results: Discussions during workshops reveal the difficulties encountered by the actors, and lead them to construct shared representations about the process organization and their respective actual activities. The creation of scenarios and organizational simulations produce co-constructed solutions which take into account the constraints of all the actors. The identification of implementation conditions of the solutions and of the approach enables actors to organize 1) the implementation of the suggested solutions and 2) the sustainability and the generalization of the cooperative and transversal approach.

Discussion: One the one hand, we consider that what we set up is a prototype-approach. Thinking about the implementation conditions of this prototype-approach lead us to
suggest a new approach, better suited to the organization. The next step is to generalize the approach and make it sustainable. On the other hand, the better understanding of the documentary process and of the role of actors enabled us to suggest changes to the process organization. These submitted changes aim at improving 1) the process organization (more adapted to the actual proceedings and constraints of actors), 2) and the cooperation between actors (made possible by shared representations).

[1] Here, it is about the coordination of redaction activities in order to produce prescriptive documents designed to power plants.
Physical workload in hospital and hotel cleaning

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Background and aim
In the cleaning industry, it is common with stressful/constrained and/or extreme postures and movements with high physical loads on the body. The cleaners are affected by disorders/diseases of the musculoskeletal system and have prolonged sick leave periods. Previous research on physical load in the cleaning industry is primarily based on observations and self-ratings. Therefore, there is a need to objectively assess the workload and technical measurements are superior when it comes to assessing the physical workload. Moreover, methods for full-day measurements of postures and movements have become much easier.

The aim of the present study was to quantify the workload in different parts of the cleaning industry (hotel housekeeping and hospital cleaning), and to compare the measured physical load between the groups and with a previous hospital cleaning study.

Methods
The physical workload (postures and movements in the upper part of the body) was recorded over a full working day on 14 hotel housekeepers and 12 hospital cleaners. In addition, heart rate measurements were performed on 12 hospital cleaners.

Results
Both hotel housekeepers and hospital cleaners had a high workload in the upper part of the body, in terms of postures and movements. Both groups exceeded five of the twelve action levels for ergonomic load proposed by Occupational and Environmental Medicine, Lund, Sweden. The hotel housekeepers had the highest physical workload. Heart rate measurements on hospital cleaners showed that the heart rate was below the recommended maximum level (recommendation from the International Labour Organization (ILO)). Compared with the previous study on hospital cleaners (Unge et al., 2007), the workload was similar to the group of traditional cleaning tasks, and higher than in a second group where the cleaners worked in smaller groups, with more varied tasks.

Conclusions
Both hotel housekeepers and hospital cleaners have a high workload in the upper part of the body, with a high risk of musculoskeletal disorders. Despite recent year’s efforts to improve the work conditions for cleaning workers, much work remains to reduce the workloads.
Abstract: Purpose Discuss difference of the influence of noise to high and low anxiety characteristics population on distraction. Methods The high and low anxiety characteristics groups who were screened by the state-characteristics questionnaire to meet the requirements. The noise level was set as quiet (<30dB), 50dB and 70dB white noise groups, the task was designed and presented by E-Prime software. During the test, the event-related potentials were recorded, and then the amplitude of P300 was analyzed and behavioral data were processed by two-factor analysis of variance method. Result (1) Anxiety levels, noise levels and their interactions had no obvious effect on the numbers of errors and reaction time, but the reaction time of the high and low anxiety characteristics population was shortened when noise level is the 70 dB. (2) At rest, the amplitude of P300 in high anxiety groups was obvious higher than that in low anxiety groups (p <0.05). (3) The amplitude of P300 in high anxiety groups decreased between 50dB and 70dB, and there was no obvious difference in the amplitudes of P300 between the two noise levels. (4) In low anxiety groups, the amplitude of P300 showed a decreasing trend under 50dB. The amplitude of the individual groups increased. The amplitude of P300 did not decrease obviously under 70dB, and more groups' amplitudes increased. Conclusion Noise levels had no obvious effect on the distraction of the high and low anxiety characteristics population, which provided theoretical support for studying the influence of noise on the distraction.
The Relationship between MRI Parameters and Spinal Compressive Loading

Type: Abstract Oral Presentation

Category: Agriculture

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Introduction:

Low back pain (LBP) remains a major socioeconomic problem, and one of the leading sources is the intervertebral disc (IVD). The health and functions of the IVD are determined by both the inherent tissue properties (e.g. proteoglycan content, osmotic pressure and hydration) and their interaction with the magnitude and time-distribution of loading. The inherent properties of the IVD are difficult to determine in vivo; however, quantitative MRI parameters, such as T$_1$, T$_2$ and ADC may extract pertinent information about the biomechanical properties of the IVD tissue, which is useful for understanding the effects of loading on the health and functions of IVD, and help in the efforts for reducing LBP in occupational settings. Therefore, the current study aims to investigate how compressive loading changes T$_1$, T$_2$ and ADC.

Methods:

Twenty functional spinal units were harvested from 10 porcine cervical spines (two from each). A 7T Bruker Biospec imaging instrument (Bruke Inc., Billerica, MA) was used for imaging. T$_1$ imaging was performed with spin lock time (TSL) ranging from 15 to 75 ms (15ms increments). The T$_1$ imaging protocol was developed and verified with 1%, 2% and 4% agarose phantom. The T$_1$ values of these phantom have been found consistent with the literature. Similarly, T$_2$-weighted imaging was performed with a series of different spin echo times (TE ranged from 15 to 75 ms, with 15ms increments). ADC was obtained by performing a series of diffusion-weighted imaging with b values range from 600 to 1000 s/mm$^2$ (with 100 s/mm$^2$ increments). The slice thickness was set at 1 mm for T$_1$ and T$_2$ imaging, and 2.26 mm for diffusion imaging.

A computer controlled load-displacement apparatus was developed to apply compressive load inside the MRI scanner. Plastic frame, rod, tube and sample holder were also built and assembled to apply loading to the specimens. T$_1$, T$_2$ and ADC were obtained from the sagittal plane of the IVD before and after receiving compressive load of 263.27 N for 60 minutes. Load magnitude corresponds to 1500N on human lumbar IVD according to the scaling factor in IVD areas between the porcine cervical and human lumbar spines.

Paired t-tests were performed to test the effects of the compressive load on T$_1$, T$_2$ and ADC. The α value of 0.05 was set as the significance criteria.

Results and Discussion:

T$_1$ and T$_2$ were found sensitive to the compressive load, which indicates that they have the potential to detect the biomechanical changes of the IVD induced by external loading. This approach will provide more specificity to understand the injury mechanism of...
the IVD, contribute to early diagnosis of IVD degeneration, and help reduce the prevalence of LBP.
Quay crane operators, who are responsible for moving containers from and to vessels, work for 4-6 hours in cabins suspended on a trolley at a height of approximately 40 m above ground level and adopting non-neutral sitting postures which alters body-seat contact pressure and trunk sway (Pau et al., 2016; Leban et al., 2017). Fatigue and discomfort cumulated during the work shift may influence the worker's performance (Bhatnager et al., 1985) in terms of efficiency and safety of the whole process. On the basis of these considerations, this study aims to quantitatively assess discomfort during a realistic 4-hour shift performed in a quay crane simulator (Bruzzone et al., 2011) using in-chair movements (ICM, Fenety et al., 2000).

Eight male professional quay crane operators were recruited for the study. They were requested to transfer as many containers as possible, but safely, from ship to shore following a predetermined unloading schedule. The whole task lasted 4 consecutive hours with no breaks.

Body-seat contact pressure were acquired using a pressure-sensitive mat (Tekscan 5330E) placed on the seat pan. From the pressure data we calculated the ICM according to three different procedures. The first (Na et al., 2005) takes into account the average pressure ($P_a$) calculated across the body-seat contact area over the entire trial duration. ICM occurs when pressure value changes exceed ±5% of the seat pan $P_a$. Le et al. (2014) define an ICM event when the peak pressure exceeds of ±6.4 kPa the average peak pressure calculated for the entire trial. The authors propose a new method based on center-of-pressure (COP, i.e. the point of application of the resultant body-seat force) displacements. In this case, ICM occur when COP displacements (either in antero-posterior or medio-lateral direction) exceed a predefined threshold with respect to the average position calculated on the whole trial.

The results show that all methods report a general increase in number of ICM as the shift progresses. In particular, the approaches which consider the body-seat pressure originate similar non-linear trends with comparable number of ICM after 4 hours (67 for Le et al. vs. 87 of Na et al. respectively). In contrast, the ICM calculated using COP displacement shows a positive linear trend with time (Pearson coefficient 0.75-0.83, p<0.001) with a number of ICM of 35 (ML) and 45 (AP).

As ICM represents an objective, dynamic measure of sitting discomfort, such results suggest that quay crane operators undergo increasing discomfort during the shift that may influence their performance. Given the non-invasive character of the pressure-sensitive mats, it is reasonable to hypothesize that body-seat interface pressure might represent a tool to monitor operator's fatigue and thus reduce the risks of critical events which may potentially occur during the work shift.
Accessibility and visual contrast: a proposal for a better evaluation of this physical quantity

Type: Abstract Oral Presentation
Category: Others

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Creativity in Practice

SPECIAL SESSION
International standards on Accessibility and Design for All:
background and evolution

Accessibility and visual contrast:
a proposal for a better evaluation of this physical quantity

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Key words
visual contrast, people with visual impairments, accessibility, Design for All/Universal Design

Abstract
PROBLEM, CONTEST

Nowadays there is an intense activity, for the definition of International and European Standards, aimed to guarantee accessibility and usability of the built environment, products, services, software, etc.

In Europe CEN, CENELEC and ETSI have been working and are still working on a series of standards concerning accessibility with Design for All approach and Universal Design, following "mandates" from EC,
according to the European Disability Strategy 2010-2020. On the other hand, ISO working groups are revising their standard on Accessibility and usability of the built environment.

In this framework, a great attention is now being given to the definition of design considerations useful to facilitate orientation and to ensure safe use of an environment, particularly for people with visual impairments.

The physical quantity more related with human visual perception is visual contrast, and several existing standards refer to this quantity to establish minimum values to be provided to aid perception of information, building elements, etc.

The issue of the right visual contrast to be provided for people with visual impairments strongly emerged within the ISO/TC 059/SC 16/WG 01 “Accessibility and usability of the built environment” and WG 05 “Visual Impairment” for the revision of ISO 21542:2011 and EN 81-70. The ongoing activities are leading also to repercussions on PrEN EN 17210.

In this work, the authors faced the problem of identifying which parameter may be most suitable to describe visual contrast, according to human sensation. The discussion focused on the alternative between the use of the LRV (Light Reflectance Value) and the Y tristimulus value, as defined by CIE.

A second issue investigated by the authors is which kind of formula is best suited to describe the visual contrast between two adjacent surfaces.

**AIM AND TOOLS**

In the aim to contribute to an improvement of international standards now under revision, the authors examined several guidelines, standards and recommendations, comparing the different evaluation methods and requirements adopted.

**RESULTS**

In the authors' proposal, visual contrast should be evaluated and specified by a parameter for which:

- A unique definition is available, widely accepted by the scientific community
- One or more measurement methodologies are precisely defined
- Measurement instruments are available on the market, by several manufacturers

**CONCLUSIONS**

The authors suggest that CIE tristimulus value Y should be chosen to evaluate visual contrast, by means of a formula basically based on the ratio between the tristimulus values of the adjacent surfaces under exam.

**References:**

CEN-CENELEC (2017) PrEN 17161 “Accessibility following a Design for All approach in products, goods and services – Extending the range of users”

CEN-CENELEC (2017) PrEN EN 17210, “Accessibility and usability of the built environment – Functional requirements”

CEN-CENELEC (2017), EN 81-70 “Safety rules for the construction & installation of lifts - Particular applications for passenger and goods passenger lifts - Part 70: Accessibility to lifts for persons including persons with disability”
ISO (2011), 21542 "Accessibility and usability of the built environment"

How many and what are the elements affecting the design process? And besides, does it exist any design experience, which is totally disconnected from no-user contextual factors?

In the actual scenario which is deeply affected by the information technologies, and characterized by the continuous growth of the relational networks thanks to the new media, we can absolutely answer no to the last question. Rather we can maintain that no “offline” product never existed.

As every design action implies the creation of relational environment, wherein users are involved, together with objects, services, no-user actors, and a lot of other subjects depending on the specific context of use of a product, we can state that product is more and more coming to the centre of a complex local system of effective agents. This is the reason why decisional design factors are going to raise in number, always being cross-connected and rapidly changing in the edge segments of the market.

In the frame of the present analysis we need new tools for catching the lattice made of lateral indirect relationships surrounding the product, and we need it runs in an iterative way, so to grab what’s really meaningful for each local market (or context).

Starting from Freud's definition, where creativity is the attempt to resolve a conflict deriving from unresolved instinctive drives such as unsatisfied desires, the research aims to verify how new communication and data management technologies can be useful for enhance the basins of collective creativity in the local, so they can become a key part of the design process alongside the designer.

To do that the present analysis supposes to transfer the design process out the manufacturing place, directly on the field of product’s life through Design Displacement Strategies. This opportunity first of all imposes the necessity to design the process interface and the modalities through which it takes place. In this way all the factors characterizing the product are transferred to the process and some important aspects, such as the ergonomics of the process, the aesthetics of the process, the safety of the process, become decisive for the enhancement of creativity as factors of innovation.

Keywords: relational environment, design displacement strategies, collective creativity, design process ergonomics
The scale of the slips, trips and falls (STF) problem is well recognised (Haslam and Stubbs, 2006). Although the multi-factorial causality of STF is reasonably well understood, efforts to reduce the incidence of injury, however, have had mixed success (Chang et al, 2016). Falls involve a loss of balance due to some reason, which results in a person falling to the ground or other lower level. Aspects of the environment involved in falls are the foot-floor interface and the presence of trip hazards. The frictional characteristics of footwear and flooring materials affect the likelihood of slipping, with these influenced by their condition and maintenance and also the presence of contaminants (e.g. water, ice, litter). Obstacles in the walkway may lead to tripping if they go undetected. Because the clearance between feet and the floor is so small during normal gait, deviations in the walking surface of as little as 10mm may be sufficient to cause a trip. Other perturbations of balance may result from contact with objects or people (e.g. bumping into or being pushed by).

Gatherings of people, that is crowds, form part of our everyday human experience. Commuting to work via transport hubs, shopping in retail environments, social occasions such as visiting bars and restaurants, or entertainment venues (e.g. music festivals, football matches, amusement parks and museums) are all examples of crowd situations. Crowd situations occur in wide ranging environments, ranging from fields, concert halls, to railway stations. In some situations, the management and infrastructure are permanent; in others the conditions and oversight is transitory. The nature of a crowd can vary from sedate and purposeful to excited and out of control.

Crowding may exacerbate risk factors for STF, with the close proximity of large numbers of individuals leading to deterioration of the walking surface or obstructed vision, for example. Crowd movement can result in jostling or pushing. STF in crowd situations can have serious consequences, for both the faller and others involved in the gathering. An individual STF in a moving crowd can result in obstruction to the crowd flow and further multiple fall or crush injuries.

Filingeri et al (2017, 2018) report the findings of interview and observations studies of multiple crowd situations, which examined the factors affecting crowd participant experience. This paper presents further analysis of the data from these studies, focusing on risk factors for STF in crowd situations. The nature of the risk factors is examined,
along with the measures currently used by crowd organisers to ameliorate these. A risk management framework for reducing the risk of STF in crowds is proposed.
In physics research dedicated to fire evacuation, studies have given rise to evacuation modelling tools that consider external factors related to the fire itself (thermal constraints, toxicity, visibility, fire and smoke propagation) and to the spatial configuration. These tools satisfactorily describe the evacuation routing, but evacuation times remain uncertain due to unconsidered human factors.

The challenge taken up by this study is to identify the human factors and their interdependence and impact on both the process and the evacuation time. The investigation features a mix of top-down and bottom-up approaches.

Studies of the literature dedicated to psychology and ergonomics and to physics have revealed that the evacuation process depends on physical factors (fire and smoke propagation, spatial configuration), group phenomena (herd behaviour, etc.) and on individual factors. The latter are related to personal physiology (e.g. mobility), to dispositional characteristics (e.g. decision-making style, emotional intelligence) and to cognitive components (especially knowledge or ignorance of the premises, spatial representation, coping strategies, etc.).

We advance the hypothesis that these factors interact in evacuation situations, but it is impossible to determine, strictly speaking, their impacts on the evacuation and time (some factors may cancel each other out and others may aggravate each other). Understanding how these factors interact and influence the evacuation process can only be envisaged through development of a bottom-up approach involving a study of real behaviours arising in evacuation situations. This approach is intended to be comprehensive. It involves analysing behaviours that arise in the light of studies reported in the literature to extend our understanding of the process dynamics. This approach may also reveal phenomena caused by factors that have not yet been identified.

The bottom-up approach demands construction of data acquisition and processing methodologies suited to fire evacuation. Acquisition involves drawing up simulated evacuation scenarios. Data processing is based on preliminary construction of an observation chart designed for studying behaviour under real conditions. The level of description used allows recording of micro-displacements, body language, postures, mimicking, verbal and paraverbal behaviours, while conserving their chronology. Self-confrontations (filmed sequences shown to several participants in the experiment to hear their impressions, comments and behavioural motivations) are conducted to acquire additional data.
The purpose of this communication is to present the observation chart and describe its usage based on a filmed evacuation sequence. We will show how the behaviour study enriched by the self-confrontation results and reference to the literature have enabled us to identify and better understand the factors underlying the phenomena arising during an evacuation.
Scheduling is characterized as a continuous management of (sometimes contradictory) constraints. Iterative reschedulings are needed in order to cope with the dynamic context of production (Cegarra, 2008). As a consequence, schedules must be robust. Robustness is understood as the ability of a system to resist to uncertainties (Roy, 2010). Following MacCarthy, Wilson and Crawford (2001), scheduling can be seen as a distributed process between actors at different trades and hierarchical levels. Robustness depends on the scheduling process. A scheduling solution is robust if it does not preclude decisions of the following schedulers and if it preserves some leeway to take care of potential unexpected events.

A research was conducted in the French public rail transport service and more particularly in the scheduling unit responsible for workers allocation in sales units. The aim of this communication is to present schedulers strategies to ensure robustness of scheduling in order to avoid vacancies. The methodology was ergonomic on-site analysis and included work observations, interviews and focus group discussions. A first step revealed that scheduling involves three levels of management could be considered as schedulers insofar as they assigned resources to positions at different times and with different scope. In a second step, all categories of schedulers were involved, including the hierarchy. In a third step the activity of two schedulers in charge of staffing the sales units was analysed.

Results confirm that schedulers have to manage a multitude of dynamic constraints that correspond to the needs of the company, the operators and the schedulers. Three phases of scheduling were identified: an upstream design phase where the objective is to specify scheduling in accordance with the prescribed constraints, an intermediate phase where scheduling is adjusted according to the schedulers’ knowledge of the process and production context, a phase close to the actual production during which unforeseen, last-minute constraints are managed. Besides, results show that robustness is built from the beginning of scheduling to its implementation. Schedulers adapt their strategies according to the diversity of the constraints they have to manage, in particular time-related ones, and to the production’s context. The strategies employed by the schedulers make it possible to integrate the human and social dimension into scheduling choices. Schedulers take operators’ preferences into account, negotiate with them, and foresee what may happen. They attempt to anticipate disturbances that may arise in this uncertain context. Despite these strategies, some vacancies remain due to a failure to maintain robustness at the end of the scheduling’s process. These results lead us to focus on the conditions, especially collective conditions of the robustness’ construction to dealing with uncertainties.
Can Borg’s RPE-scale be used as an estimate of workday energy consumption in physically demanding work?

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Background

It has been observed in experimental studies that rating physical exertion on Borg’s RPE-scale [1] strongly correlates with heart-rate, e.g. \( r = 0.74 \) [2], during physical training in laboratories. These associations have exclusively been demonstrated on populations that have been very well-fitted, on subjects that have undergone some kind of rehabilitation or on larger populations where the subjects had been cycling on ergometers. To our knowledge, this association has never been tested among a specific occupational group.

Methods

Full workday heart rate measurements were performed on 54 voluntary garbage collectors in different geographical places in Sweden, and in three different types of communities, apartment buildings, own houses and country side. They were 42 (SD 26) years, 1.79 (0.16) m tall, and weighted 84 (25) kg. Two of the 54 workers were women.

From the breaks-excluded average heart-rate, also the corresponding percentage of their individual Heart rate reserve (HRR, the range between resting heart rate and the age-estimated maximum heart rate), was computed.

The variable RPE was the answer given just after the workday, to the question “How physically demanding do you rate this workday?” on Borg’s 6-20 RPE-scale where 6 means “Not at all” and 20 means “Maximum”. For a well-fitted individual a given value of RPE multiplied by 10 is supposed to estimate an exercising heart rate.

Pearson’s correlation was calculated between RPE and Heart rate, and between RPE and %HRR for all study persons, within three different age groups: \(<=34\), 35-49 and \(>=50\) years respectively and within three groups with different number of years worked as a garbage collector: \(<=5\) years; 6-20 years and \(>20\) years respectively.

Results

The mean heart rate was 99 (SD 26) bpm and the mean used HRR was 28.1 (13.6) %. The mean RPE was 13 (5).

None of the correlations was significantly higher than 0. The correlation between RPE and heart rate was 0.05, and the correlation between RPE and %HRR was 0.12. Within the age groups and number of years worked as a garbage collector, the heart rate correlations varied between 0.02 and 0.45, and the %HRR correlations varied between -0.22 and 0.45.
Conclusion

Borg's RPE-scale does not seem to be a good estimate of workday energy consumption, since correlations were significantly different from 0. An explanation could be that the worker put other cardiovascularly heavy/non-heavy aspects into the question, as psychosocially demanding tasks, and or specific heavy tasks in limited periods of the day.
Theoretical impact of workplace-based primary prevention of lumbar disc surgery in a French region: a pilot study

Type: Abstract Oral Presentation

Category: Others

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Introduction: Lumbar disc-related disorders are a main cause of work-related osteoarticular morbidity. Lumbar disc surgery (LDS) has been chosen as sentinel event for the epidemiological surveillance of these disorders since LDS can be identified in the medical databases from public and private hospitals. The aim was to assess the theoretical impact of workplace-based primary interventions designed to reduce exposure to personal and/or work-related risk factors for LDS.

Methods: Cases of LDS were assessed using hospital discharge records for persons aged 20-64 in 2007-8 in the French Pays de la Loire region. Work histories were obtained by postal questionnaire. The analysis was performed on the longest occupation of each entire working life before LDS, only for those employed at the time of surgery. Using work-related attributable fractions (AFEs), we estimated the number of work-related cases of LDS (WR-LDS) in high-risk industry sectors, with more than ten LDS cases reported. We simulated three theoretical scenarios of workplace-based primary prevention for sectors at risk: a mono-component work-centered intervention reducing the incidence of WR-LDS by 10% (10%-WI), and two multicomponent global interventions reducing the incidence of all cases of LDS by 5% (5%-GI) and 10% (10%-GI) by targeting personal and occupational risk factors. The preventive efficiency was estimated as the ratio of LDS hypothetically avoided / total number of LDS in the sector considered.

Results: Four industry sectors were at high risk of LDS in the region, amounting to 435 [351-532] LDS cases, of which 152 [68-253] were WR-LDS: construction and information & communication for men; wholesale & retail trade and accommodation & food service activities for women. AFE was limited for each industry sector, 30%, 50%, 33% and 55%, respectively. The 10%-WI, 5%-GI and 10%-GI scenarios hypothetically prevented 15 [7-25], 22 [18-27] and 44 [35-53] LDS cases among sectors at risk, respectively. For each sector at risk, the hypothetical preventive efficiency was lower for the 10%-WI scenario compared to the 10%-GI and even the 5%-GI scenarios. Thus, for accommodation & food service activities for women (the highest AFE) the preventive efficiency was 5.9% [2.0-13.0] for the 10%-WI scenario, 8.8% [4.1-21.7] for the 10%-GI scenario and 5.9% [2.0-8.7] for the 5%-GI scenario. For construction for men (the lowest AFE) the preventive efficiency was 3.0% [1.2-6.4] for the 10%-WI scenario, 9.7% [6.8-14.5] for the 10%-GI scenario and 5.2% [3.7-7.3] for the 5%-GI scenario.

Discussion: AFEs did not exceed 55%. Prevention scenarios combining actions on personal and occupational risk factors would be more effective than prevention scenarios focused only on occupational risk factors, even with higher incidence reduction targets. This
suggests that, to reduce the incidence of LDS, implementing actions of promotion of health at work would be necessary in addition of actions on occupational risks.
Raising the retirement age characterizes the Italian pension policies as long as many other Western countries. The problems associated with the rise of the working-age population occur at the level of the production sector and at the level of the over 50 age workers safety and health risks, who work in the handling and control of industrial machineries. (ILO, 2015)

The paper presents the results emerging of survey conducted in the metal industry. The sector of mechanical engineering is part of the metal industry, and it deals with machineries and facilities production. Today many people work into the metal industry, especially the over 50 workers.

The physiological changes that characterizes ageing can be summarised as reduction of physical and perceptual capacities, reduction of attention capacities and processing speed of information. Although they could be compensated for experience and knowledge of the tasks, they imply relevant problems in all the working activities especially for the use of complex machineries.

By identifying the over 50 workers as a specific category of users, the design needs require the adaptation of the workstation to prevent any risks related to safety and to incapacity to work. The purpose of this ergonomics evaluation is the raising of safety and usability standard conditions, considering the reduction of physical and perceptual capacities, the reduction of attention capacities as main feature of over 50 users.

This is the case of OCEM 2 company. It is made up of workers aged between 22 and 54, and it bases its know-how on making single-layer presses and double-layer presses for the production of indoor and outdoor tiles.

The project in question aims to an ergonomic evaluation of 6 workstations in the carpentry and assembly departments.

The purpose of research project is to improve current workstations through an euristic evaluation of users risks conditions, using the methodological approach of ergonomics for design and its theoretical and operational tools, as Task Analysis, Users observation, Thinking Aloud, questionnaires and interviews. The aim of the results is to provide the basis for developing the design phase and to improve users risk conditions, usability and users comfort.
Physical anthropometry in Ergonomics studies seeks to apply the knowledge of body size to the design of workplaces adapted to human characteristics. The present study, which is currently underway, has the objective of associating the anthropometric dimensions of a sample of Chilean university students with the furniture used in classrooms. The ultimate goal is to propose suitable standards for Chilean universities.

18 body dimensions were measured in a sample of 259 students, 113 female, and 146 male, using a Harpenden anthropometer (Holtain Ltd.U.K®). The 19 anthropometric dimensions are those recommended in the Chilean Standard 2639-2002, which is based on the international proposal of the ISO 7250 standard. For the evaluation of the furniture, a metallic metric tape was used. To date, the furniture of 35 university classrooms has been evaluated.

Mean values, standard deviations and percentile 5 and 95 were calculated for males and females and for the whole group. Average stature was 160.9 cm for women and 173.9 for men. As average, male and female students were taller than reported in a study of anthropometric characteristics of Chilean population recently published by Castelluci et al (2017). The trend for University students to be taller has also been demonstrated in Chile in previous studies, Apud et al (1999 - 2009).

The analysis of the relationship between body size of the students and the furniture they use, which will be analysed with examples in this communication, showed deficiencies not only in size of computer stations, chairs and tables, but also in the design and maintenance making them even more uncomfortable, particularly for those students who spend long time in sitting posture. Furthermore, all students use the same furniture without any consideration for differences in body size. In this respect, the discussion is centered on the need to take as reference the extremes of 5th and 95th percentile of the students population, but more important is to establish the distribution of body dimensions, at least for a basic set of measurements for seats and tables design, also with inclusive criteria for populations with special needs.

As a conclusion, although the ideal will be to have furniture that could be regulated to the size of each individual, this is not realistic in developing countries. Therefore, a proposal will be presented for a standard of furniture to be used by university students, based on the distribution of body size. Also, a discussion is made on the need to determine the number of different sizes of furniture according to the distribution of body dimensions. The final goal is to advance towards a standardization which allows students to develop their activities in comfortable conditions.
Inclusive design strategies to enhance inclusivity for all in public transportation - A case study on a railway station

Type: Abstract Oral Presentation
Category: Transport

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Transportation systems should be accessible to everyone. Depending on how the environments are designed, they affect people in different ways; physically, psychologically, emotionally and socially.

The purpose of this study is, through application of inclusive design theories, to propose ideas for strategies to improve the suitability of public transportation centers for all travelers, with special emphasis on elderly, people with mobility impairments or impaired vision. The central railway station in Gothenburg, Sweden has been used as study object. Following context tasks were analyzed:

How is significant information regarding transportation found?

How can passengers orientate in and around the railway station?

How can passengers locate and manage purchase of refreshments?

The procedure for the analysis was:

1. Studying needs and demands of the target groups, using literature, observations and interviews
2. Exploring the context to identify problem areas, using observations and interviews
3. Assembling requirement lists based on users’ special needs and context tasks
4. Compiling strategies based on requirements and reflections concerning special needs

The results show that most people plan their trip in advance by buying tickets online and arrive at the station close to departure time. People with disabilities often need time to find necessary information and locate right track, train or other transportation options. If late changes are made, they have difficulties to perceive the information and locate new tracks or replacement busses. Most elderly want personal service to feel secure, not having to study information screens or listen to audio messages. Visually impaired persons required better placing of information signs and a layout that enhance the readability and intelligibility. They also highlighted the lack of information signs at the tracks and the importance of a uniform design of the ground structure for enhanced localization for people using white
canes. They also appreciated if all train companies could offer a mobile application giving a description where to stand on the platform to reach their seat when boarding. Comments regarding restaurants and cafes were that they often are designed for customers on the go, and rarely offer suitable seating for users with physical impairments.

To conclude, the results show that a variety of inclusive design strategies are needed to enhance the perception of inclusivity for all people in public transportation. One strategy is to take into consideration that disabilities can be situation based, which means that appropriate design guidelines should be used for improving understanding, mobility and user experience related to the specific environment. Another is to reflect on the amount and clarity of visual and audible information. Mobile applications concerning information and orientation could be developed using human factors design guidelines. An important strategy is also to involve users with various deficiencies in all parts of the redesign process.
The operator system consists of all elements of the user interface to the vehicle: Interiors, actuators, and seats. To ensure operator efficiency, well-being and health, the components must be analyzed and developed on a system level.

The product development process at Grammer AG has defined perceived quality as its guiding theme. Its foundation is deducting design requirements from understanding users and use cases for the respective product applications. Experiencing comfort in user-product interaction is the result of internal human computing of sensory input into a holistic impression in a fluid process over interaction time, and the comfort definition and target is thus: an overall positive user interaction experience with a product.

The field of ergonomics provides the compendium for analyzing and rating the interaction between user and product. Its goal is to understand the interaction system fully and optimize this interaction. In order to be able to do this, human beings in their variation are the foundation. Grammer Ergonomics is the hub for planning and distributing all ergonomic content as applicable. The Ergo-Innovationlab provides the scope of perceived quality testing, and performs innovation verification in its six domains anthropometrics, ergomechanics, perception, thermal comfort, seat comfort testing and variable environments. To expand content and capacity, there are strategic partnerships in the research partner network, for instance in spine research. The developed product range encompasses driver and passenger seats for trucks, agriculture and construction equipment, fork lift trucks, bus, rail, multifunctional armrests, and automotive components such as head restraints, armrests, and center consoles. Recent topics have been supporting the human spine in rotated positions, product layout for global user populations, seat and vehicle operation concepts, and benefits of haptic feedback. The development of associated ergonomic tools and methods is a continuous process. It is connected to permanently changing parameters (moving targets), such as new technologies that influence vehicles and workplaces, e.g.: autonomous driving, connectivity and smart products.
INTERVENTI DI SOSTEGNO INAIL AL REINSERIMENTO LAVORATIVO DELLE PERSONE CON DISABILITÀ DA LAVORO: PROGETTI DI ADATTAMENTO DELLA POSTAZIONE DI LAVORO E ABBATTIMENTO DELLE BARRIERE ARCHITETTONICHE

P. Anzidei1, L. De Filippo2, L. Frusteri1; Annamaria Iotti3; F. Nappi1; L. Prestinenza2; D. Sani2

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Abstract

L’articolo 1, comma 166, della legge 23 dicembre 2014, n. 190, ha attribuito all’Inail competenze in materia di reinserimento e di integrazione lavorativa delle persone con disabilità da lavoro, completando il modello di tutela del lavoratore infortunato o tecnopatico attraverso il suo reinserimento lavorativo oltre che sociale. I destinatari sono i lavoratori tutelati dall’Inail che, a causa di menomazioni o limitazioni funzionali dovute a infortunio sul lavoro o a malattia professionale, necessitano di interventi che consentano o agevolino la prosecuzione dell’attività lavorativa.

Per questi soggetti l’Inail realizza progetti personalizzati con lo scopo di reinserrirli nel mondo del lavoro; priorità è riservata alla conservazione del medesimo impiego ma è fornito supporto anche per la ricerca di nuova occupazione. Sono finanziati, quindi, interventi di ristrutturazione per il superamento o l’abbattimento delle barriere architettoniche e/o di adattamento delle postazioni di lavoro e interventi formativi di riqualificazione professionale.

La norma prevede tre tipologie di intervento per la conservazione del posto di lavoro:
a) interventi di superamento e di abbattimento delle barriere architettoniche nei luoghi di lavoro (interventi edilizi, impiantistici e domotici, dispositivi finalized a consentire l’accessibilità e la fruibilità degli ambienti di lavoro);

b) interventi di adeguamento e di adattamento delle postazioni di lavoro (adeguamento degli arredi della postazione di lavoro, ausili e dispositivi tecnologici, informatici o di automazione funzionali all’adeguamento della postazione o delle attrezzature di lavoro, comandi speciali e adattamenti di veicoli costituenti strumento di lavoro);

c) interventi di formazione e addestramento all’utilizzo delle postazioni e delle relative attrezzature di lavoro connessi agli adeguamenti.

Alla luce delle prime esperienze operative, nel presente lavoro viene illustrato l’apporto della Consulenza tecnica accertamento rischi e prevenzione e della Consulenza tecnica dell’Inail nella realizzazione dei progetti personalizzati di reinserimento lavorativo.

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Background: Ankle-foot orthoses, AFOs, are required for some persons to perform their jobs. The performance and cost of AFOs is often limited by plaster molding fabrication methods required to custom fit each user. 3D scanners and printers could make it possible to mass produce customized AFOs, but models that consider individual capacities and job tasks demands are needed for the designing AFOs that satisfy users' needs.

Objective: This work aims to develop a model that can be used to design an AFO that best meets the demands of a given worker performing a given task. This paper describes a pilot study for collecting foot movement data that can used to inform the development of a kinematic model for evaluating gait patterns and designing AFOs.

Method: Two patients with ankle disabilities were recruited and asked to perform three walks with different footwear (normal shoes, medium-stiff AFOs (3.6 N-m/deg), and stiff AFOs (4.5 N-m/deg) from -5° (dorsiflexion) ~ 15° (plantarflexion)). LEGSys+TM IMU system is used to measure sagittal kinematics for the affected and unaffected limb.

Results: Step length for the impaired limbs was significantly (p<0.05) longer than the unimpaired extremities (0.61 m ± 0.03 m v. 0.43 m ± 0.03 m). The step lengths for the affected limbs with either AFO was significantly greater (about 10%) than the affected limb not wearing an AFO. Step length for the affected limb was slightly smaller for the stiff AFO (about 6%). Knee flexion angle of unimpaired limbs at initial foot contact were significantly greater for regular shoes trials than AFO trials (11° ± 3° v. 4° ± 3°).

Conclusion: Based on a kinematic analysis of the observed data, we hypothesize that the impairment results in reduced ability to propel the body during the swing of the unaffected limb. We also hypothesize that subjects shorten their step length for the stiff AFO to reduced foot angle at heel contact. Additional subjects and trials are required to fully develop a kinematic model and to test the model under various work conditions.
[724] Information for users as a key system element to delivering a better healthcare service

Type: Abstract Oral Presentation
Category: Healthcare

Zuli T. Galindo-Estupiñan¹; Carlos Aceves-Gonzalez¹; John A. Rey-Galindo¹; Elvia Luz Gonzalez-Muñoz²

¹Universidad de Guadalajara, Guadalajara, Mexico

Design of healthcare services should consider the capabilities and needs of users, as well as the diversity of them, with the purpose of delivering an efficient, effective and satisfactory service. The information delivery by the service providers is one of the elements of the system that allow that users have a clear idea about how to use the service also the affects its perceived quality.

This case of the study was carried out in the external consultation service that provides the Neurological Department in a healthcare institution in Mexico. The patients of this service suffer chronic diseases like epilepsy, Parkinson, multiple sclerosis, dementia and other pathologies. Depending on the patient's health state could lose the sensory capabilities as well as the motor deficiency and cognitive deterioration. Additionally, some of these patients have to go to the service with another person because they depend on other people to mobilize and help with other needs. The aim of this study was to identify the information needs of users in two stages in external consultation service.

The study compiled 11 interviews with staff members and 32 questionnaires with users, patients as well as caregivers. The results show that in general, the patients were satisfied with the information received during the stages analyzed. Nevertheless, the users manifest the need to receive information about: the waiting time for the consultation, the physician that will attend them and the medical and administrative procedures that they have to do. Some considerations for the information redesign is the limited ability that has the more vulnerable users, those with sensorial or cognitive capabilities reduced due to the diseases that affect them or for the aging itself.

The information has a huge importance in the service due to this allow that users know which steps to follow during the service stages, with that knowledge they could drop the uncertainty. Uncertainty has been directly related to user’s satisfaction perception in services delivery. The results of this research emphasize the need to give information not only with a face to face but using another communication channel to support the information delivery. For that reason is important to concentrate on the service information design that would be delivered to the users also taking into the consideration the user’s needs and abilities.
Assessment of Job Rotation Effects for Lifting Jobs Using Fatigue Failure Analysis

Type: Abstract Oral Presentation
Category: Manufacturing

Sean Gallagher1; Mark Schall, Jr.1; Richard Sesek1; Rong Huangfu1
1Auburn University, Auburn, AL, USA

Many companies use job rotation as a method to control MSDs in the workplace. However, evidence regarding the effectiveness of this method in reducing MSDs is equivocal. A recent systematic review concluded that weak evidence existed regarding the efficacy of job rotation as a method for MSD reduction, with most showing no clear evidence (Padula et al., 2017).

A particular difficulty is quantification of MSD exposure associated with job rotation strategies. Fortunately, fatigue failure theory provides a method of calculating the effects associated with job rotation schemes. In the current analysis, we use the LiFFT low back risk assessment tool (Gallagher et al., 2017) to assess the efficacy of using a job rotation strategy to balance three jobs: one involving high low back risk, one medium, and one low back risk. The LiFFT risk assessment tool is based on fatigue failure theory and uses the peak load moment and the number of task repetitions associated with a lifting task to develop a “daily dose” of exposure. This tool has been validated against two epidemiological studies and has been shown to be significantly associated with low back outcomes (Gallagher et al., 2017).

In the present job rotation analysis, we developed three different mono-task lifting jobs having 20%, 40%, and 60% probability of high risk group membership (Marras et al., 1993) using the LiFFT cumulative damage measure (each assuming an 8 hour workday). Each mono-task job required 486 lifts per workday, with peak moments of 27.3, 58.5, and 97.5 foot-pounds for low, medium, and high-risk jobs, respectively. These are summarized in Table 1.

<table>
<thead>
<tr>
<th>Task</th>
<th>Peak Moment</th>
<th>Repeated</th>
<th>Cumulative Damage</th>
<th>High Back Risk Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>27.3</td>
<td>486</td>
<td>0.0662</td>
<td>20%</td>
</tr>
<tr>
<td>Med Risk</td>
<td>58.5</td>
<td>486</td>
<td>0.1015</td>
<td>40%</td>
</tr>
<tr>
<td>High Risk</td>
<td>97.5</td>
<td>486</td>
<td>0.1103</td>
<td>60%</td>
</tr>
</tbody>
</table>

The job rotation scheme to balance the risk of these jobs was designed such that each worker would rotate through each job (a third of the time at each station). Thus, workers would perform 162 repetitions at each job. The LiFFT tool was used to calculate the estimated risk associated the job rotation scheme.

Table 2 provides the assessment of the job rotation method. As can be seen, the rotation scheme results in an exposure that is high risk (> 50% injury risk) for each employee participating in the rotation. In terms of cumulative damage, the high-risk job accounted for...
86.8% of the total damage, while the medium job accounted for 11.6%, and the easy job 2.6%.

The results of the job rotation scheme are that the low-risk job becomes high risk, the medium-risk job becomes high risk, and the high-risk job stays high risk. This result stems from the fact that exposing the lower-risk workers to the high-risk task (even for a portion of the workday) has a substantial effect on their total daily load, accounting for 87% of the cumulative damage sustained during the job rotation.
Validation of the Lifting Fatigue Failure Tool (LiFFT)

Type: Abstract Oral Presentation
Category: Manufacturing
Sean Gallagher¹; Richard Sesek¹; Mark Schall, Jr.¹; Rong Huangfu¹
¹Auburn University, Auburn, AL, USA

LiFFT is an easy-to-use risk assessment tool for evaluating the demands of manual lifting tasks. LiFFT is based on fatigue failure theory, which allows assessment of cumulative damage due to repeated stress. Only three pieces of information are needed: 1) load weight; 2) maximum horizontal distance from the hip joint to the load during the lift; and 3) the number of repetitions performed during the workday. The purpose of LiFFT is to determine the cumulative low back load experienced during a workday.

LiFFT uses a fatigue failure curve based on previous work on cadaver spinal motion segments (Brinckmann et al. 1988; Gallagher et al. 2007). Given a peak load moment, an estimate of compression is derived and compared to an average spine compressive strength (Jager and Luttmann, 1991) to develop an estimate of the damage per cycle (DPC) for that task. The DPC is multiplied by the number of repetitions to obtain a cumulative damage (CD) estimate for the task. If multiple lifting tasks are performed, CD estimates for each task are summed to obtain a “daily dose” of cumulative damage.

Two epidemiological databases were used to validate LiFFT. The first was the lumbar motion monitor (LMM) database (Zurada et al., 1997). Low-risk jobs were those having no injuries or turnover for the preceding three years. High-risk jobs were those having at least 12 injuries per 100 person-years. In this study, the unit of analysis was the job rather than the individual, thus control for individual characteristics was not possible. The second database was from an epidemiological study from an automotive manufacturer (Sesek, 1999). A total of 304 jobs involving lifting tasks were analyzed to validate LiFFT. Of these, four separate outcomes were analyzed. Subsets ranged from 179-304 subjects and outcomes involved current pain or pain last year, and attribution as to whether the current job has eased (scores of 4,5) or exacerbated (1,2) symptoms. These data were controlled for manufacturing site, age, sex, and BMI. While the LMM database consisted of mono-task jobs, the automotive database included multiple lifting tasks, for which CD was summed across tasks.

Results for the LMM and automotive studies are shown in Tables 1 and 2. The log of the continuous LiFFT CD measure was significantly associated with the probability of a high-risk job in the LMM database (OR = 2.78, 95% CI = [2.02,3.83]). For the automotive database, the LiFFT CD measure (Table 2), controlled for site, gender, age and BMI, also demonstrated significant ORs for all 4 outcomes (ranging from 1.22-1.51).

This validation study demonstrates that the cumulative damage metric of the LiFFT risk assessment tool is significantly associated with the prevalence of low back outcomes in two separate cross-sectional studies.
Table 1. Results of logistic regression analysis assessing the relationship between the LIFT log OR measure (continuous variable) and the probability of a job being high risk (OR = 1.00 per 100 person-years/Marano et al., 1999). (Note: all study components job-level risk and OR are adjusted for individual characteristics.)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>df</th>
<th>Chi sq</th>
<th>p</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability Job in High Risk</td>
<td>1</td>
<td>33.22</td>
<td>0.001</td>
<td>1.78</td>
<td>(2.02, 3.83)</td>
</tr>
</tbody>
</table>

Table 2. Results of logistic regression analyses examining the relationship between the LIFT log OR measure (continuous variable) and low back outcomes from a cross-sectional longitudinal study of 7425 participants from a large automaker manufacturer [Leach, 1999]. Results are controlled for site, age, sex, and BMI.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>df</th>
<th>Chi sq</th>
<th>p</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBP Last Year (L v. S)</td>
<td>1</td>
<td>4.79</td>
<td>0.029</td>
<td>1.43</td>
<td>(1.05, 1.94)</td>
</tr>
<tr>
<td>LBP Last Year (L v. S)</td>
<td>1</td>
<td>6.08</td>
<td>0.012</td>
<td>1.22</td>
<td>(1.04, 1.43)</td>
</tr>
<tr>
<td>LBP Today (L v. S)</td>
<td>1</td>
<td>4.95</td>
<td>0.026</td>
<td>1.49</td>
<td>(1.07, 2.07)</td>
</tr>
<tr>
<td>LBP Today (L v. S)</td>
<td>1</td>
<td>6.25</td>
<td>0.012</td>
<td>1.23</td>
<td>(1.04, 1.45)</td>
</tr>
</tbody>
</table>
A common tool for workplace design is digital human modelling software in which the work process is simulated by a virtual manikin. A major drawback of this type of simulation is that the motion of the virtual manikin is based on research focusing on single motions (e.g., symmetric lifting), whereas in industry real workers conduct multiple-task processes that include a sequence of several tasks (e.g., sequential lifting, turning, and carrying) in which different actions are combined (e.g., turning the body during lifting). Thus, motion prediction and hence the joint load of current digital human modelling technologies are not accurate. Additional drawbacks of most current human modelling software systems for ergonomics design are that they use a quasi-static calculation of the load and that they do not include muscle modeling. The objective of this study is to address these drawbacks by developing a simulation for motion prediction for multiple-task manual material-handling jobs, based on motion optimization. The simulation was conducted using the OpenSim™ platform (Opensim, NCSRR, Stanford, USA), which is a tool for simulating human motion that takes into consideration the dynamics of the motion (e.g. acceleration and moment of inertia) and enables the user to calculate joint moment, muscle force, and metabolic rate. As a first attempt, we simulated a simple reaching movement. The inputs for the simulation were the initial location of the virtual manikin and the initial and final locations of the target. The best solution for the motion prediction was found using an optimization algorithm that minimized one of two objective functions: 1) total work of the joints, or 2) jerk. To obtain this solution, we examined two optimization methods: fminsearch (by Matlab) and a genetic algorithm. Finally, the best solutions that were obtained by the optimization procedure were compared to the real motion of human subjects. Our preliminary results showed that the motion outputted as the optimal motion by each of the objective functions was very similar to real human motion. For the shoulder angle, the best solution using the fminsearch method and minimizing the total work resulted in a RMSE of 2.65 degrees in comparison to real human motion. Moreover, the best solution resulted in total work of 22 joules, which is a mere 12 joules less than the work during the real motion that was recorded and constitutes an improvement of 89% relative to the initial solution examined by the optimization procedure. On the basis of these results, we believe that, by using an optimization procedure that takes into consideration both the work of the joints and jerk, we should be able to predict a human multi-task-job motion and to simulate it with proximity to real human motion by using a virtual manikin.
The dialogue workshop, a method to analyze the coordination needs between heterogeneous stakeholders for risk prevention in micro and small enterprises (MSEs)

Type: Abstract Oral Presentation
Category: Others

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1 Pacte Laboratory, Grenoble, France; 2 INRS, Nancy, France; 3 LIP Laboratory, Grenoble, France

Objectives: The aim is to describe the coordination conditions between OSH advisors and professional organisations in order to develop good practices in risk prevention in MSEs. Owner-managers of MSEs often have difficulties in applying OSH legislation and a lack of time and skills for doing it. Moreover, OSH is not their priority: the business market is a higher concern, they rather have a reactive attitude towards occupational risks. We will here explore a determining factor to develop risk prevention in MSEs: the role of the stakeholders' coordination to create a prevention program in two case studies conducted in both the road transport and construction sectors.

Method: This study examines the French context of the Sesame research, financed by EU-OSHA. This research involved nine EU Member States (2014 - 2017) in order to explore barriers, facilitators and good practices in OSH, and to increase knowledge about determining factors. In France, we compared two networks having different OSH intermediaries that developed risk prevention actions in MSEs adapted to both studied sectors. Before choosing these networks, we had inventory and selected good practices programs (4). For each of them, collective interviews (2) were made with their leader(s), completed by individual interviews with different stakeholders of the program (4).

Discussion groups were conducted during a one-day dialogue workshop with different stakeholders (OSH regulators, OSH advisors, professional organisations, worker and employer representations) of these programs. This dialogue workshop was made of discussion groups in two distinct times: 1/ by sector of activity about roles, practices, incentives and obstacles in OSH activities in MSEs, 2/ between peers about strategies and needs in OSH activities in MSEs for each type of stakeholder.

Results:

Few MSEs are visited by labor inspection and few occupational health services are used by MSEs as a support in risk prevention. Most of the time, OSH advisors can hardly contact them directly. And when an MSE have a question about OSH, it often contacts the intermediaries to be helped. Advices related to risk prevention are given by professional partners or private services. The cooperation between professional organisations and OSH advisors seems necessary to develop a proactive approach. The stakeholders’ coordination in a network is a major stake to create a specific program, considering the particular needs of the professional branch. The collaboration between different partners offers various supports to help MSEs: advices for safer equipment, tools to make the risk
assessment, online trainings about safety. The network created between different stakeholders can improve the prevention efficiency in MSEs. Then, we must continue to enable stakeholders' meetings, to coordinate their actions in MSEs. We need to be able to better identify their networks, support and pilot them.
In order to evaluate reach-and-grasp conditions, both hand tracking and finger tracking are usually involved to drive the virtual hand motion and deformation. In this paper, a novel approach to reach-and-grasp tasks is proposed which needs only tracking the hand's 6-dof motions. To find a simple yet effective way for reach-and-grasp operations, the proposed method incorporates intuitive virtual grasping heuristics and neurophysiology results which stated that fingertip motions for reach-and-grasp movements to a variety of objects tended to follow particular curved paths. A comparative study has been performed under the same grasping conditions between the proposed method and an intuitive virtual grasping method which uses both hand tracking and finger tracking devices. It is shown from the experimental results that the proposed method is better in complete time, accuracy and 3 subjective criteria. The proposed approach has been verified using a simple demo application.
Musculoskeletal disorders (MSD) represent a long standing workplace safety issue both in Australia and worldwide. Despite the development of systems to gather, analyse and report detailed information on MSDs, organisations do not appear to be extracting sufficient knowledge to support prevention. A research project entitled ‘Learning the Lessons from WMSDs: A framework for reporting and investigation’ was funded in 2014 by the Institute for Safety, Compensation and Recovery Research (ISCRR). ISCRR was established in 2009 as a collaboration between Monash University, WorkSafe Victoria and Victoria’s Transport Accident Commission to facilitate research and best practice in injury prevention, rehabilitation and compensation.

This research project aimed to develop a practical framework for optimising learning from reports and investigations into work-related MSD. This project was of interest to the Human Factors and Ergonomics Unit (HFEU) at WorkSafe Victoria due to the close alignment with a provision in the Victorian Occupational Health and Safety (OHS) legislation. The OHS Regulations (2007) – Manual Handling Chapter outlines the legal requirement for employers to review, and if necessary revise, manual handling risk control measures following the report of a musculoskeletal disorder. The goal of the translation was to develop a practical framework which aligns with the legislation so it could be used by the Regulator to develop practical guidance for employers and other end users. Previous research highlights the challenges faced by researchers in translating research findings into policy and practice. Similar challenges are also faced by regulators. This presentation will provide an
overview of the translation process and present the issues regulators face in translating research into practice for employers and others.

The research translation process used a participatory approach that was facilitated by ISCRR, with the research team and WorkSafe’s HFEU interacting regularly to increase each other's understanding of framework used in the research project, the framework of the OHS legislation and the terminology, including legal definitions. This interaction helped significantly to enable subsequent translation of the research results and a plan was developed by ISCRR with the HFEU and the research team as findings began to emerge. During the course of this project WorkSafe Victoria added to the participatory approach by engaging with employer and employee representatives to gain buy-in and seek feedback on practical measures for implementation. This translation process will be elaborated upon in this presentation. Discussion will also focus on the challenges and key outcomes from the project.

References


Presenting author biography:

Alison Gembarovski is the Principal Ergonomist and manager of the Ergonomics and Human Factors Unit at WorkSafe Victoria. She has had >25 years’ experience both as a physiotherapist and an ergonomist. In her capacity at the WorkSafe Victoria she has worked in a diverse range of industry sectors including textiles, food, automotive, sawmilling, forestry, home and community care, children’s services and emergency services. Her main area of interest is on the translation of evidence into practice and on the prevention of musculoskeletal disorders (MSD) and the role that organisational factors play in the development of MSD and other health outcomes.
The city of Limeira is officially designated as the jewel capital of Brazil, besides being recognized in the world scenery in this productive sector. When looking up this successful data from financial point of view, we notice it comes promptly accompanied by income and competition discussions, among others market characteristics. But what is not announced is that the high volume of earrings, bracelets and rings that are daily handed out to stores and consumers all around the planet, hold a quiet specific manufacture, merged with art and little automation, in addition to being developed by informal workers, in great part and child labor. Despite these phenomenon, little about the work itself is known, its content, in what manner and under what conditions it is fulfilled by workers.

This research aimed to evidence the work aspects of the most important production sector in the city of Limeira, Sao Paulo, the semi-jewels. Its nature and decisive features involved were focused, because once it has implicated in degraded consequences to society, new knowledge about it can contribute to understanding the situation and to future changes.

The Ergonomic Work Analysis (EWA) was the method used to guide and tell something about the immeasurable experience and dedication of these artist workers, without whom none of the financial results would be achieved. The study developed throughout the year of 2016 took place in three formal factories in the city and revealed issues that confront the complexity to produce handcrafted in large-scale delivery, facing intense variety of products, situations and conditions. According to the initial will to understanding the work, but also it as part of the city context, the EWA applied was most deeply emerged in one of companies, in which more intrinsic details about the activity were shown, allowing emphasis to more evident results on: how the formal and informal work are connected and complementing; and how these workers make do to respond to free market.

The everyday routine in the factories is marked by on-demand requests, in addition to products being customized not only in their design characteristics, but also in the volume dimension, being possible to require dozens to thousands of vary products in a short static deadline. The knowledge and work demanded go as far from creating and assembling, through services and after-sale activities, up to analysis and managing of costs and logistics, making these workers the greater richness of this production.

Keywords: Ergonomics, Ergonomic Work Analysis, Semi-jewels.
ABSTRACT: Studies in the field of ergonomics of the activity are still scarce for the understanding of the work developed in the maintenance of transmission lines of the electric power industry. In the last years, this sector has undergone considerable changes, highlighting the privatization process and the increasing use of outsourced services, which contributed to the increase in the number of accidents (SILVA, 2015). When dealing with accidents, they are often attributed to "human error". However, to say that "human error" is the cause of an accident is a simplification that does not favor prevention. Often, errors are consequences of characteristics of the situation that did not allow operators and "collectives" to mobilize their skills in a relevant way (DANIELLOU; SIMARD; BOISSIÈRES, 2010). Some questions regarding this industry, and especially the activity of maintenance of transmission lines, can be raised: What physical, cognitive and psychosocial demands caused by the maintenance activities of transmission lines, more specifically in live lines (LV) ? How do such factors influence the health of the individual? In this way, the objective of this project is to identify ergonomic and psychosocial aspects of the maintenance activities of electric power transmission lines, taking into account the human and organizational factors of the activity. The aim is to achieve this objective through an assessment of the physical and psychosocial requirements, considering human and organizational factors of the maintenance activities of transmission lines (LV) of an electric power utility in the State of São Paulo, Brazil. The evaluation of the work of the electricians, focusing on Medium Voltage Live Line (LV), will be carried out according to the method of Ergonomic Analysis of Work (AET) described by Guérin et al. (2001). The research is underway and the concessionaire studied employs 5,000 electricians, including 530 LV electricians. In the Live Line activities using the Air Basket, the electrician remains in the basket in the same position for long periods, working with raised arms and / or stretched arms and performing repetitive movements, supporting weight, overloading muscle groups, generating pain complaints in the upper limbs in almost all professionals. In addition to the environmental and biomechanical risks involved in this activity, there is also a high psychic demand as organizational factors become more relevant due to the increase in workload and deadlines pressures, associated with the need not to interrupt supply of electricity, due to the evaluation criteria determined by the Brazilian National Regulatory Agency.
TEXT NECK, MORE TECHNOLOGY, LESS HEALTH?

Abstract

The term text neck or neck of text is a term introduced by Dr Dean Firshman and that has taken force little by little, and is described as the result of the excessive use of the mobile, typical of those who keep their heads too long downward and forward to see your cell phone. The repetition and constancy of this position can generate a permanent injury, whose main cause is the weight of the head.

According to the study "Evaluation of tensions in the cervical spine and posture caused by the position of the head" published by the surgeon Kenneth Hansraj, our head weighs between 4.5 and 5.5 kg. However, depending on the angle you are in, the effective weight increases. That is, if the head is at 15 °, the effective weight, which falls on the neck reaches 12.25 kg, this is the case when handling a mobile device (Smartphone, Tablet, among others). Typical symptoms are headache, pain in shoulders and neck.
Likewise. In Colombia in 2015, a survey conducted by Deloitte was applied, where issues related to the types of devices that are possessed, connectivity and usage trends were addressed. It was answered by a thousand people, men and women between the ages of 16 and 44, including people from the rural and urban sectors.

"For thousands of consumers in Colombia, the smartphone has become the most personal item and its most prized company (to become almost an extension of your body). It has become essential, accompanies us and participates in many of our daily routines and is the conduit for many of our social interactions," said Nelson Valero, of Deloitte in Colombia. It reveals the survey that users were asked about the frequency of use and it was found that the youngest are the most connected. 57% of people with less than 24 years of age consult their telephone more than 50 times a day, compared to 37% of people over 35 who consult it with the same frequency.

With this in mind, we set out to investigate the effects of the excessive use of these mobile devices on 95 young people, aged 17 to 36 years old, which, as the study conducted by Deloitte tells us, is the most exposed population when using these devices.

**Keywords:** technology, text neck, pain, mobile devices, symptomatology, frequency.
[2076] Exploring the relationships among safety climate, job satisfaction, organizational commitment and healthcare performance

Type: Abstract Oral Presentation

Category: Healthcare

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Using data from large-scale survey of some 65,000 healthcare professionals in Italy, we explore the relationships among safety perceptions, self-reported levels of job satisfaction and organizational commitment and objective performance measures.

This work aims at contributing a nascent stream of research that investigates how safety climate predicts variables beyond safety outcomes (Huang et al., 2016; Smith, 2017), such as self-reported levels of job satisfaction and organizational commitment. Whereas most previous studies in this area exclusively rely on personnel data, we also analyse how safety perceptions, organizational commitment and job satisfaction jointly predict healthcare performance as measured through objective multidimensional indicators (Nuti and Vainieri, 2016).

In order to test our hypotheses, we used data collected from an organizational climate survey of the employees of 85 public health authorities from nine Regional Health Systems (RHSs). This survey is an individual-based questionnaire, which contains measures regarding safety climate, job satisfaction, organizational commitment as well as other self-reported attitudes and behaviours. The survey is administered via computer assisted web interviewing (CAWI) on a census basis (Pizzini and Furlan, 2012). The survey has been conducted in a network of RHSs that adopt and fund, on a voluntary basis, a common performance management system (Inter-Regional Performance Evaluation System, IRPES), aimed at collecting the performance data of health authorities for benchmarking (Nuti et al., 2016).

Our findings show that safety perceptions significantly predict job satisfaction, organizational commitment as well as objective measures of healthcare performance. We use structural equation modelling to illuminate multivariate associations among these constructs.
User-Interface and operators: evolution in Computed Tomography -CT- technology

Type: Abstract Oral Presentation
Category: Healthcare

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Computed Tomography – CT - is the most used diagnostic technique for the three-dimensional imaging of patients' body portions. Due to its level of complexity, CT requires expert technicians in order to be effectively operated and its functioning is usually located inside social-technical contexts characterized by a high level of interaction between the system’s components.

The main objective of the study reported here is to analyze the CT operators’ perceptions in relation to the evolution of the technology they use, with a specific focus on the level of usability of the user interface.

To this aim, 6 years ago the technicians of the Emergency Room of the hospital “Santa Maria alle Scotte” in Siena were individually interviewed. 6 operators expressed their opinions in relation to the CT they used paying particular attention to factors as: its complexity, its level of automation, its precision, its level of usability, the level of attention required to operate it properly, the mental workload they experienced, the level of multitasking, its intuitiveness, and the quantity of errors made. The participants in the study were asked to report their opinions about these factors comparing the technology they used 10 years before with the one currently adopted. In addition, they were also required to foresee how it would be in the future. Data were collected on a Likert type 5-point scale.

The results obtained in the first phase of the study didn’t suggest any negative relationship between the technicians and the CT technology: even possible problematic factors like the technology complexity and the relative high number of errors were not evaluated as critical issues. In addition, cognitive overload, multitasking, attentional captures appeared all to be easily managed, probably as a consequence of the high level of experience of the operators.

The results of this still ongoing research will show how the subjective expectations, whether satisfied or denied, have influenced the man-machine relationship at the present time. In addition they will suggest hypotheses for the improvement of the working conditions by suggesting advances in the human-machine interaction.
In line with the dynamism of technologies development, in particular the digital ones, the medical equipments have to be constantly updated and improved.

By considering this continuously evolving complex phenomenon, the study here reported is focused on the Computed Tomography (CT) technology. More specifically, CT is analyzed taking into consideration its evolution both from a functional and from a user-interaction point of view.

Patients are obviously different from each other, and as a consequence CT should evolve towards an increasing customization in order to satisfy different specific necessities. Patients like children, elders and overweight persons, for instance, can often have problems with apnea and immobility, thus demanding for improvements of the imaging and graphics definition in a shorter scan time. Sensitive to these issues, many innovative solutions are now available on the market. However, hospitals and health systems do not always have the budget necessary to continuously acquire highly specific and expensive technology.

The study reported here has a twofold objective.

The first one is specifically focused on the CTs used in the “Le Scotte” hospital of Siena. It implies a comparison between the technology adopted in 2011 and those ones currently used. This analysis is specifically aimed at highlighting possible evolutions in the user interface and to verify whether they are also related to an increase in the usability levels.

The study is also conducted in order to get an overview of the most innovative CTs already available, and it is carried out through a comparative analysis of the major CT producers: GE, Philips, Siemens and Toshiba. The recent introduction on the market of the Dual Source Technology by Siemens, created new scenarios, in particular by revising the standards in diagnosis and by drawing up new types of graphics processing, but it also entailed an increase of the prices. By empirically examining the newest updates in the user interfaces we commit to produce a deeper understanding of a complex situation in which financial resources of health systems, ergonomics and patients’ safety are factors intertwined.

Preliminary findings suggest that technical and ergonomics improvements proceed at different pace, the first being faster than the second. Technical improvements are day by day achieving higher level in the efficiency of the exams and also patients’ safety is reaching acceptable standard levels. Changes in the user interfaces, on the contrary, are
only mediated from other technologies and appear to be, in many ways, not adequately accounting for operators’ characteristics.

Preliminary results are suggesting that these negative considerations, anyway, are mitigated by the operational competence of the technicians which, being very skilled, are able to compensate many usability drawbacks.
How age and pace of work affect movement variability during repetitive assembly tasks.

Type: Abstract Oral Presentation
Category: Others

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During production, companies aim to ensure optimal productivity and quality. With this in mind, workstation designers tend to assume that operators will perform tasks in a uniform manner, and tend not to include movement variability parameters in their designs. The aim of this study was to characterise movement variability during repetitive assembly tasks performed at a defined pace. Particular attention was paid to how two factors influenced this variability: the operator's age – an intrinsic factor – and the pace of work – an extrinsic factor.

Sixty-three right-handed men in three different age groups (junior: 30-35 years old; medium: 45-50 years old; senior: 60-65 years old) voluntarily participated in the experimental protocol, which was performed in a laboratory. Subjects were currently or previously employed in a "physically-demanding" profession, and were asked to perform a repetitive assembly task in conditions close to those encountered at a real-life workstation. Assembly was performed at two defined work paces (comfortable and rapid) over two 20-minute work sessions. How assembly was performed was categorised using a grid to code actions, developed from observation of video recordings of assembly cycles. The duration of assembly cycles was measured. A mixed linear model was used to analyse the number of assembly approaches used, and the duration of assembly cycles was analysed for each operator, each age group and each work pace. In this model, the operator was considered a random effect variable and the age group and pace were fixed effect variables.

Based on combinations of the actions identified in the video-recordings, parts could theoretically be assembled in 144 different ways; 44 of these were observed. In addition, 78.8% of all assemblies performed corresponded to just three assembly approaches. The number of ways in which parts were assembled was not significantly affected by operators' age or the work pace imposed. Moreover, age was not significantly linked to the duration of assembly cycles. For all operators, the duration of an assembly cycle was significantly shorter at the rapid pace than at the comfortable pace.

Variability was observed in assembly approaches when the procedure was not imposed. The variability observed during assembly, as performed for this study, was unaffected by operators' age or the pace of work. No effect of variability was observed on the duration of assembly cycles, nor on the adaptation to changes in pace. In contrast, variability allowed operators alternatives to repetitive movement which could potentially exert strain on the locomotor system. Allowing operators the possibility to spontaneously use variable movements during repetitive tasks appears to be an important element to consider when designing workstations.
A technology corner for operator training in manufacturing tasks

Type: Abstract Oral Presentation
Category: BUSINESS CASE - Education and Training

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This study is part of a project carried on in Fiat Chrysler Automobiles with the aim of introducing innovation and Industry 4.0 technologies in workers' training. Nowadays, the training is performed using a system, called “Manufacturing Training System” (MTS), composed by three different areas: a document area in which there are step method procedures, quick kaizen and operation cards for each work phase; an ability corner with tools useful to perform activities and a simulated production line on which the operator can practice.

Keeping in mind User Center Design principles and focusing on the active engagement of the user in each design stage, what actions can be asked users to perform and what tasks the system has to do automatically, the iterative process with a multidisciplinary design a project was built up. In the first phase, the Cognitive Ergonomists observed and interviewed Team Leaders, workers that coordinate and manage other workers and know critical issues of their domain tasks. In a second phase, “personas” tool with specific characteristics and scenarios were used to analyze users' needs. After that the new training system features were defined.

Thanks to requirement definition, four thematic areas were defined: ergonomics and safety, documents and procedures, equipment and workstation and operating procedures. For each area, the training was divided into informative moment and practice one.

According to this approach, different tools have been chosen for each moment: Augmented Reality for the informative moment, useful for learning and acquiring information and notions, and a training system based on Gamification Techniques. Furthermore, storyboards were proposed as new tool in order to help operators learning. In the nearest future, it will be necessary to implement mock-ups and to text them with workers in order to validate the project hypothesis and to find critical issues and potentiate positive approaches.
The shift to postmodernist thinking comes roughly at the end of the Ulm School period. The Design loses its link with modern utopia leaving a void and sees itself as an orphan of the cultural elite that saw it born – factor that we are sure had a negative impact for the social evolution of the discipline. The work of Gordon Matta-Clark could have offered some answers to fill this void. However, his brief career left no legacy and today almost no physical object remains as heritage of his vision. His glance at the individuality of Man is well illustrated in Conical Intersections or Circus, one of his latest works. Matta-Clark operated his interventions so that they can only be understood through the experience of space. The union between concept, space and object acquire in this work an almost perfect symbiosis. Rachel Whiteread pursues a similar concept, based on hidden relationships, which only through intervention are revealed. In one of her inaugural works, Hot Water Bottle, Whiteread fills a plastic bottle with cement, and after the object is destroyed only the solidified space inside remains. Although our general perception of the object is not altered, the object itself is totally devoid of the original purpose. It ceases to be the membrane that limits space, to become space itself.

Through our cognitive processes, space is nothing more than a cartesian plane, where we operate our lives. The objects we use, or even our body as object, operates through this plateau. Nevertheless, this referential is more than just a relational medium for objects. Through Bruce Nauman’s The Cast of the Space Under My Chair, we want to rethink space not as emptiness of forms, but as the form itself. As a methodology, we propose the juxtaposition between two works, Skyspace Seldon Seen by James Turrell and Houghton Hut by Rachel Whiteread, both as references in space. In James Turrell we find the classical approach of spatial representation, the habitable technical object, the architectural archetype, the space-delimiting membrane. In Whiteread we find exactly the opposite, where space is treated as a technical object itself, a clear result of crystallized space and visible only through intervention, a memory, a monument. This now uninhabitable archetype, encapsulates the form that was imperceptible as an object of its interior space. In the process of analysing the two works, the fundamental basis of the research is to address the questions of how form generates space or, on the other hand, how space can generate a form. In other words, to conduct a dialogue between the disciplines of Architecture and Design, clarifying the ergonomic relationship between the two ways of generating space.
Wayfinding and Communication design and as strategic systems to improve the well-being of children in pediatric hospitals.

Type: Abstract Oral Presentation
Category: Healthcare

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In recent years there has been a growing need to design wayfinding systems and communication more effectively, as we realize the great importance they have in everyday people’s life, becoming necessary and operative guidelines tools for improving the quality of life.

Sometimes these tools are used as simple signposting or mere decorations designed to embellish a specific place, as happens in place dedicated to children. Instead they are very important and strategic instruments able to improve the liveability and usability of specific environment by different kind of users. Among these ones, the children are very particular, because they feel, think and behave in a very different way beside the adults.

Today there are just few examples of wayfinding systems and communication design products, especially designed according to children needs and their psycho-physical and emotional characteristics.

In designing a wayfinding system for children, at first it is necessary to know their skills and abilities, that are different also according to their age. The designer has to refer to their collective imaginary, capturing their interest and stimulating their abilities. Moreover, it is necessary to insert playful elements within the project, an essential factor when designing for this particular kind of user.

Generally, the hospital environment causes a high level of stress in children. Indeed, because of their young ages, they have a very limited experience and therefore they do not have the psychological and emotional state to deal with kind of stressful environment.

Wayfinding systems and communication design products improving the user experience, are able not only to orient children inside unknown spaces, but also to make it “familiar” a place never seen before, making the child feels at ease, avoiding or reducing the stress that this place can bring to the user.

The Design approach starts from the principles of Human Factor Design, and refers especially to the children, that are the main users of the present work. The research considers also the active design guidelines statements that underline the importance of interiors design able to influence the behaviour of people through the environment.

The research used an interdisciplinary approach involving many different actors such as pedagogists, psychologists and pediatricians, that are fundamental to understand children behaviours and emotions, that closely depend on the scenario and the context in which they live.
The aim of the present research is to propose an innovative approach in designing for children individuating a series of good practices for strategic design of communication and wayfinding systems to be applied inside different paediatric hospitals, in order to improve the well-being of children within the hospital environment, reducing the stress that the environment can cause to them, and making them feel at ease.
Still today, pre-school is generally set in a traditional way as it was twenty or thirty years ago. In general, we can say that, in western countries, pre-school spaces and products are usually designed according to standard ergonomics rules including measurements, dimensioning and safe materials (Wise, 1991).

Instead, it should be taken into account that is also necessary to consider children according to the principle of cognitive psychology and keep in consideration their emotional experiences.

Despite the growing interest for this issue, which encompasses different disciplines - e.g. design, pedagogy, psychology - and despite several international prizes on designing new buildings for pre-school, at the moment it's not easy to find products for pre-school thought by placing children at the centre of the analysis. For the most, the furnishing are represented by products designed according security requirements and anthropometric measures but not considering behaviours and physical abilities, not being able, therefore, to communicate with them using their languages.

Designing products for kids at pre-school is a big challenge for designers because it assumes the will of changing the current design approach, generally based on resolving practical problems and considering children as little adults in a transition phase.

Referring to the Human factor approach, and to the studies on childwood carried out by educators, such as M.Montessori and L.Malaguzzi, this research leads to a virtuous way, focusing on project priorities related to children's unexpressed needs and emotions and to educators' learning theories.

According to the Italian guideline (Ministero dell'istruzione, 2012), pre-school educators have the possibility to choose children activities to use as educational method to develop specific skills. Today the common tools at children and educators' disposal do not facilitate these tasks. Consequently we can state that the design of furniture and products can have a very important role, resulting, in this way, the other essential pillar, really responsible for the pre-school quality of education, together with the other one, the educators.

The aim of this research is to identify a set of design principles and good practices to design pre-school experiencing products and spaces children centred in order to improve the quality of experiences on childwood education and growing. Furthermore another key objective of this study is to promote a new way of designing products and interior settings for pre-school to take into proper account the interaction with children. At the same time these products and furnishing will have also to help educators during their daily routines.
and standard teaching activities. Finally we can say that this work proposes an innovative collaborative approach in designing products and interior design for pre-school in order to integrate learning and teaching methods through pleasant experiences in pre-school habitats, facilitating social relationship and inclusion.
Anthropometry for ergonomic design of workstations: the influence of age and geographical area on workers variability

Type: Abstract Oral Presentation
Category: Manufacturing

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In companies with plants in different regions, an anthropometric assessment of a large number of workers provides measurements useful to design workstation according to the ergonomic approach. In these valuations, the reference human sample can show strong dimensional (anthropometric), functional and biomechanical variability in relation to the characteristics of different people because of gender and constitution, but also geographical area. The present paper shows some reflections about the results of “La Fabbrica si Misura” project, the anthropometric measurement campaign that involved a large sample of Fiat Chrysler Automobiles (FCA) workers of both genders throughout the Italian plants. In this context, our main purpose was to study the anthropometric variability in terms of age and geographical area, in order to identify differences in workers’ dimensions useful to design workstations adopting real users’ data. These assessments can also contribute to create and update the anthropometric database for the choice of Personal Protective Equipment or aids suitable in terms of different sizes and body proportions.

This paper shows the preliminary results from the analysis of the male sample data collected during 2017 in FCA plants located in Italy. The analyses were conducted on more than 3000 male subjects aged between 18 and 65 years. For each subject anthropometric measurements of the whole body and body segments (depth, heights and widths) were chosen among those useful for virtual design applications in FCA.

In order to evaluate the differences between workers from different Italian areas and age classes, subjects from North, Centre and South of Italy were analysed separately and distinguished by age.

Results highlighted differences referred to the variability of the sample in terms of compositions of age classes among subjects from different plants. Moreover it emphasizes workers dimensional characteristics differences according to age and geographical provenance. Outcomes obtained from the analysis of the anthropometric features of interest, such as stature and some widths, resulted consistent with changes occurred during the story of the plant and its place, in terms of job demand, needs and workers’ origin. Considerations on workers variability highlighted in the present study could give useful suggestions for the ergonomic design of workstations adapted on users’ dimensions and needs.
This paper presents results from an ongoing research project investing visual ergonomics in control room environments. The aim of the project is to evaluate the visual ergonomic challenges in control rooms in relation to the design of the working environment in general. The evaluation will be compared to the legal requirements and guidelines available.

In order to clarify visual demands the project includes a subjective assessment regarding the employees’ visual situation.

In all, the project will include about 20 to 25 different workplaces, grouped in different characteristics of control room environments regarding visual conditions.

Specifically, this part of the study reports from a case/field study at a Swedish process industry, including five control rooms for various processes involving nine respondents.

**Methods and procedures.** Hagner photometer S2, LMK Mobile advanced digital luminance camera and analysis software was used to measure illuminance and luminance in workplace. The purpose of the measurements is to find out if major differences in luminance exist within the field of vision and between the different visual environments as major changes in focus occur.

An Eye Tracker (Tobii Glasses 2) together with analysis software was used to evaluate eye movements, i.e., how the eyes shifted between different fixations, e.g. focus distances, and how long the employee focuses on the different visual objects included in the task.

Surveys were also conducted on experienced workload and vision experience, as well as a survey on personal background, age, employment, employment conditions, etc.

**Results.** Preliminary results show that task in control rooms includes major changes in focus distances. Measured luminance values within the field of view as well as between the different focus distances indicate differences that may cause visual contrast glare.

**General results:**
- Important to measure the lighting conditions. Those who work in the control room are not always aware of shortcomings.
• Focus on performing tasks. If tired, unconcentrated, you do not always understand that it depends on the workplace's design.
• Poor contrast between characters and background. Gray text on gray screen background is not optimal for readability.

**Conclusion.** Preliminary results show that visual conditions of the control room are reduced. When an assignment has elevated visual requirements, e.g. reduced visual condition due to glare, this may contribute to pain in the neck and shoulders.
The Effects of Advisor Status, Performance, and Time Pressure on People’s Responses in a Luggage-Screening Task

Type: Abstract Oral Presentation
Category: Others
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In a busy airport, the decision whether to take passengers aside and search their luggage for dangerous items can have important consequences. If an officer fails to search and stop a bag containing a dangerous object, a life-threatening incident might occur. But stopping a bag unnecessarily means that the officer might lose time searching the bag and face an irate passenger. Passengers’ bags, however, are often cluttered with personal belongings of varying shapes and sizes. It can be difficult to determine what is dangerous or not, especially if the decisions must be made quickly in cases of busy flight schedules. Additionally, the decision to search bags is often made with input from the surrounding officers on duty. This scenario raises several questions: 1) Past findings suggest that humans are more reliant on an automated aid when under time pressure in a visual search task, but does this translate to human-human reliance? 2) Are humans more likely to agree with another person in these ambiguous situation if the person is assumed to be an expert or a novice, regardless of the person’s performance? In the present study, eighty participants performed a simulated luggage-screening task. They were partnered with an advisor of either expert or novice status whose performance was either 90% or 70% accurate. Participants made two choices each trial: their first choice with no advisor input, and their second choice after advisor input. The second choice was made within either 2 seconds or 8 seconds of receiving the advisor’s input; failure to do so resulted in a lengthy time-out period. Participants tended to disagree with their own first choice and agree with the expert advisor more regardless of whether the expert was more accurate or not. However, under the 2-second time pressure, participants were more likely to disagree with their own first choice and agree with the more accurate advisor, regardless of the advisor’s status. Participants were also more likely to agree with the expert with higher accuracy, especially when the advisor suggested that the bag was unsafe. The findings indicate a tendency for people to assume less responsibility for their decisions and defer to their partner, especially when a quick decision is required and when they assume their partner is more accurate than them. This overreliance on others’ opinions might have negative consequences in real life, particularly when relying on fallible human judgments. More awareness is needed regarding how a stressful environment may influence reliance on other’s opinions, and how better techniques are needed to make the best decisions under high stress and time pressure.

Keywords: Advisors, decision-making, time pressure, trust.
The influence of physiological breaks and work organization on musculoskeletal pain index of slaughterhouse workers

Objective: To analyze the influence of physiological breaks and work organization on musculoskeletal pain index of slaughterhouse workers

Method: The research was conducted on a Brazilian slaughterhouse through direct observation, interviews and an ergonomics assessment method. The company has around 60 workers with a daily eight hours shift. Direct observation of the production process was composed by four visits by the researchers. The main aspects addressed on the interviews was the job description, employee's profile (including age and gender), shiftwork information, company and activity experience, physical activity practice, other simultaneous occupational activities, identification of the workplace and sector, information of the workstation and time of work that precedes the current, stories of possible workplace accidents and information about how it was pauses and casters and the illness of employees. The company physiological breaks (or pauses) and the team work organization was analyzed in terms of sequence, periods and schedules. Also the Corlett and Manenica (1980) diagram was applied in order to verify the workers perception about pain and discomfort. Finally the OCRA (Occupation Repetitive Actions) method was used considering the jobs characteristics of highly repetitive arms movements.

Results: In the interviews bleeding task was considered by the workers as the most tiring and heavy. According to the subjects “the day is slow to pass by; at the end of the morning they were all exhausted already; many employees took painkillers during the activity”. A total of 15 employees has responded to the Corlett and Manenica (1980) diagram. An index of 93.33% of the employees reported shoulder discomfort, 86.67% in the arms, 60% in the forearms, 60% in the hands, 66.68% in the neck, 60% in the upper and middle back and 73.33% in the lower back. In other segments, the percentage of discomfort was considered low or nonexistent. The OCRA checklist results shows shoulder overload associated with a high frequency of movements. Of the nine tasks analyzed only the carcass saw is below the limit of the OCRA risk levels with a value of 9.83. All the other tasks have values higher than 11.

Discussion and conclusion: The required break times attend the Brazilian norm requirements, however the period without adequate recovery still need to be adjusted. The OCRA index showed high occupational risk in almost all tasks, mainly related to the frequency of movements and poor postures of the upper limbs. After data analysis a caster plan was developed to covers all tasks. The objective was alternate between high risk tasks, reduce exposure time to poor postures and alternate muscular groups.
[3413] FROM MACRO TO MICRO - THE REGULATIONS OF AN ERGONOMIST IN OIL COMPANY

Type: Abstract Oral Presentation
Category: Others
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FROM MACRO TO MICRO
THE REGULATIONS OF AN ERGONOMIST IN OIL COMPANY
(track Activity Theories for Work Analysis and Design)

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SUMMARY

The aim is to describe the process control macro, meso and micro levels of an ergonomist in a Venezuelan oil company. Elements developed take into account the contexts technical, legal, and political production that characterizes this type of business, specifically in the course of the research and practice of ergonomics focuses on the analysis of the activity. The advent of computer programs in the country, offering ergonomic analysis of work (RULA, REBA-OCRA) generated a practice of ergonomics, focused on preventive and corrective actions, without a real diagnosis. Meso regulations are the finding of a lack of specific standards Venezuelans, forcing them to consider international regulations, questioning constantly, taking into account economic, social and industrial country. An ergonomic intervention is always the management of power relations: Between different logics of: production, management of human resources, improvement of working conditions, among others. - Between internal actors: the occupational doctor, the prevention technicians and the supervisor. We played with his reports in several ways: - By mobilizing actors, people. - By creating places of exchange where the actors will be able to build compromises that will result in choices and decisions. This work has expanded the practice and research of an ergonomist, formed to analyze the activity.

Keywords: regulation, oil company, Activity Analysis,. Awareness. Reflexive activity.
ABSTRACT

Public transport in Mexico is presented as a very viable option for transportation; however, for reasons that respond to technical requirements such as the type of chassis used in public transport vehicles, most of them have heights in their entry rungs of around 40 cms, which can be not only an obstacle, but a hazard especially for the most vulnerable populations such as the elderly.

Therefore, the objective of this study is to determine the maximum comfort height of a bus step for the elderly Mexican population. The study included the participation of 12 women and 9 men aged between 61 and 90 years.

During the investigation some measurement of the lower extremities were made and a questionnaire was applied to them regarding general characteristics and daily activities of the participants. Additionally, the perception of comfort was evaluated climbing steps of different heights. The difference between these was 5 cm, being the lowest rung of 10 cm and the highest 40 cm, the last one based on the General Norm of a technical matter which is governed by the State of Jalisco SM / IMTJ / 002/2014. The activity was videotaped for a further analysis.

The results did not show a relation between anthropometric measures and the choice of the rung height. However, there seems to be a close relation between the performance of physical activities and the choice of the rung height, since three of the four people that chose the lowest height of rung do not perform any physical activity, while the two people who chose the highest rungs, they perform exercises that are more demanding.
The rungs that were most preferred were those measuring 15cm and 20cm, these were chosen by 71% of the participants, with an election frequency of seven and eight people respectively. As we can see, it is important to review the design of the buses entrance and, overall, review the technical standard to reconsider the criterion of the rungs height and avoid that this remain to be constituting a difficulty factor of use and even more, a hazard for vulnerable populations.
The underwater environment has been seen as a potentially dangerous working environment (Baddeley, 2000), requiring high levels of situation awareness to function safely (Heywood, 2012). As a working environment, it is inherently complicated with multiple effects on the operator, including limited sensory input. Research into the effect of submersion and breathing type on cognitive functioning and the severity of any impacts would allow for adaptations in training and operation methods underwater, leading to reduced risk and increased efficiency in task performance.

Literature surrounding the topic of cognitive function in the underwater environment is limited and was limited to assisted breathing only, no apnea based studies looked into cognitive functioning but rather focused on the human dive response and related physiological effects on being underwater (Baddeley, 1966; Feiner, Bickler, & Severinghaus, 1995; Gooden, 1994; Heusser et al., 2009; Landsberg, 1975; Lemaitre et al., 2007; Walterspacher, Scholz, Tetzlaff, & Sorichter, 2011). Submersion in water impacts both the sympathetic and parasympathetic nervous systems, which impact heart rate and heart rate variability (Schipke & Pelzer, 2001). Apnea increases the activation of the parasympathetic nervous system, inducing bradycardia in the body (Gooden, 1994; Landsberg, 1975; Schipke & Pelzer, 2001). Breath hold triggers an increase in muscle sympathetic nerve activation (Heusser et al., 2009). Assisted breathing can increase the parasympathetic response through the noise or feedback generated by the breathing equipment (Schipke & Pelzer, 2001). All these effects affect the body and can influence a person’s ability to perform cognitively.

A pilot study focused on the impact of submersion in water and breathing modality (assisted breathing and apnea) on different stages of the information processing chain. This showed that only more complex tasks are affected, with no uniform reason as to why. Memory was impacted in terms of speed of recall in the apnea condition only. Visual detection was affected in terms of speed and accuracy in both underwater conditions, leading to the conclusion that submersion caused performance decrease. The recognition task was only affected in the assisted breathing condition, in terms of both speed and accuracy, indicating that the assisted breathing was the factor responsible for the decrease in performance.

The pilot study approached the understanding of cognitive functioning using Wickens (1984) multiple resource model, viewing the cognitive process as an information processing chain. Having multiple processes chained together in an order of use. The proposed study will look into cognitive functioning in terms of resource utilization, a set of functions occurring concurrently and sequentially using the same resource pool. Measurement of cognitive workload will be done through various tests and different
measures of cognitive workload, such as heart rate variability, will be looked into in terms of viability for use underwater.
The mechanical load on the skin is a combination of pressure and shear.

Shear is the force resulting from the friction at the body support interface. It is not known how these external loads are transferred to local stresses and strains inside the tissue and how this eventually results in tissue damage and discomfort.

The aim of this study is to find out if an equal maximum shear stress yields an equal blood flow and to test the existing theory of Zhang\(^1\), which says that the blood flow reduction is nearly proportional to the resultant of the normal and shear forces applied on the skin.

Six load combinations with different pressure and shear stress were applied on the sacrum with an equal maximum shear stress (\(t_{\text{max}}\)) of 6.0 kPa within the skin. Also a load combination with a lower maximum shear stress (4.9 kPa) and a load combination with a higher maximum shear stress (6.56 kPa) were applied. The skin oxygen tension (pO\(_2\)) was measured with these different combinations on a young, healthy population.

With an equal maximum shear stress of 6 kPa, no significant difference in skin oxygen tension was found. There was a significant difference though between the skin oxygen tension with a lower maximum shear stress (4.90 kPa) and the skin oxygen tension with a maximum shear stress of 6.0 kPa. Therefore, the theory that an equal maximum shear stress yields an equal level of blood flow cannot be rejected.

No significant relationship was found between the resultant force and the skin oxygen tension. This contradicts Zhang’s theory.
Playful learning for kids with Special Educational Needs.

Type: Abstract Oral Presentation
Category: Education and Training

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It has been verified that at present in the Italian schools there are about 15-20% of students presenting different kinds of "Special Educational Needs." In order to respond to BES, the schools follow the Customized Learning Plan (PDP), a useful tool for designing operational models, strategies, systems and learning criteria for each student. For the various operators involved in the treatment of the disorders and also for the parents, it is of great importance to have adequate, efficient and flexible support tools that respect the desires and the enthusiasm of children of different age, without creating additional psychological and social discomfort. This research presents a particular relevance if we focus on the issue of management of entertainment and playful learning through digital systems offering a 'playful interaction'. New concepts of 'game' and 'device for interactive activities' offer screen-based compounds to scenarios on the relation between user and device, including physical activities or integrated physical gestures, which relate the observation of screen to the physical reality. At the same time, we highlight the diffusion of new product-based systems of consultation and interaction through digital devices that work through physical device as a 'medium' between portal/website (often accompanied by social and viral systems) and user experience (i.e. physical devices as 'Nike fuel' becoming interactive artifacts connecting screen profiling to practical user experiences).

The research focuses on different user scenarios based on specific personas with relevant characteristics both in screen-based or product-based interaction, or in addition in a combination of these two research areas. Scenario-based design methodology represents a strategic framework in defining new user/product or user/product/screen interaction contexts. In particular, the scenario methodology focuses on educational needs related to the daily context and anthropological aspects of the user, then on cultural with specific relevance within the interaction framework.

Pursuing this goal, the Department of Department of Mathematics and Informatics and the Design Campus of the University of Florence, in collaboration with a team of speech therapists and psychologists, have developed some playful learning tools for children with Special Educational Needs. On the one hand, a number of new DSA and DSL treatment apps, on the other, playful products that interact with a screen, have been designed and built, extending the specific role of UX and UI.

by full prof. Elisabetta Cianfanelli, full prof. Pierluigi Crescenzi, PhD Gabriele Goretti, PhD Benedetta Terenzi.
A Comparison Between Representative 3D Faces Based on Bi- and Multivariate Analysis

Type: Abstract Oral Presentation
Category: Others
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Abstract

One of the challenges a designer faces when designing a product for people is translating anthropometric data of the target population into product dimensions or a sizing system. Currently, sizing systems are often based on traditional anthropometric data and generally use the variation of one or two key body dimensions directly related to the product. This information is usually presented in tables or scatterplots but rarely represents the complexity of the human form. For products that need to closely fit a certain part of the body it is relevant to incorporate multiple key dimensions. This can be realized by a multivariate approach which maps the variation in these dimensions in order to generate a sizing system. The most common approach is conducting a principal component analysis (PCA). A PCA is often used to analyse anthropometric datasets in order to discover trends in the variation of multiple dimensions. However, increasing the number of dimensions will generally lead to a more complex result which may be difficult to interpret and apply to product design.

Recent developments in the field of 3D imaging have resulted in an increase in the incorporation of 3D scans in anthropometric surveys. The richness of 3D data makes it possible to visualize complex results from anthropometric analysis. By generating 3D models, that represent the variability of the target population, this information becomes more understandable for designers. In addition, designers can then easily utilize these sets of 3D models in their design process, especially with the use of computer aided design (CAD) programs.

In order to develop a ventilation mask for children, this study compares representative models of 3D faces based on bivariate and multivariate analysis of 303 children’s faces, aged 0.5 to 7 years. First, a bivariate distribution was generated based on two key-dimensions and then a multivariate distribution was generated based on a PCA of 9 key dimensions. Second, based on each distribution, the participants were divided into four clusters. A representative face model was generated for each cluster, which were then compared based on differences in shape. For the design of a ventilation mask, a mask contour was projected on each model, to measure and evaluate the relevant differences in shape of the contour. Finally, these results are discussed with regard to the implication for the sizing and overall design of the mask and more generally the added value of these methods for designers.
Road Freight Transport (RFT) companies therefore embody a sector of capital importance to the French economy; they represent an annual turnover of 44 billion euros, which is generated by more than 37,200 companies and roughly 420,000 employees. This sector is confronted by strong competition and growing pressure from customers and suppliers, tight delivery times, exacerbated flexibility, etc. RFT companies are also subjected to specific national and community standards and regulations. In parallel, they are required to fulfill performance duties in terms of preventing risks of occupational accidents and diseases. In 2016, CNAM TS statistics reports 70 deaths per year, 3,000,000 work days lost, an average 6 work days lost per employee, an index of frequency (73 ‰) higher than that of the BTP often taken as high reference of the loss ratio. The planner builds the transport rounds by integrating at best all dimensions (regulation, economic, environmental and prevention of health and safety of their employees).

It is up to the planner to manage all these issues and adopt a compromise between these dimensions, when building delivery rounds.

The planner must adopt The quality of the adopted compromise depends on the time the planner can give to this operation, on his/her representation of each constraint and its weight and on the difficulty of the delivery round to be performed. In this context, the Smart Planning project aims to develop a computer system to help planning balanced from the point of view of the preservation of the environment and human capital, while ensuring the profitability of the activity and the respect of regulations. The purpose of this paper is to present the results from the first step. It proposes, with an ergonomic analysis, to identify the prescribed and tacit constraints manipulated by the planners (constraints formulated, relaxed or satisfied) in two companies. In order to define the characteristics of a valid and balanced round in economic, ecological and health and safety terms, the other business players (drivers, managers, etc.) are also included in the analysis and formalization process. A questionnaire is drawn up to validate and enrich the data on the health and safety dimension. This questionnaire was relayed by sector’s players (professional federations and competitiveness cluster) and was submitted to the transport companies.

The scope of this one is to validate different determinants identified with the two companies via ergonomic analysis, and investigates the respondents’ assessment of these determinants and their possible consideration during planning.

It is not a business case
Psychosocial risks at work may develop from many sources but most could be avoided through appropriate design of the work organisation, workplaces and tools. Laws exist in European countries that require the ergonomic design of work, specifically in relation to both physical and mental loads. Labour inspectors are required to check that companies comply with these laws, however little research exists on company responses to labour inspectorate interventions regarding psychosocial risks. Psychosocial risks are not readily observable and, therefore, require an audit of company practice by the inspectors, rather than work-through inspections. Between 2014 and 2018 the Swiss labour inspectors conducted an inspection campaign on psychosocial risk prevention. An evaluation study was conducted to quantify the effectiveness of this enforcement campaign on company practices. The aim was to assist the inspectors to develop appropriate working methods for the task.

Using questionnaire surveys and a comparable collective of non-inspected companies, comparisons were made between the intervention group of 185 companies audited by inspectors, and the 161 similar companies, not inspected during the study period. As the inspectors were free to choose the companies for inspection (they generally concentrate their efforts in known problem sectors and branches) a quasi-experimental study resulted. A survey was conducted either by telephone interview or online (as desired by the company) before the inspector visited the company (pre-test) and then one year later. The control companies were asked to respond to the same battery of questions in the same way twice with an interval of one year.

Inspected firms improved their management of health and safety and demonstrated more competence in the management of psychosocial issues compared to the pre-inspection level. An improvement was also noted in the control group but it was significantly less than in the experimental group. They also demonstrated an increased willingness to take action on prevention issues. To a lesser extent, they also implemented some specific psychosocial risk management measures, particularly those aimed at individual support for stressed employees. However, inspection visits did
not lead to increased employee participation in the prevention of workplace risks, improvements in work organisation, working schedules or staffing levels.

These results support observations from the inspectors, that companies tend to see psychosocial risks as an individual problem and not as the result of poor work organisation. The recommendations of the study are that a prevention approach grounded in the assessment and improvement of job design, content and organisation must be more strongly emphasised. The connections between these factors and psychosocial risks are poorly understood by companies. Recommendations were made for changes in the types of questions that labour inspectors ask during their audits and the information material that they disseminate to companies to better support this message.
A human postures inertial tracking system for ergonomic assessments

Type: Abstract Oral Presentation

Category: Automotive

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Since their early development for health purposes in 1950s motion tracking systems have been strongly developed for several applications. Nowadays, using Micro Electro-Mechanics Systems (MEMS) technologies, these systems have become compact and light, being popular for several applications such as immersive reality, animation, human-computer interaction and so on.

Looking at the industry, in particular the manufacturing industry is knowing a period of changes, leaded by Industry 4.0 pillars, with the purpose to make factories smart, flexible, collaborative and human-centered.

To achieve this goal, the use of Internet of Things (IoT) devices, such as wearable ones, is necessary to acquire and to analyze real data, whose results will be used to take decision in a smart way.

In the automotive industries, ergonomic postural analyses are a key step in the workstations design. Motion tracking systems represent fundamental tools to provide data about the angles assumed by articular joints of workers while carrying out working tasks, in order to assess the critical issues according to ISO 11226 standard.

The aim of this work is to present the inertial motion tracking system, developed at the Dept. of Industrial and Information Engineering of the University of Campania “Luigi Vanvitelli” in collaboration with Linup S.r.l., composed by inertial measurement units (IMU).

The system allows to estimate the attitude of the fundamental human body segments (pelvis, trunk upper limbs and lower limbs) and to evaluate the joint angles assumed during the working tasks by workers. An Extended Kalman filter is used to estimate the attitude, combining measurements from tri-axial accelerometers, magnetometers and gyroscopes of each sensor.

The system is modular: it’s composed by 4 independent modules in full-body configuration, each one made of 3 or 4 sensors. From acquired data it is possible to code an algorithm to automatically evaluate the postural critical issues of the workstation.

In this paper the full-body inertial motion tracking system is presented, supported by several test cases, carried out in Fiat Chrysler Automobile (FCA) assembly lines, to test system reliability in industrial environments, where there are high level of electromagnetic noise that can affect measurements.
Simulation techniques for the ergonomic performance evaluation of manual workplaces during preliminary draft phase

Type: Abstract Oral Presentation
Category: Automotive

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Among the technologies included in Industry 4.0, the fourth industrial revolution, Digital Manufacturing (DM) represents a new approach to evaluate the performance of production processes in a virtual environment.

DM can be seen as the industrial declination of Virtual Reality (VR). It is the use of an integrated computer-based system that allows to create simulation, 3D visualization and different tools to define the product and the manufacturing process simultaneously. DM is performed by means of PLM (Product Lifecycle Management) software that integrates in a unique shared environment a collaborative management of products and processes, including CAD, CAE and CAM analysis.

Virtualizations and simulations of production processes generate benefit, in terms of time and costs for companies, optimizing the assembly line and providing parameters for studying human-machine interaction.

Regarding this last topic, the aim of this paper is to propose an innovative method to support the workplaces design, based on simulation techniques that allow to set a virtual scenario in which a Digital Human Model (DHM) is able to carry on assembly tasks. Data from simulations can be analyzed and used to assess ergonomic indexes in a preventive and proactive approach. This approach can be defined as Virtual Ergonomics.

As other automotive manufacturers, Fiat Chrysler Automobiles (FCA) applies EAWS (European Assessment Work Sheet) to assess the ergonomic biomechanical overload of workplaces in design phase. EAWS is an ergonomic screening method of first level useful to evaluate biomechanical overload in complex industrial environment according to international standards (ISO 11226 and ISO 11228-1, -2, -3).

The ergonomics risk assessment, already in design phase, allows to identify critical issues and to define and put in practice corrective actions in the earlier phase being more successful and less expensive.

In order to support the methodology proposed in this research, a case study is described, based on the EAWS index evaluation of a workstation of FCA plant assembly shop.
The simulation has been realized by using PLM software Tecnomatix Process Simulate by Siemens® and the EAWS analysis has been performed by using EAWSdigital by MTM®, a software integrated in Tecnomatix.

The methodology can be considered innovative to support human-centered design of production process in developing new products.
Stop slip, trip and fall...use smarter technology

Type: Abstract Oral Presentation
Category: Others

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Key Words: Smart Technology; behavioural factor, safety hazard

Introduction

According to OSHA slips, trips & falls make up majority of general industry accidents (US$), 15% of all accidental deaths; 2nd leading cause behind motor vehicles - $12,000/year, one of most frequently-reported injuries -25% of reported claims/year and over 17% of all disabling occupational injuries result from falls. The UK Health and Safety Executive reports, non-fatal injuries to employees by most common accident kinds - (Non-fatal injuries reported under RIDDOR 2016/17) slip trip or fall at the same level is 29%; the highest in the category of seven.

Two main factors that increase the risks of slips, trips and falls are physical and behavioral. Physical factors can be biological example, failing eyesight &/or visual perception; age, ones physical condition, fatigue, stress, illness, medications, alcohol and the effects of drugs. The conditions that contributes to the risk of a physical factor being realized vary from uneven surfaces, minor changes in elevation, poor signage; absence of protective barriers or rails, lack of contrast between stairs and poor lighting.

On the other hand, behavioural factors giving rise to a fall include carrying or moving cumbersome objects or simply too many objects at one time, not paying attention to surroundings or walking distracted, taking unapproved shortcuts or being in a hurry and rushing. A growing common occurrence that also cause slips, trips and fall is operating a hand held cell phone while walking.

Methods

According to a November 2017 Wikipedia, over 70 countries worldwide have banned used of hand-held cell phone use whilst driving. The ban is not a deterrent hence the Bluetooth as a solution to reduce the risk of an accident.

The World Health Organization creation and promotion of the World No Tobacco Day since 1987 does not eliminate the safety hazard of smoking, but it helps in building awareness and reducing the associated risks.

Discussion
An option to reduce the incidents of slip trip and fall due to behavioral factors associated with the use of hand held cell phone whilst walking is with the use of smart technology. If there are house arrest ankle bracelets then there can be safety hazard alert bracelets.

Results

Implementing prevention at the design stage of mobile cell phone technology can help to:

1. Change behaviour and promote a culture of prevention and safety.
2. Reduce the number of slip and fall by means of a safety alert mechanisms
3. Reduce the pressure on the public health system...
4. Improve reporting, data collection and statistical monitoring tools in developing countries

What better way to protect pedestrians than with the technology that makes them mobile.
Advances in information and communication technologies (ICT) are changing the way health care services are provided. It is possible to manage your own health through a patient portal, whilst your doctor may seek advice in real time from a specialist colleague not in the same location. Concurrently, healthcare systems around the world face increasing pressures from a growing and aging population, inequity of access and finite financial and human resources. Telehealth, the delivery of health care services at a distance using information and communication technologies (World Health Organization, 2010), is one solution to problems such as accessibility, quality, professional resource scarcity and cost (Bradford et al., 2016; van Dyk, 2014). Videoconferencing is an example of a synchronous (real time) service. Despite much potential contribution from a human factors/ergonomics approach (Demiris et al., 2010; Hignett et al., 2013) relatively little attention has been given to telehealth in the published ergonomics literature.

In New Zealand (NZ) telehealth videoconferencing use is increasing (NZ Telehealth Forum, 2014). This reflects a global increase in interest in telehealth (World Health Organization, 2010, 2016). International findings suggest that telehealth can be effective and cost-effective for health outcomes (Akiyama & Yoo, 2016; Assimacopoulos et al., 2008; McLean et al., 2013; Wade et al., 2010); reduce travel and associated costs (Müller, Alstadhaug, & Bekkelund, 2016; Wootton et al., 2011) and improve access to healthcare for isolated communities (Birns et al., 2013; Moffatt & Eley, 2010; Sevean et al, 2009). However, research indicates that the diffusion of telehealth into routine care remains problematic (Zanaboni & Wootton, 2012) with many examples of telehealth programs that fail past the pilot stage (Broens et al., 2007; Eason, Waterson, & Davda, 2014; Hendy et al., 2012; Wade et al., Elliott, Karnon, & Elshaug, 2010). The literature suggests that the barriers to success include societal factors (e.g. law); organisational factors (e.g. cost, change management), consumer factors (e.g. computer literacy), provider factors (e.g. resistance to change) and technological factors (e.g. bandwidth, usability), (Brewster et al., 2014; Kruse et al., 2016; LeRouge & Garfield, 2013). Furthermore, telehealth is a disruptive innovation with business models and processes requiring change when technology is introduced into a complex healthcare system (Bagot et al., 2015).

This study, underpinned by socio-technical systems theory and the SEIPS model (Carayon et al., 2006), seeks to explore the impact of telehealth video-conferencing services on the work system for key stakeholders from the perspective of an expert group, the NZ Telehealth Forum leadership group. All twenty members of the group will be interviewed (data collection is currently in progress) using a semi-structured schedule. The interviews
will be transcribed, and the data coded using thematic content analysis (Bazeley, 2009). These results will be presented at the conference.
The design of innovative services follows an end-users centered approach, in which ergonomics have long played a role. Thanks to the implementation of an iterative design cycle where users are regularly involved, their needs can be followed closely, and the development of the product adapted according to changes in their requirements: evolving needs, design project obligations...

Agile project methods offer a framework supporting innovation, creativity and flexibility (Sherehiy, Karwowski, & Layer, 2007), and were first applied to software development in the 1990s, then more generally to the design of services in the 2000s. In accordance with Sy (2007), we consider that agility offers a design and development process that is perfectly matched to a design procedure centred on the end-users. Furthermore, the management of agile projects must be defended before developers worried about adopting an ergonomic approach.

To do this, a 2-hour workshop, created by Alan Cyment and named "Birdie Birdie", aims to make participants (project leaders, UX designers, ergonomists) aware of and train them in the management of the Agile-Scrum project. By means of a fun and creative project, the participants learn how agile projects are organized: management via Sprint, Iterations... In practice, each team of 5-8 members must create a LEGO bird by responding to a set of requirements (known as User Stories). The teams have 4 iterations (known as Sprints) to organize their activities and design their bird. As with all projects, the requirements change from one iteration to another and the teams must adapt their organization in a structured way with the help of a backlog (a list of activities) that they define themselves. Both an amusing and stimulating activity, the participants learn how they can organize themselves in an agile mode, in order to best respond to client requirements, which are themselves a response to the requirements of the end-users. At the end of the challenge, each team presents its LEGO bird and explains the difficulties and solutions that they have implemented to obtain their results.

The relevance of this workshop, in which several teams have participated, has been evaluated as being particularly interesting for its ability to make participants aware of the interest of an iterative procedure in the design of products or services. Furthermore, several principles of agile approaches, found in the user centered design procedure, were assessed: close collaboration between those involved in the project, regular end-user assessments, acceptance of the changes in the product development throughout the design process, delivery and regular testing of the design choice with the aid of a prototype.

The results of this study show that the Birdie Birdie workshop offers the ideal setting to help developers adopt new design paradigms to promote innovation and creativity.
Today’s food supply system is built up to a great extent on refrigeration technology. In line with the trend of recent years, it is reasonable to assume that frozen food will experience a growing significance in the future. Due to this trend, the number of workplaces in cold-storage depots is also likely to increase in the future. As a cold environment may be a significant health risk factor, work organisation as well as technical and constructional equipment in cold-storage depots should be designed on the basis of ergonomic measurements. However, previous publications suggests that the theoretical requirements of cold protective clothing (grounded in national and international laws and standards) are not based on scientific and practical studies. In order to quantify the physiological responses to working in the cold, 60 subjects (30 male and 30 female) had to carry out a whole working day in a cold store (-24°C). The subjects had to work under predetermined, realistic working conditions with modified working phases with a duration of 80, 100, and 120 min, separated by identical warming-up breaks of 20 min. Simultaneously, the work physiologically relevant parameters such as “body core temperature”, “skin temperature”, “heart rate”, “blood pressure” and “energy expenditure” were measured. In addition to the 60 non-professional subjects which were also asked to evaluate their subjective experiences while working in the cold and after the working day, 128 professional order-pickers out of 24 deep cold-storage depots had been systematically interviewed to different topics regarding the cold-protective clothing, such as the degree of restraint, the cold protection, the comfort and the perspiration. The results from the field study show that order-picking in deep cold results in elevated stress and strain for the human organism due to the superposition of the cold climate and the high physical workload. The cold protective suit (comprising of a thermal jacket and thermal pants) appears to protect sufficiently. Nevertheless, it must be noted that the insulation value is 2 times higher as required by the international standard DIN EN ISO 11079 (2008). Furthermore, the weight of the protective clothing has an impact on activation of the cardiovascular system, expressed through an increase of the work-related heart rates. In contrast to the protective suit there is need for improvements of the cold-insulating boots and gloves as the skin temperature of the fingers and the toes showed a substantial decrease while working in the cold. As the cold protective clothing does not provide an adequately entire protection against cold, there is need for improvements to create preventive occupational health and safety. In addition, a complete revision of the theoretical requirements is strongly recommended.
The work environment significantly affects the performance and satisfaction of employees. An optimal work environment is a commitment to reduce the likelihood of occurrence of unwanted events, injuries, or fatal outcomes. An environment can cause an employee to be obstructed while performing regular work activities. Therefore, preventive or proactive measures are applied to reduce negative effects. Performing surgical operations is a complex process involving several actors. The effectiveness of the operation depends on the efficiency of their coordination and communication, individual skills, and team work. In some situations, this may be crucial for saving someone's life. In this paper, the key factors for evaluating activities in surgical operating rooms are identified.
How nurses perceive organisational climate surrounding patient handoffs in Japanese hospitals?

Type: Abstract Oral Presentation
Category: Healthcare

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Patient handoff is a critical process in health care. There are many factors contributing to effective and safe handoffs, via which patients can be smoothly and appropriately transferred with important patient care information and responsibility. To capture these factors from professional points of view, a self-administered questionnaire was developed and applied to the Japanese nurse survey in 2011 (Gu et al., 2012). However, in the last decade, there have been great changes and innovations not only in technologies but also management practices for patient handoffs. With these changes as background, the present paper seeks to extract climate factors contributing to handoff quality and safety, and to capture their crucial characteristics in the current Japanese hospital context. Changes of the climate in the last six years are also investigated and discussed.

A new questionnaire was developed by adding, deleting and revising some question items from the former one. It comprises two major sections besides a demographic part: (1) staff views of patient handoffs, and (2) frequency of handoffs lacking required information. In Section 1, there were a total of 34 items connecting to handoff quality and safety: 26 items designed for handoffs between units (i.e., unit handoff) and 8 items for shift reports (i.e., shift handoff). Respondents were asked to rate their agreement/disagreement level on a five-point Likert scale. In the second section, respondents rated the frequency of insufficient information in case of a patient was transferred to/from a specific unit or between shifts, on a five-point scale from 1 (always) to 5 (not at all). The survey was conducted between October and December 2017. Up to now, 523 responses have been collected from six hospitals. We expect to collect approximately 7,500 responses from 31 general hospitals in the final sample.

Tentative results from the current sample are described: Overall, 58% of respondents showed positive views to unit handoffs and 56% to shift handoffs. Six handoff climate factors were elicited with 52% cumulative variance by applying principal component analysis to unit handoff item responses: working conditions; handoff procedures; staff communication; handoff coordination; patient involvement; and information and responsibility transfer. Two additional factors were acquired with 53% cumulative variance from shift handoff item responses: information transfer; and procedures and conditions. The most negative views were shown to handoff coordination (19%) and the most positive views to patient involvement (63%). Regarding other factors, nurses had not so positive attitudes that about 40% of respondents had high acknowledgments.

We will mention more results and discussions in the full paper by using the complete sample, e.g., differences/similarities in handoff climate between units and organizations, perceptions of insufficient information frequency in various cases, and a trend of handoff climate changes in the six-year interval.
In single-handed sailing, the more the skipper helms the boat the better for the performance (Foerthmann, 2013; Jones, 1990). This is not always possible however, and the maritime navigation literature in HF&E says little about single-handed sailing performances. This communication presents a technological research conducted by ERSYA with Team Arkema on the « Augmented Skipper »: a system that extends the skipper’s agency over the boat, eases the sailing and enhances safety and performance.

In 2014, we performed an activity analysis (interviews and observation in situ on a multihull) which put into evidence how the skipper consults his information instruments (when at the chart table, at the helm or in the central cockpit) and commands the boat (when at the helm or through the autopilot). A critical result is the skipper’s need to know as quickly as possible if weather conditions can become dangerous in the next minute, in order to react immediately, remotely if needed. When maneuvering, sleeping or managing strategy inside the ship, the skipper can only trust his feelings to perceive the environment and cannot command according to the changes that can suddenly happen.

Two design outcomes of the « Augmented Skipper » are presented:

1. **In-the-minute weather change alerts.** Overall weather prediction models are often too large to predict and warn of the next-minute states of the sea and wind, leading to a loss of performance and unsafe situations.
2. **Analog dial.** Reading numerous digital informations can be confusing in situations of lack of sleep, of waking up and/or of maneuvering. This led us to design an analog dial (re-creating the boat and the environment) to provide more scrutable information so as to extend the accountability of the digital data.

In 2015 & 2016, we designed a simulator and a scenario generator for testing an experimental device proposing several modalities of interactions with the boat, its sensors and autopilot: voice & gesture-based commands, vibration & vision-based information. The results suggest the relevance of a mobile, wearable, vision-and-vibration-based notification interface and a physical hand-based command. In 2017, we specified the functionalities and developed a mock-up of the future device, following methods from user-centered design.

So far, this type of device does not exist on the market since electronics are usually less innovative than the other parts of the boats (foils, sails, materials, etc.). It will be discussed in light of navigation literature in HF & E. Our simulator could be re-used to create or test...
future innovative multimodal sailing technologies. As a conclusion, we would like to discuss the place of "creativity in practice" (the theme of this congress) in such projects where co-design and empirical data are also required.
Facilitating positive and meaningful experiences with technology is crucial in helping a user adopt and maintain a gradual and steady relationship with the system. Prior research has demonstrated that trust plays an increasingly important role in this process. Yet, despite its importance, past research has mainly focused on studying and researching trust in technology mediated interactions. As technology matures and nature of the IT artefacts becomes increasingly intelligent, non-deterministic and human like, it is necessary to move beyond studying trust relationships between people mediated by IT and focus on studying the relationship of the user with the IT artefact itself, wherein the artefact is not just a mediator but a trustee in a trustor-trustee relationship. Studying trust relationship of a user with a technological artefact is still in its infancy with no reliable psychometric instruments for trust measurement in HCI.

We posit that to bridge this research gap, it is necessary to understand the composition of trust as a construct and also understand how to evaluate it. Building on previous work which empirically modelled trust in user technology interactions, we evaluate a human computer trust model. We test the proposed model using partial-least square structural equation modelling (PLS-SEM). Our study contributes to the literature by (a) Advancing the discussion on human-like technologies and (b) advancing the discussion of role of trust in human-artefact relationship.
An Improved Design of Calico Grocery Eco Bag

Type: Abstract Oral Presentation

Category: Others

Alma María Jennifer Gutierrez¹; Aena Camille Arsua¹; Yna Dominique Capuno¹; Emilio Joaquin Castillo¹

¹De La Salle University, Manila, Philippines

The use of plastic bags has a negative environment impact, and other alternatives such as paper bags, boxes and current eco-bags proved to have a short lifetime. Due to the problems encountered by consumers in current calico eco-bags in supermarkets, there is a need to redesign the eco-bags. This study focused on an improved design for calico eco-bags which considers different customer needs in terms of its function and ergonomics aspect. The main concern of this study was to address the problem with regards to the eco-bag's water resistance, presence of dividers, ease of cleaning, and durability. An environmentally conscious product development methodology which was integration of Environmentally Conscious Quality Function Deployment (ECQFD), Theory of Inventive Problem Solving (TRIZ), Analytical Hierarchy Process (AHP), Ashby's Chart Method and Simple Weighted Additive Method was used to select the best design which addresses the problem with current calico eco-bags. The effectiveness of the prototype was tested in terms of its performance and usability. Based on the conducted tests and survey, the prototype was able to address not only the main concerns of consumers, but the minor problem as well. The satisfaction rating of all the customer needs, except for the weight, obtained a lesser value compared to the satisfaction rating of the current eco-bags in the market. This proves that the prototype is better than the current eco-bags. A research was done regarding the selling price and it was decided that the optimal selling price is Php450.
What can an Ergonomist do to manage dangerous substances better?

Gyula Szabó PhD Eur. Erg
Federation of European Ergonomics Societies (FEES)

The objective of the European Month of Ergonomics (EME) of the Federation of European Ergonomics Societies (FEES) is to promote the ergonomics profession in Europe. The first theme “Know your ergonomics” gave an introduction in 2009. The following EMEs became specific, and the topics are dedicated to the actual campaigns of the European Agency for Safety and Health at Work (EU-OSHA). The EME goal is not only to relay the EU-OSHA message but to highlight the role of the ergonomics profession, to show how an ergonomist can contribute to a healthier and safer workplace, to improve performance and increase workers’ satisfaction.

At first glance the EU-OSHA current campaign theme “manage dangerous substances” is not the most suitable material for an EME, but in reality the human characteristics, abilities and limitations must be considered, and the ergonomics approach should be followed in the design of hazardous material related tasks too.

According to the three main ergonomics application fields defined by IEA the EME 2018/19 “Ergonomist to manage dangerous substances better” covers the applicable physical, cognitive and organizational interventions related both to handling materials themselves and handling the relevant information.

Traditionally FEES prepares a slideshow to help federated societies and every interested professional to spread the EME message. This new slideshow contains a brief introduction on EME and EU-OSHA campaign, some definitions, the expectable benefits of the use ergonomics expertise and references to further information.

To make the EME more understandable and attractive several examples are presented.
Physically handling dangerous substances means e.g. material handling, lifting, moving, carrying which requires proper package shape and size, tools, process, task and organisational design. Cognitive ergonomics regarding dangerous substances e.g. can improve the visual appearance with colour and shape coding, symbols and pictograms, environmental design to easy recognition. Organisational ergonomics can help to eliminate modality changes, decrease exposures, define better processes. When dealing with hazardous materials the information provision is of high importance. The required deep understanding of human factors regarding e.g. the storing and displaying hard copies of material safety data sheets, the design of printed or electronic SDSs, the organisation of the downstream and feedback information flow and the provision of information to workers.

We hope this EME will prove again that ergonomics can be a competitive factor in healthier and safer workplaces.
Aging and improvement of life quality

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The level of progress of a society directly depends on the approach of this society towards the elderly. As the global population and life duration grows worldwide, the phenomenon of aging becomes more and more important to address. As of April 1, 2017, the total number of population of Armenia was 2.98 mln., out of which 12.9% are the retired elderly people aged 63 years and above. This figure shows an increase in aged population as compared to 2011 when their share was only 11.5%. In absolute figures the growth of elderly population during the last 5 years was 11559. According to the UN forecast, by 2050 the share of aged population will reach 22-23%. Average life duration of the population of Armenia is 74.8, during last 2 years the average life duration increased by 0.5 year. For care and treatment of the aged population currently there are 11 nursing homes in Armenia, out of which 5 are state institutions and the rest are privately owned. In each of the privately owned nursing homes there are 10 to 45 dwellers, while in the state institutions there are 200 to 450 people.

This abstract presents a research based on the data retrieved from one of the privately owned nursing homes for the elderly, located in Abovyan city of Armenia, where currently there are 36 dwellers, aged from 50 to 95, average annual death rate is 7. The paper seeks to identify the advantages and shortcomings of the nursing homes and to offer successful solution for improving the life quality of the elderly. The research applied ergonomic approach to the issue to view the elderly and the aging process in a wider scope of the surrounding environment, as well as physical and psychological peculiarities.

The issues identified during this study highlight the necessity of further activities directed at improvement of the environment created for the aged population, as well as the importance to view the care of the elderly as an individual area of science. An important component of this improvement is the formation of charity and humanity approach towards the elderly on behalf of the medical workers, where the humanistic philosophy of Mother Theresa is taken as basis.
ABSTRACT

The goal of this study is to investigate the relationship between the ergonomic conditions and productivity in the garment industry in Bangladesh. There is evidence in the literature that productivity is affected by the ergonomic conditions of workers. However, the research on this issue is limited and that counts in particular for the garment industry in Bangladesh. This research covers six garments factories where production lines with 250 sewing machine operators were studied. Both quantitative and qualitative methods were applied. The ergonomic conditions are assessed by a workplace analysis with both observations, measurements and interviews of workers. Productivity is based on data on production given by the companies as well as observations and measurements of the production flow as well as the individual work functions. In addition, interviews with managers are used to increase our understanding of the context and the general factors affecting productivity and ergonomic conditions at the workers level. Our preliminary results show that frequent ergonomic problems are affecting both the workers and the performance of the sewing tasks. Musculoskeletal disorders are predominant and involve eye strain, pain in the neck, arm, shoulder and lower back as well as general fatigue. More specifically, poorly designed work stations are causing Musculoskeletal pain, which leads to frequent visits to doctors and reduces the productivity of workers. In addition, measurements of productivity show that the process flow is hampered by the same poorly designed work stations. These findings help to understand the role of the design of workplaces for the possibilities to minimize ergonomic problems and reduce the negative effects on productivity and improve overall well-being of workers at the workplace. However, these possible benefits may be lost if the company use the opportunity to increase the work pace.

Keywords: Garment, Bangladesh, Productivity, Ergonomics, Sewing floor.
Vigilance is the capacity for observers or operators to maintain attention over an extended duration of time. Most commonly, the construct has been operationalized as the ability to detect rare and critical signals (Davies & Parasuraman, 1982; Parasuraman, 1979; Warm, 1984). Due to inherent constraints in human physical and cognitive processing capacities, the longer one expects an observer keep watch, the more likely it is that a signal will be missed. Consequently, without some means of computer or automation-based assistance, failures in operator vigilance are likely to occur. Six decades of vigilance research have reliably observed a characteristic loss in monitoring performance over time, a phenomenon that Mackworth (1948) referred to as the vigilance decrement function (and see Davies & Parasuraman, 1982).

As many modern day operational tasks that require vigilant monitoring of visual stimuli entail life-or-death consequences for numerous system stakeholders (i.e., anesthesia monitoring for prolonged medical surgeries, homeland security, airline baggage screening, air traffic control, etc.), it is unsurprising that research has sought to establish and validate methods of counteracting such an adverse behavioral trend. One of these strategies implemented to foster effective vigilance performance is cueing: providing the operator with a reliable prompt concerning signal onset probability. Most protocols have thus far based such cues on task-related or environmental factors. The present work addresses the myriad methodological concerns of using cues based on these factors in the design of effective vigilance cueing systems, and proposes an alternative perspective with preliminary empirical research to support this novel approach. The present study examines the efficacy of cueing when nominally based on the operator’s psychophysiological state (i.e., blood oxygenation levels in frontal lobe cortical tissue) in a novel vigilance task incorporating dynamic rather than static visual displays. Pilot results pertaining to performance outcomes, physiological measures (cortical blood oxygenation and heart rate variability), and perceived workload and stress are interpreted via Signal Detection Theory and the Resource Theory of vigilance.
A large scale chemical, biological, radiological and nuclear (CBRN) response will need cross-border, multi-professional co-operation. The emergency services (fire, police and ambulance) will be working together in situations that are high risk and time critical, with different skill sets, training, and mental models. The response environment may be hazardous and ambiguous, with key information such as the cause (natural disaster, accident or terrorism), contaminant (C, B, R or N), numbers of injuries and fatalities, and stability of the working situation likely to be unknown for a period of time. Cross-border interoperability advice is available from the North Atlantic Treaty Organisation (NATO, 2015) as a concept of operations (CONOPS) with guidelines for information gathering/assessment/dissemination, scene management, saving/protecting lives, and specialist support.

This paper presents the first European consensus of a sociotechnical system (STS) map to represent a harmonised concept of operations (CONOPS). AcciMaps were iteratively co-designed with End Users (fire, ambulance, police and military) across three countries (UK, Finland and Greece). AcciMaps were originally developed to analyse STS interacting events and decision-making processes for opportunities of loss of control (and accidents; Branford et al., 2009) and have also been used as a good approach to represent organisational hierarchies, action and lines of communication within multiple STS (Salmon et al, 2012; 2017).

Data were collected using firstly, document analysis both open source (e.g. NATO, 2015), and restricted (if access was approved), to extract task and operator information; secondly through interviews with senior ranking (Gold or Silver Command level) representatives of the participating end users. The data were represented by hierarchy (Gold to first responder) using the themes of communication, planning, action, and reflection.

Despite differences in terminology and between service sectors, consensus was achieved for the command structures (Gold, Silver and Bronze), and Hot Zone responders (Specialist Blue Light Responders and Blue Light Responders). A Control Room was included as the communication spine. Blue Light Responder activities were limited by their scope of practice and available equipment, for example breathing apparatus.

The harmonised EU AcciMap offers a high level STS map of CBRN response. It provides the platform for cross-service and cross-border discussion about detailed activities. The next stage of the project is looking at detailed tasks and technologies using hierarchical task analysis to represent both complex response scenarios (macro) and detailed technologies (micro interfaces) for detection, diagnosis and decontamination.
The design of industrial workplaces or workstations should take into consideration both the workers’ productivity and the risk of injury (Riemer and Bechar, 2016). Several studies focusing on improving workplace design addressed these considerations using Digital Human Modelling (DHM) software (Battini et al., 2011; Cimino et al., 2009). Similarly, DHM has been applied in optimization frameworks for workplace design (Ben-Gal and Bukchin, 2002; Del-Rio Vilas et al., 2013). Also, Harari et al. (2017) recently solved this optimization problem using a two-step grid search, which comprised a coarse search of the entire solution span and a fine search around the coarse search's best solution. Although the above studies are innovative, they use a multi-objective function that combines productivity and injury risk measures, whereas in industry the injury risk is typically considered as a constraint (e.g., the compression force on the lower back should not exceed 3,400 N).

To address the above-described drawback, this study offers a new optimization tool for workplace design using DHM (Jack™). The optimization aims to maximize productivity under ergonomic constraints and is solved using Genetic Algorithm (GA). To demonstrate this approach, a case study of a box-conveying process was examined. This process required the worker to lift a box from a conveyor, carry it for 3 m, and lower it onto a platform before returning to the starting point. The design parameters were the conveyor's and platform's heights and the box's mass. The optimization algorithm maximized the production rate (weight of boxes transferred per minute) without exceeding three ergonomic thresholds: 1) a compression force of 3400 N on the L5/S1 vertebra joint (Waters et al., 1993); 2) a Rapid Upper Limb Assessment (RULA; McAtamney and Corlett, 1993) score of 4; and 3) a metabolic rate ($\text{Vo}_2$) of 1000 ml/min (NIOSH, 1981). The compression force was calculated by Jack™. The RULA was calculated with a special code using the kinematics output of Jack™. $\text{Vo}_2$ was calculated using the equations of Dempsey et al. (2008). The worker’s pace was calculated using the equations of Harari et al. (2018).

The optimal design obtained for maximizing productivity with the ergonomic constraints was compared to solving the optimization problem with a multi-objective function, where in both cases the GA was used. Solving with the ergonomics as constraints increased the productivity by 105%. In addition, the performance of the GA was compared to that of the two-step grid search, and the GA was found to reduce computational time by 90% and to increase productivity by 69%.

We believe that the new design approach presented here can enhance the capabilities of ergonomists and industrial engineers by enabling them to produce better designs that maximize productivity while maintaining the workers’ injury risk below ergonomic thresholds.
One of the main functions of the human hand is its interaction with physical environment where the most important is the prehensile grasp of a physical object. In this sense the human hand can be effectively used as a tool for different tasks or as an interface to use different powered and non-powered hand tools and products. Most ergonomic analyses of products and hand tools are done using physical prototypes and costly measurement systems. Extensive ergonomic knowledge, which is needed during the development phase of a new product and its poor integration with existing, established software in the field of computer aided design has affected that companies do not, or in low scales, address the ergonomic principles in the design phase of a new product.

Therefore, the aim of this research was to perform grasping simulations using a developed finite element digital human hand model (FE-DHHM). Based on performed grasping simulations, the results of contact area were compared to real-life grasping scenarios.

Research methods developing the finite element digital human hand model mainly comprised of the accurate FE model geometry determination based on medical imaging. After obtaining the DICOM images, manual segmentation of anatomical structures has been performed in medical imaging software and IGES models have been generated for the appropriate definition of FE model in Abaqus software. Special attention was given to material definition since soft tissue (skin, subcutaneous tissue, etc.) shows non-linear viscoelastic properties. Numerous DOF of human hand have been defined using appropriate boundary conditions at corresponding joints, which allow for realistic movement and numeric stability.

Based on the joint link structure, the developed FE-DHHM is joint angle driven. Therefore, the joint movement is simulated using the connectors connecting two adjacent bones into one joint. The rotation of the joint is specified in the manner of degree of rotation. In order to perform grasping simulations, the FE-DHHM has been coupled to a motion capture system where joint angles of real-life hand grasping a cylindrical handle and a Stanford bunny have been extracted and feed into the FE model. Hereby realistic hand postures and grasping patterns have been obtained.

The simplified joint definition introduced in this paper is numerically low-cost and provides accurate movement of the bones. Therefore, the movement and deformation of soft tissue can be also considered as bio-mechanically accurate, since the material model has been verified and validated by us in previous papers. This is also confirmed by the results of contact area of real-life grasping scenarios and simulations, which overlap to large extent. Simulations have shown that the FE-DHHM is numerically feasible and also stable, which presents a reasonable bio-mechanical movement during simulations.
The shift from manufacturing to service industries, combined with technological advances has resulted in increasing numbers of people employed in sedentary occupations. Research by Kazi et al (2014) has demonstrated that UK employees spend more time sitting at work than they spend sleeping at night. The increase in sedentary behavior at work is a major public health concern, as prolonged sitting is a known risk factor for a wide range of chronic diseases including obesity, cardiovascular disease, cancer and type 2 diabetes. Given its large contribution to sedentary behaviour, the workplace has been highlighted as a key setting for interventions designed to reduce sedentary behaviour. Following extensive user engagement with employees, managers and occupational health experts, the research team developed a new intervention entitled Walking Works Wonders (WWW) which comprised innovative health education and supporting materials to increase physical activity and reduce sedentary behaviour in the workplace. WWW involves tailoring health information according to employees’ readiness for change. The approach recognises that when attempting to motivate behaviour change, success is greater when interventions align with recipients’ attitudes and beliefs. The efficacy of a tailored approach in WWW was established by comparing tailored interventions with standard conditions and control groups in a 24 month longitudinal study in 10 worksites with 1120 participants across the UK. The quasi-experimental study comprised 3 conditions: tailored information; standard information and control and individual worksites were allocated to 1 of these 3 conditions. The longitudinal study explored the impact of the intervention on a range of objective measures (BMI, %Fat, waist circumference, blood pressure and heart rate) and a wide range of self-reported measures of physical activity, sedentary behaviour, physical and psychological health. Results showed that the tailored intervention significantly reduced BMI and waist circumference compared to standard and control conditions. For both intervention groups (tailored and standard) there were significant improvements (reductions) in resting heart rate. Additionally, employees who received either a standard or tailored intervention demonstrated significantly higher self-reported work ability, organizational commitment, job motivation, job satisfaction, and a reduction in intention to quit the organization. The results suggest that physical activity interventions offer important benefits for employees in terms of improving health and wellbeing, and that adopting a tailored approach is particularly effective in terms of reducing BMI and waist circumference. Workplace health interventions designed to increase physical activity and reduce sedentary behaviour are likely to be more effective where the information is tailored to employees’ attitudes and readiness to change.
[1090] Designing for collaboration in hospitals

Type: Abstract Oral Presentation  
Category: Healthcare  

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Hospitals are one of contemporary society’s most complex organisations characterized by, among other things, having multiple organizational and occupational boundaries, which require timely collaboration between different groups of healthcare professionals and organisational units to achieve efficient daily operations. This paper presents a study of how and with which organizational mechanisms healthcare professionals in practice design for boundary-spanning collaboration in an attempt to improve quality, patient care, efficiency and employee well-being.

We carried out an in-depth multiple-case study of collaborative practices across five departments from four large university hospitals. The selected departments covered both emergency and elective care. The data collection included extensive interviews and observations. The data analysis showed how the case departments had designed and formalised their daily hospital operations to solve collaboration and performance issues.

The results indicate that local management and local staff are active in designing the collaboration during daily operations. They utilise behavioural formalisation elements (plans and rules, roles and routines) as well as liaison devices (artefacts and proximity) to design their collaboration. An important finding in the departments was the tendency to bundle several design elements and use them in parallel or in sequence in order to create the most efficient collaboration. A bundle could, for example, include elements such as standardized plans, resource allocation decision rules, assigned formal roles, huddles, boards, and physical proximity. They typically introduced the design changes in a bottom-up approach where local staff and management initiate the bundles by themselves. These bundles supplement the central organisational structures, processes, and support systems which the local management and staff experienced as less capable of ensuring fluent coordination at the frontline practice.

For healthcare professionals and hospital managers the results open interesting perspectives for the further development of the hospital organisation. We show the relevance of designing bundles of organizational design features to secure collaboration capable of solving collective tasks and bridging departmental and occupational silos to improve healthcare delivery as well as improve well-being of the staff.
In Europe, freight transport by truck is a central element of logistics (Reim, 2017). It is of eminent importance to take the ergonomic requirements of the truck driver into account for cabin design. Here ingress and egress a frequent tasks producing relevant strain. To improve this situation and to enrich the knowledge of driver behaviour, an empirical study was conducted to identify motion strategies for truck ingress and egress. Therefore, 36 truck drivers had to perform the ingress and egress actions into and out of a two-step truck (representing the distribution vehicle sector) and a three-step truck (representing the long haul sector) with each six repetitions. The sample covered a range from the 5th percentile to the 95th percentile of the European truck driver population. Motion behaviour was recorded with CAPTIV, a motion-tracking system based on IMU sensors, and by 2 video cameras, one from the side view and other from the top view.

As a first step during the data evaluation process, the motion phases are determined by leading body parts in such a way that the motion phases occur absolutely sequentially (Rigel, 2005). At the end of each motion phase the position of every single extremity according to predefined key points is assigned in the order they occur during the entire motion. A key point is a geometry element, which a driver can grasp or stand on, like a handhold or a step. This procedure results in a so-called motion code, a time-ordered sequence of key points for every extremity. The assigned ingress and egress motion strategies will be analysed according to the influence of the parameter body height, body mass index, preferred foot (right / left) and number of steps of their own truck (2- / 3-step ingress).

Additionally, the parameter utilisation rate of available joint angle is introduced as the ratio of joint angle captured during motion to joint angle limit or rather maximum of joint angle of the joint concerned. This work examines whether the utilisation rate of available joint angle can be used as a validation parameter for the level of human demands during truck ingress and egress. This would be the basis to evaluate different concepts for ingress and egress cabin design. The idea of the utilisation rate of available joint angle is based on the so called 0g-posture in a weightless space. In the 0g-posture each joint angle is located in a middle position (Mount, Whitmore, & Stealey, 2003); hence the joint load comes to a minimum.
Conditionally automated driving (CAD, corresponding to level 3 of the SAE taxonomy) will lead to a paradigm shift in the field of driver state monitoring systems. High underload, more distraction and diversion caused by the possibility of dealing with non-driving related tasks will greatly influence the driver state with possible problems occurring when trying to get the driver back into the loop in a take-over situation. Therefore, driver state assessment will gain importance in order to perform a safe and comfortable hand-over. While many papers have focussed on driver state assessment with manual driving (e.g. Dong et al. 2011; Knipling and Wierwille W. W. 1994), the purpose of this paper is to provide an overview of driver state models and monitoring systems in the context of CAD. Based on three popular driver state models (Heikoop et al. 2015; Rauch et al. 2009; Marberger et al. 2018), we focussed on the commonly used driver state constructs fatigue, distraction and stress. Further influencing factors are named but not analysed in detail. As part of this review, different definitions for these constructs are summarized and possible metrics to operationalize these constructs were identified and critically reviewed. This was done by especially looking at the stated detection rates and the validity of used driver state monitoring systems like eye-tracking, subjective measures or motion tracking. For each system, advantages and limitations were identified from the reviewed studies. When reviewing the literature, it became apparent, that driver state and the different driver state constructs lack a common definition. Particularly the term fatigue is often used synonymously with drowsiness or sleepiness. Drowsiness and distraction were the constructs most often investigated, as their indicators can be observed easily. In the context of CAD, the measurement of driving performance (e.g. Standard Deviation of Lane Position) which showed a promising correlation with drowsiness, will become irrelevant. Overall, the most promising driver state monitoring systems in the context of CAD were eye-tracking, EEG, and subjective parameters. Subjective metrics (e.g. Karolinska Sleepiness Scale, Expert Assessment) demonstrated good correlations with EEG and driver state, but are prone to misjudgement and may interrupt studies. Eye-tracking (e.g. PERCLOS, blink duration) is a technology with great potential, but needs further development to reliably detect the driver state. Especially more movement and postural changes inside the car, as well as different lightning conditions and glasses challenge today’s eye-tracking systems and so the availability and robustness has to be questioned in many situations. These limitations show the necessity to use multiple metrics in order to reliably assess the driver state. Furthermore, the impact of drowsiness/fatigue needs further research.
Anthropometric Factors in Seat Comfort Evaluation: Identification and Quantification of Body Dimensions affecting Seating Comfort

Type: Abstract Oral Presentation
Category: Automotive

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In the past decades there has been a lot of research on the diversity of factors influencing seating comfort (Hiemstra-van Mastrigt et al., 2017). Apart from the seat's characteristics, the usage/task and the environment, another main factor affecting the perception of comfort is the human being (Vink & Hallbeck, 2012). The individual facet of the human, especially the unique anthropometry of every single person, impacts significantly the determination of the properties and contour of automotive seats.

The influence of the anthropometry on subjective and objective comfort parameters has been explored in different studies (Kolich, 2003). Most experiments had been focusing on the bilateral correlation between the anthropometry and a subjective comfort rating or objective parameters such as pressure distribution (Paul et al., 2012). No study in the literature explored all three parameters in a multi-correlation approach in order to identify and quantify the anthropometric effect in seat comfort evaluation. This is, however, the target of the present study.

Seventy participants (32 females, 38 males) took part in the experiment. Besides body height and weight, three body parts on the upper (shoulder width, sitting height and waist circumference) and lower body (sitting width, sitting depth and thigh circumference) were measured. The subjects were acquired using a presurvey in order to obtain a sample with a broad anthropometric spectrum. The participants assessed two different seats with a comfort questionnaire consisting of 22 items. Pressure data was collected using two pressure maps on the backrest and the seat cushion. The driver seats of two different series-production vehicles have been evaluated. A 22-way Multi-Contour-Seat of an Audi A8 were used as a “comfort-baseline” seat. The comfort oriented contour of the seat design combined with the amount of seat adjustments were assumed to ensure an optimal fit for a wide anthropometric variety. The second seat was an 8-way Sport-Seat (Audi Q2) with prominent side bolster and stiffer foam. The seat was defined as “comfort-critical” due to its limited setting options and sportive seat design, which presumably leads participants to rate the seat worse compared to the “comfort-baseline” seat due to their body dimensions.

The results showed that the “comfort-baseline” seat was rated significantly better compared to the “comfort-critical” seat. Also the pressure parameters differ between both seats. Another analysis proved that the assumed anthropometric effects occur more frequently on the tight shaped sport seat. Ordinal-logistic regression models were used to predict the subjective comfort rating. The data from the body parts as well as the pressure parameters improved the predictive capability of the regression models.
With the method used in this experiment, it was possible to identify and quantify body dimension affecting seating comfort and underlie the importance of anthropometry in seat comfort evaluation.
The ability to telecommute has changed working life for staff at universities and colleges. Although the opportunity to work away from the office at any time gives workers more freedom to manage their work, it also imposes higher demands on workers to set limits to their work. To date, little is known about how telecommuting affects teaching and research staff, and how it should be practiced to maintain healthy, productive and motivated personnel. In an ongoing study, we aim to determine if there is an optimal amount of telecommuting for male and female academics with respect to perceived health, stress, recovery, work-life balance, and work motivation. A web-based survey is conducted among lecturers and professors at Swedish universities and colleges. The questionnaires included in the survey are the General Health Questionnaire [1] for assessing health, Work Stress Questionnaire [2] for assessing work-related stress, validated items for assessing recovery [3], parts of Copenhagen Psychosocial Questionnaire [4] for assessing work-life balance, and the Basic Need Satisfaction Scale [5] for assessing work motivation. In addition to these questionnaires, background questions are included about age, gender, family situation, type and extent of employment, work content, commuting time and the extent of telecommuting performed. Background characteristics of the participants included so far (n=309) are shown in table 1. Data have been analyzed with multivariate (MANOVA) and univariate (ANOVA) analyses of variance to determine whether ratings of health, stress, recovery, work-life balance, and work motivation differ depending on the extent of telecommuting performed. The level of significance was set to p<0.05. In crude models with the single independent variable telecommuting (less than once per month/ several times per month/ several times per week), the MANOVA was significant (Wilks’ lambda: p=0.035). ANOVAs showed that this difference was attributed to differences in fatigue and stress associated with indistinct organization and conflicts (table 2). When gender was added to the MANOVA model, it too was significant, but there was no interaction effect between gender and telecommuting (table 2). In ANOVAs, the results for telecommuting remained similar, and gender differences were identified in fatigue as well as stress associated with indistinct organization and conflicts (table 2). When age was added to the MANOVA model, it too was significant, but there was no interaction effect between age and telecommuting (table 2). In ANOVAs, the results for telecommuting remained similar, and age differences were identified in fatigue as well as stress associated with indistinct organization and conflicts (table 2). After adjusting for age, type of employment, commuting time and amount of teaching time, the MANOVA results did not change, and marginally different results were found in the ANOVAs (table 2). Among the covariates, age, type of employment, and amount of teaching time were significant. The preliminary findings suggest that perceived fatigue and stress associated with indistinct organization and conflicts increase as the extent of telecommuting becomes larger, but their cause and effect relationship cannot be deduced.
Table 1. Background characteristics of the participants.

<table>
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<th>Age (years)</th>
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<th>Mean</th>
<th>Standard deviation</th>
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<td>Management (%)</td>
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<td>Other (%)</td>
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<tr>
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<tr>
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<td>Several times/month</td>
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<td>Several times/week</td>
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Table 2. Results from multivariate and univariate analyses of variance. Significant differences are shown in bold.

<table>
<thead>
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<td>Intercept</td>
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Tcom=telecommuting (less than once per month/ several times per month/ several times per week); Tcom*Gender=interaction between telecommuting and gender; EmployType=type of employ (temporary/permanent/position); CommTime=commuting time (minutes); TeachTime (%) teaching; Health=index from General Health Questionnaire; Autonomy; Competence; Relatedness; indices of basic need satisfaction Scale; Org/Conflict; Demand/Commit; Influence; W-L interference; indices of stress associated with individual organization and conflicts; individual demands and control influence at work and work to leisure time interference from Work Stress Questionnaire; Rest, Fatigue; indices of recovery; W-L balance; index of work-life balance from Copenhagen Psychosocial Questionnaire.
The ongoing megatrend of automation leads to major changes of the division of tasks between human and machine. One area in which automation is currently strongly promoted is the automotive sector. The path to fully autonomous cars can be divided into 6 levels, whereby humans are still integrated into the control loop up to level 3 (SAE International, 2014). In levels 2 and 3 the driver has to monitor the system, whereas in level 3 he is conceptualized as fallback option when the car reaches a system boundary or undergoes a system failure. From special interest in this context is the so called irony of automation (Bainbridge, 1983). If a person no longer carries out routine activities, as they are taken over by the machine, this results in a loss of skills and competence. However, in the case of a system failure, a person must be able to solve the problem and / or take over control - sometimes within a short period of time. When designing automated systems, it is therefore essential to prevent a critical loss of competence. The prerequisite for this is the valid measurement of the current level of competence and, even more important, the detection of a critical change of competence.

Based on the somatic marker hypothesis (Bechara, Damasio, Tranel, & Damasio, 1997; Damasio, 1994), two experiments were conducted in the driver-vehicle domain. Participants were confronted with potentially hazardous traffic situations by means of videos or driving simulation. Electrodermal activity was measured in both experiments. The empirical results concerning the relationship between driving experience and electrodermal activity were summarized in the model of experience-dependent somatic activation. The model postulates an inverse U-shaped relationship between these two variables. Therefore, it provides the opportunity to assess the level of experience and associated skills and competencies by means of electrodermal activity. Practical implications and limitations of the approach are critically discussed.
The Effect of Auditory-vocal Load on Drivers Performance.

Type: Abstract Oral Presentation
Category: Transport

sara hejazi1, masoumeh kourosharami1
1 Imperial Medical Center of Iran, tehran, Iran

Distraction is one of the main factors of car accidents. There are many contributing factors which play significant roles in distraction of drivers. In this study, it is aimed to examine the impact of dialogue between driver and passenger on drivers' distraction.

Material and method: With a driver simulator, 24 experienced drivers (23-50 year-old) drove for 30 minutes in 4 sections that talked with passanger. This passenger asked some question about general information of driver in first language, memory, general information in second language and finally problem solving. After each conversation, DALI test, as a subjective test, carried out for more confirmation.

Results and conclusion: the results demonstrates that distraction happened in memory and problem solving sections and also DALI result shows that talking about memory and general topics in second language and problem solving expel cognitive load on drivers. It is resulted that talking with passanger on problem solving and in general topics on second language has negative impact on Reaction Time (RT) and Standard Deviation of Lateral Position (SDLP) in simulated driving. These data suggests that content of dialogue should be taken into consideration in distracted driver.
Cars are becoming increasingly automated and intelligent and will soon be able to drive on their own. The new intelligent technology will mean that the communication needs between driver and vehicle will shift. As the car takes over some decision-making, it will go from simply informing about current status to communicate its intentions to the driver, as well as its awareness of its surroundings. It will also need to be able to engage in negotiation with the driver, as well as other road users, in situations where intentions clash.

For the former drivers, their task will shift from making active decisions on an action and operation level, to a more passive role assessing the decisions made by the vehicle. To do this, the driver will need to interpret the vehicle’s intentions: is it going to turn here? Has the vehicle detected the person at the zebra crossing? The driver will also communicate more strategic goals: go to this destination, park close to the entrance. Automation offers the possibility to engage in other activities than driving. This in turn will mean a decreased receptivity to information coming from the vehicle, especially visual information but also auditory.

All of these shifts present challenges for the design of the interface. A graphical user interface will no longer be as effective as it is not looked at, and intentions are difficult to communicate through traditional interface designs. However, much of the research in autonomous vehicle interaction still revolves around the traditional auditory and visual modes. To open up the full potential of interactive possibilities and allow for the creation of interfaces that can enable effective and satisfactory communication between driver and vehicle, we propose that the view on which elements of the vehicle that the interface encompasses needs to be redefined.

This paper will present and argue for a holistic framework to aid analysis and design of human – vehicle interaction. The framework is on based on three types of interactive surfaces. The first is the explicitly designed interfaces of today, the second is the interior design of the vehicle as a whole and the third is the implicit information included in the vehicle’s movement pattern. The framework will foremost explore the third surface and how movements should be designed to effectively convey intentions and awareness without being uncomfortable (i.e. nauseating or annoying). Further, how communication to the driver and to other road users via car behaviour can be aligned and interpreted equally well by inside and outside the vehicle. The framework will also cover the challenge of how to design all three levels of the interface as a coherent interaction.
The ergonomic office chair is the most important tool determining a workers' seated productivity in conjunction with the computer. Yet it is misunderstood, undervalued, underutilized and the least appreciated asset employers purchase. Until now, there has never been a way to inventory and measure chair quality and competency for ongoing use in the workplace.

Few employers, if any, use an organizational or systems approach to managing chairs as an asset in the workplace. In addition, employers do not recognize when employee chairs are at the end of their life cycle keeping them far too long, exposing themselves and their employees to increased liability, reduced productivity and increased risk for seated musculoskeletal disorders leading to workers’ compensation claims.

The furniture industry has developed widely accepted ergonomic guidelines for chairs but what is missing is an objective methodology regarding how to determine whether to keep, repair or replace office task chairs once they are in the workplace.

Research was conducted over a 6-year period to develop a chair assessment system (CAS) to coincide with the ergonomic chair life cycle. The CAS helps employers take an organizational approach to inventory chair assets over time to determine chair quality and competency as it pertains to use patterns, sustainability and viability of chairs in the workplace.

Using the chair assessment system’s methodology to inventory and assess chair quality and competency provides employers with the information they need to determine which chairs can remain in operation, which need to be repaired (while under warranty) and which should be removed due to risk of failure or harm to the user. If they are to be removed and replaced, a chair fitting system is provided to assure correct chair purchase for the individual.

The assessment methodology utilizes 6 objective categories essential to chair comfort and viability. Results from numerous trials will be presented to show the value of an operational approach to chair asset management in the workplace.

Based on numerous trials in the workplace, feedback from industry leaders and practitioners, the chair assessment system provides practical and informative data in a simple and easy to use format allowing employers to better understand chairs as a system. Employers must take the time to inventory and assess task chairs for safety, health and productivity impact.

The chair assessment system is an effective way to assure employee seated work health and chair satisfaction. Using an inventory and asset management system to measure task
chair quality, competency and fit helps employers and practitioners determine the most effective chairs, which need to be repaired and which should be replaced to minimize risk, liability and exposure to seated work discomfort.
Investigation of sensitivity of OWAS and DIN EN 1005 4 to assess workload of static working postures by surface electromyography

Type: Abstract Oral Presentation
Category: Manufacturing

Tobias Hellig¹; Brandl Christopher¹; Mertens Alexander¹

¹RWTH Aachen University, Chair and Institute of Industrial Engineering and Ergonomics, Aachen, Germany

Today musculoskeletal disorders (MSD) are a common problem in many industrialised countries. The World Health Organisation stated, that prevalence of MSDs will more than double in 2020 compared with the prevalence in the year 2000 (World Health Organisation 2003). Investigations of working conditions have identified awkward working postures as major risk factor for the development of MSDs (Roman-Liu 2014; Widanarko et al. 2012). To reduce working persons exposure to awkward working postures analysing and assessment methods are used in practise, i.e. Owako working-posture analysing system (OWAS) or German and European standard DIN EN 1005-4 (Safety of machinery - Human physical performance - Part 4: Evaluation of working postures and movements in relation to machinery 2009). Besides these observation based methods a wide range of direct measurement methods has been developed (David 2005), like force measurements or surface electromyography (EMG). Due to a limited operational capability in practise observation based methods like OWAS are used in practise mostly (Brandl, Mertens, and Schlick 2017). However, observation based methods sometimes suffer from validity and reliability (Takala et al. 2010).

In the context of the stress-strain concept (Rohmert 1986) during static working postures muscle activity represents the limiting factor of the human body. Therefore muscle activity captured by EMG can provide highly accurate data to assess workload of static working postures.

To examine sensitivity of OWAS and DIN EN 1005-4 to assess a significant increase of workload of static working postures a laboratory study was conducted. Therefore 24 persons participated in an investigation of 16 different one minute lasting static working postures, which were defined by a combination of standing straight on both legs, ventral flexion angle of the trunk (0°, 20°, 40° and 60°) and shoulder flexion angle (0°, 30°, 60° and 90°). Besides an assessment of the investigated 16 working postures using OWAS and ISO 11226, muscle activity of the eight following muscles was measured: left and right trapezius pars descendes, left and right trapezius pars ascendens, left and right anterior deltoideus and left and right erector spinae.

An analysis of variance revealed a significant increase of muscle activity with increasing angles of ventral flexion of the trunk and shoulder flexion. Nevertheless, this significant increase of muscle activity is not reflected by increasing risk indices of OWAS and DIN EN 1005-4. Thus there is evidence that using observation based measures to analyse and assess work load may lead to an inaccurate assessment of workload erased by static working postures.
In 2016, according to the National Institute of Statistics and Geography (INEGI 2016) “the incidence of breast malignancy among the population aged 20 years and over is 14.80 new cases per 100,000 people. In women, it peaks in those of the 60-64 age group (68.05 for every 100,000 women in that age group). Worldwide, it is estimated that each year 1.38 million new cases are detected and there are 458,000 deaths due to this cause, being this type of cancer with higher incidence among women (World Health Organization [WHO], 2016a, INEGI 2016b). As a result of this analysis and the continuous contact with people suffering from this condition, several facets of breast cancer were observed, not only in a psychological way, but also in a physical way, depending on the type of cancer detected, the treatment is different. that doctors indicate, however, when there is surgery or radiation in the procedure, lymph nodes are removed or damaged resulting in the majority of cases the disease is known as “lymphedema”. For the World Health Organization (WHO), breast cancer is the most frequent and increasing in women in both developed and developing countries. Through the studies of the American Cancer Society (2016c) it can be observed that "lymphedema is produced by:

- Surgery: During cancer surgeries, the doctor may remove lymph nodes near the tumor to determine if the cancer has spread. When lymph nodes are removed, the lymphatic vessels that carry fluid from that area to the rest of the body are also removed, because they cross the lymph nodes and are connected around them. The removal of lymph nodes and vessels makes it difficult to pass the fluid lymphatic from arms, legs and other parts of the body to the chest, where it is poured back into the bloodstream. If the remaining lymphatic vessels can not capture enough fluid from the area, it accumulates and causes swelling, or lymphedema.
- Radiation: Radiation therapy can affect the transport of lymphatic fluid by generating damage and scar tissue in lymph nodes and vessels. This increases the risk of lymphedema.
- Cancer Occasionally, the same tumor can block part of the lymphatic system and cause lymphedema. Infections Infections that limit the passage of lymphatic fluids can cause lymphedema.

In the present document, it will be refounded in the research and development process regarding lymphedema, explaining the art prior to arriving at the final design that will derive in the medical device with aesthetic and functional characteristics.
ABSTRACT

Trade unionism in Argentina, as elsewhere in the world distorts its own role by factors, economic, cultural, social, etc. In general, it has not been possible to adapt to the real world, or its attempt to adapt to the very slow due to its own limitations. That is why the need arises to adapt understanding the context of the world and work.

The present work pretends to approach, according to the experience obtained in the last 18 months by the direction of health and safety of the Union Workers and Plastic Employees (UOYEP), the contribution that the ergonomics can do, from its definition, for the adaptation of Argentine unionism to the needs of the current world and thus improve the scope of work, the worker-employer relationship, covering all the needs of workers from their conception as a human being and contribute to the growth of companies and therefore to the economy of the country.

That is why we must draw a concept, a principle or a definition about what the role of trade unionism should be.

The objectives set are to raise awareness and train all the members of the trade union organization to work together with employers forming joint committees of safety and security and how to obtain the reduction of accidents and occupational diseases, improve work processes, identify and to make workers aware of the need to train and professionalize them to improve competitiveness.

First, a partial study of the number of companies and type of activity by region is carried out. Then, an analysis of the most frequent type of activity, accident statistics, knowledge and regulatory compliance, type of culture and economic capacity of the region. Then specific objectives were presented such as training, surveys, inspections and controls in establishments. The formation of the joint hygiene and safety committees at the national level is the way in which the union through the delegates influences the improvement of the conditions in general.

Finally, it is understood that the union must have a multidisciplinary functioning, that the relations between the worker, the activity that is carried out and the elements of the system in which he is immersed, with the purpose of diminishing the physical, mental and psychic burdens of the individual and to adapt the products, systems, jobs and environments to the characteristics, limitations and needs of its users; seeking to optimize its efficiency, safety, comfort and overall system performance.
Road vehicles such as cars, trucks, emergency vehicles, cyclists, scooters, and motorcyclists are driven by people that sometimes need to interact among themselves and with pedestrians. These interactions primarily involve transfer of information, coordination of activities, and negotiations. Of particular interest are the negotiations which take place when two road users have a conflict.

Conflict arises when resources can be used by more than one agent, but only one agent can use the resource at a given time. Examples of conflict on the road abound: when cars stop at a pedestrian crossing, they are forced to stay put until all the pedestrians pass. When a vehicle change from one lane to another and attempts to infringes on the safety region of a vehicle already in the lane, conflict arises.

Conflicts are “resolved” when one agent moves into the conflict space and occupies it at the expense of another. In manually-driven cars operating today, the resolution of conflicts is based on traffic code that spells out priorities by means of rules. Rules such as “in an intersection, the vehicle on the left must yield the right-of-way to the vehicle on the right” -- define priorities. However, there are situations where it is difficult to determine which priority scheme is in effect either because road signage is not present or that the rules are ambiguous. There are also many situations on the road where if the priority scheme is maintained verbatim, one party to the conflict is blocked from moving (starvation).

Today, such situations are resolved by ad-hoc negotiation between two or more humans (e.g., driver-pedestrian, driver-driver, driver-cyclist). One of the reasons why these interactions are usually successful is that humans share intrinsic values such as fairness and sanctity of life that guides them in these situations. Since there may not be a human driver in an AV, human-to-human interactions do not exist. At least in the short run, autonomous vehicle behavior will have to be designed in a way that some aspects of these negotiations can be done.

In this presentation, we will elucidate the foundational aspects of inter-agent interactions on the road. To this end provide a modeling framework to describe the road space and discuss in detail the concept of conflict and methods for its resolution in the context of autonomous vehicles. We explain our approach using detailed examples of typical vehicular conflicts including crosswalks, jaywalkers, 4-way interactions, and roundabouts.
Assessment of usability of products and comfort of environments is a hard task because many participants and strict management of experimental conditions are required to improve the reliability of experiment. In recent years, the evaluation method of human motion that can clarify the usability is needed. The aim of present study is to analyze the neck motion based on feature extraction with motion division and to clarify the relationship between the neck motion and workability. Previous researches show that neck motions are affected by the weight of product wearing on head. It is necessary to consider the neck motion for the evaluation of product to be mounted on the head such as Head-Mounted Display. In particular, using head-mounted display is associated with human motion.

Feature extraction and motion division are enable us to perform desirable model fitting for ergonomic assessment. These methods bring us accurate understanding of features of whole body motion by temporally divided segmentation. In general, motion division method determines the state of motion using principal component analysis or the similarity of histogram of joint angle. We propose the motion division method based on calculating probability density function (PDF) from Gaussian distribution. Algorithm of proposing method is based on an assumption that the sequential motion can be divided to the strict elements of motion. Moreover, a feature of motion is extracted when an element switches to other one. Extracting these feature elements is carried out by PDF calculating from Gaussian distribution. Participants were six males and four females. In the experiment, each participant was instructed to gaze at target object in a sitting posture. Working posture of each participant was measured to evaluate the effects of working velocity and position of target object. Working velocity was controlled based on three subjective scale: fast, normal, and slow. Position of target object set four conditions on horizontal angle (0, 20, 40 and 60 degrees) and three conditions on elevation angle (60, 0 and -60 degrees). Moreover, participants answered a questionnaire about the subjective workload and workability at the end of each trial. The results of experiment showed that the rotation of neck was affected by the working velocity. The subjective workability was lowest when the working velocity condition of slow and decreased with increasing horizontal and elevation angle of neck. The numbers of extracted feature point decreased with decreasing the working velocity. Normal working velocity condition maximized the numbers of extracted feature point. Moreover, participants answered the best subjective workability in the normal condition. These results show that increasing of extracted feature points may improve the workability.
It didn’t click: A study of non-seat belt motor vehicle fatalities in New Zealand

Type: Abstract Oral Presentation
Category: Transport

Lily Hirsch¹; Hamish Mackie¹; Richard Scott¹; Simon Douglas²; Dylan Thomsen²

¹Mackie Research, Auckland, New Zealand; ²AA Research Foundation, Wellington, New Zealand

There is an increased risk of death or serious injury for occupants who did not wear a seat belt in a crash. Recent studies have also identified a number of risk factors associated with vehicle occupants who did not wear a seat belt and were killed, which include: vehicle factors; time of day; age; gender; ethnicity; education; and a history of previous offences. In New Zealand, non-seat belt fatalities accounted for 19-26% of the overall motor vehicle road deaths between 2006 and 2016, and shows no sign of decreasing. It is important to better understand the contextual factors associated with crashes where seat belts are not worn, so that more relevant and effective road safety interventions can be designed and implemented. The aim of this research was to determine the profiles for seat belt non-users who were killed in motor vehicle crashes. An in-depth analysis of 200 non-seat belt fatalities was carried out following a Safe System framework, using Serious Crash Unit reports. Following this, a cluster analysis was conducted to develop five profiles of vehicle occupants who are killed in crashes where seat belts are not worn. While the stereotypical ‘young risky males’ were clearly an important group, a range of people and contexts for those killed in non-seat belt crashes emerged from the cluster analysis. This has implications for tailored road safety interventions, as a variety of motivations and influences are likely to be at play, depending on the people involved.
A COMPARISON OF WEARABLE MEASUREMENT SYSTEMS FOR ESTIMATING TRUNK POSTURES IN MANUAL MATERIAL HANDLING

Type: Abstract Oral Presentation
Category: Others

Molly Hischke¹; Jose Arroyo¹; John Rosecrance¹

¹Colorado State University, Fort Collins, USA

1. Introduction

For decades, low back disorders (LBDs) have been recognized as major causes of injury among many occupational populations (NRC, 2001; Marras et al., 2009). Tasks like manual material handling (MMH) routinely demand workers to engage in awkward trunk postures (Coenen et al., 2013; Putz-Anderson and Bernard, 1997; Marras; 2010). Tasks involving awkward trunk postures has been associated with low back disorders in numerous occupations (Lavender et al., 2012; Marras et al., 1993; van Dieën et al., 2010; Zurada, Karwowski, and Marras, 2004).

Wearable devices are becoming more common to assess motion as an occupational tool, and limited research exists comparing their performance. The purpose of the present study was to evaluate the comparability and agreement between a simple wearable measurement system (Bioharness 3), and a complex wearable system (Xsens™) for estimating trunk postures during simulated MMH.

2. Methods

Thirty healthy participants were recruited from Colorado State University. Each participant was fitted with both a Zephyr™ Bioharness 3 (Zephyr Technology Corporation, USA), and Xsens™ (Xsens Technologies, NL). Participants wore the two systems simultaneously during simulated tasks in the laboratory that involved reaching, lifting, lowering, and pushing a load for ten minutes.

3. Results/Discussion

Results indicated that the Bioharness 3 and Xsens systems were comparable for strictly estimating trunk postures involving flexion and extension of 30° or less. The Bioharness also exhibited moderate to strong agreement and correlations with the Xsens system for measuring common exposure assessment metrics, including amplitude probability distribution functions and percent time spent in specific trunk posture categories. However, the large root mean square difference, and Bland Altman limits of agreements suggests poor agreement and lack of comparability. More research is needed to determine if the differences between the two systems impact clinical applications.
Abstract This paper discusses a strategy to implement the participatory ergonomic approach by training ergocoaches at KLM. In 2008 KLM Cargo, a division of KLM started with a small group of 8 employees. An ergonomist and a professional coach trained them to become an ergocoach. This Ergocoach Project had three goals. 1. Create a safe and ergonomic work environment together with the employees. 2. Increase the awareness of the employees to work safe and healthy. And 3. make it become normal to talk to and with each other about working safe and healthy.

In the project the ergocoaches learn basic skills about safety and ergonomics. In four sessions a facilitator helps them to define and solve safety and ergonomic issues (participatory approach) and in another four sessions they learn and practice coach techniques. On the last day a final presentation is held by the ergocoaches.

After the first Ergocoach project soon more departments of KLM Cargo followed. The presence of ergocoaches is a great success, they are now part of an ergocoach structure within the organization. They solve ergonomic or safety issues, they are part of (re)design projects, they coach colleagues and train temporary workers. In some departments we even see a decrease of accidents. Although there is no hard evidence, KLM Cargo believe that ergocoaches are one off the reasons of this decrease of accidents.

What makes the ergocoaches successful within KLM Cargo? First you need the support of the management by giving the ergocoaches time to fulfill their role, help them solving difficult issues and facilitate a good ergocoach structure. Second a good communication plan and third regularly meetings. Meetings between ergocoaches within a department, but also between departments and with management and important partners (safety professionals, engineering etc.).

At this moment besides KLM Cargo, also KLM Engineering & Maintenance and KLM Ground Services Baggage started training ergocoaches. They learn from the successes and failures of the Ergocoach structure of KLM Cargo. And most important the ergocoaches of the different divisions of KLM share knowledge and work together.

With all of these experiences with ergocoaches at KLM the trainers enrolled the Ergocoach project in Kenia, as part of the DoctortoDoctor project of KLM and VUmc. More than 100 clinical nurses and physiotherapists are since 2015 successfully trained as ErgoCoach. Local Train the trainers continue the Ergocoach Project, supported by staff and management of the hospital.
Towards more interactive stress-related self-monitoring tools to improve quality of life

Type: Abstract Oral Presentation
Category: Healthcare
Corinna Christmann\textsuperscript{1}; Gregor Zolynski\textsuperscript{1}; Alexandra Hoffmann\textsuperscript{1}; Gabriele Bleser\textsuperscript{1}
\textsuperscript{1}University of Kaiserslautern, Department of Computer Science, wearHEALTH, Kaiserslautern, Germany

Stress-related illness is a major cause for long-term sick leave and is assumed to even increase in the future. Self-monitoring with diaries is one way to identify stress causing events and to understand the personal reactions to these events. Due to the broad distribution of smartphones over the past decade, health apps offer a promising approach to facilitate self-monitoring in daily life. A recent review of stress management apps revealed, however, that despite the broad technical possibilities, these apps often lack in innovative interaction strategies [1].

To overcome this gap, a stress-related self-monitoring app was developed which links diary entries to changes in the appearance of an avatar (Fig. 1). The stress-related diary categories cover sleep, physical exercise, perceived positive and negative events (uplifts and daily hassles), prevalent emotional state, subjective stress level, and consumption of fruits, vegetables, water, and caffeine. During data entry the values are immediately colored using a color scheme similar to traffic light labeling to provide a direct appraisal and feedback (Fig. 2). This appraisal is based on latest recommendations from health and nutrition organizations [2-6]. Each diary category is linked to a distinctive property of the avatar in order to provide vicarious reinforcement. This interactive feedback approach is assumed to support regular usage behavior [7].

We conducted a four-week user study with 55 young adults to test everyday practicability and receive a first user feedback. To investigate whether regular usage behavior and user experience are influenced by vicarious reinforcement through the avatar, participants randomly received one of two versions of the self-monitoring app: In the experimental group the avatar’s appearance was directly influenced by the user’s diary entries, whereas no changes appeared in the control group. After the four week test interval, participants were asked for feedback by means of the Mobile Application Rating Scale [8]. Moreover, participants filled out standardized psychometric questionnaires measuring the subjective stress level [9], occurrence of daily hassles [10], quality of sleep [11] and physical symptoms [9].

Diary entries were correlated with the scores of the respective standardized psychometric questionnaires (all $p$’s $< .05$), indicating convergent validity of the diary categories. The functionality of the app was rated as well working, as indexed by performance, ease of use, navigation and gestural design. Friedman test revealed a significant increase of missing diary entries over time for the control group ($\text{Chi}^2(3) = 11.078$, $p = .011$), whereas no increase over time was detected in the experimental group ($\text{Chi}^2(3) = 0.327$, $p = .955$). In line with this finding, participants of the experimental group stated that watching the avatar’s change over time was fun. These results are a first step towards more interactive stress-related self-monitoring tools to improve quality of life.
<table>
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Fig. 1
A trend when using digital human modelling (DHM) tools for ergonomics design is to simulate and assess sequences of the human-system interaction [1,2]. This approach offers more realistic simulations and assessments compared to what simulations and assessments of a few static instances would represent, and hence provide the DHM tool user with enriched decision support regarding the ergonomic quality of the proposed design.

The paper illustrates and discusses the development and utilisation of a DHM tool when establishing a predefined test procedure concept for the assessment of physical ergonomic conditions in the vehicle interior design process, expanding the work presented in [3]. The purpose of the approach is to contribute to offer ergonomists and design engineers valuable tools for decision support along the design process so that ergonomic issues can be dealt with in an efficient, objective and proactive manner. In more detail, the paper looks at how to instruct manikins to perform a series of tasks to form a consistent test procedure, how to assess outcomes in relation to set requirements, and to compare and judge different design proposals. The test procedure concept is illustrated by a use case from the vehicle industry, utilising the DHM tool IPS IMMA [4].

Keywords: digital human modelling, ergonomics, design, vehicle, interior, assessment, test, procedure

References

The exterior and interior of products are often considered separately as two independent aspects. From an ergonomic point of view there are products that are mainly used from the outside, like a drilling machine and others that are used from the inside, like a motor vehicle. The importance of the exterior and interior design in these cases differ regarding ergonomic aspects. As a consequence of technological changes, such as increased automation, the borders between exterior and interior can become blurred. A window as an elementary interface element and part of the view field can be transformed into a screen to present multimedia information in the automated driving mode. By this the aesthetic of the product exterior and interior are also affected due to changes in the colour and graphics of the perceived greenhouse. In these cases, an isolated view upon the exterior and interior hinders the implementation of new functionalities for users and the handling of disruptive changes.

The Integrated Product Gestalt Design method proposed in this research project helps to consider the complexity of different Subgestalts as well as the interrelations between exterior and interior. Therefore, we distinguish between the Subgestalts layout (assembly), shape, colour with surface and graphics to describe both the exterior and interior. In addition, the inner space is introduced as a means to describe interrelations between the exterior and interior. The aim of the Integrated Product Gestalt Design Method is to structure and highlight the interactions between these views and their Subgestalts in order to support the collaboration and coordination of engineers, ergonomists and designers during the design process.

To derive essential relations between the exterior and interior view a wide range of different products, investment goods, as well as consumer goods are analyzed. This analysis demonstrates the most common relations between exterior, interior and inner space and provides insights into structuring the design process. Therefore, the most typical technical-functional relations concerning frame, function and interface elements of the product are described in detail. It becomes clear which interface elements refer to the exterior and which to the interior. Additionally, the aesthetic relations regarding the purity of the design and the Design-DNA are analyzed within the selected products. Using the gained knowledge it is possible to seek out recurring patterns of relations between exterior, inner space and interior. This is a prerequisite for the predictive advancement of the Integrated Product Gestalt Design method.

Thus, the method facilitates the next step of a guided implementation into the development and ergonomic process, since the links between the disciplines are highlighted.
makes it easier to understand the technical as well as the ergonomic point of view to find the best compromise during the development process.
Autonomy at work, can (too) much autonomy cause health complaints and sick leave?

Type: Abstract Oral Presentation

Category: Others

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Background and purpose: In research, high autonomy is seen as a core aspect with work, alleviating negative consequences of work. However, high autonomy is also suggested to be a burden, being a stressful obligation having to take control over the work performance. Recent studies among knowledge workers have found contradictory or ambiguous descriptions of autonomy, also among the same individuals. Against this background, high autonomy may not necessarily be beneficial, even though many hold it to be a core value and an intrinsic part of their identity as employees. The aim of this study is to explore if high autonomy may be a cause for work-related long-term sick leave, by using a sociotechnical framework.

Study design: The study is designed as an explorative case study, with 8 highly educated female workers (age range 28-52) with a present or former long-term work-related sick leave (burnout, fatigue, stress, depression, MSD). The interviews followed an interview guide with open questions, where freedom were used as a proxy for autonomy. The transcribed text was analysed by means of a sociotechnical model called the balance-theory.

Results: All interviewees appreciated their autonomy in the task performance allowing for individual planning, independency, skills discretion and creativity. However, they also described autonomy in terms of a perceived lack of organisational structures and leadership. They described this lack of structures, allowing for informal decisions and strong organisational subcultures to influence their daily work practice, as well leaving all responsibility for setting limits on the individual workers, enhancing stress and health complaints. Informants with former histories of sick leave, became even more vulnerable, within such boundary less structures.

Discussion and conclusion: The results point to a combination of high autonomy at a task level and lack of organisational structures enhancing stress and health complaints. For this group of workers, high autonomy in itself was not the problem. However, consequences of high autonomy, like unpredictability became a source of great unease and concern. The findings are in line with contemporary studies questioning the ultimate positive associations to high autonomy and high autonomy as a leverage. On the contrary, we suggest that for specific groups of workers, high autonomy should be balanced with predictable organisational structures, not being a leverage in itself.

Keywords: autonomy, work organisation, sociotechnical, stress
Agriculture into the future, new organisation, new occupational health and safety risks?

Type: Abstract Oral Presentation
Category: Agriculture

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Background and purpose: Agriculture is a hazardous industry, with a high frequency of injuries. As working life has changed last decades due to technological changes, globalization and labor market changes, so has also agriculture. In Norway, farm size has increase, agriculture has become technology intensive with a high amount of automated milking systems and more dependent on hired help. A recent Norwegian questionnaire study found farm characteristics and organizational factors to be risk factors for injuries, pointing to an increased complexity. The aim of this study is by sosiotecchnical system theory to explore how a new generation of farmers describe their work organization in relation to occupational health and safety.

Study design: The study is an explorative interview study, with 9 farmers from three different parts of Norway, representing different operational conditions. An open interview guide was used and interviews were transcribed. Content analysis was performed, however using the framework of the balance-theory with the domains technology, organization, physical environment, task design and individual characteristics.

Results: The farmers describe expanding their farm both in size and regarding outbuildings recent years, as well as make judgements about new technology. Considering occupational health and safety, several paradoxes arises. For the farmers, new technology (e.g automated milking and feeding systems) is considered a relief with regards how tasks become less physically demanding and less time consuming. One the other hand, new technology and larger farm size require increased attention to organizational factors such as OHS-training of employees. The physical environment also changes. New outbuildings may entail new logistic solutions for the farm, with farm activity less in contact with domestic buildings and children. On the other hand, the driving distances to reach all parts of the farm becomes longer. The managerial approach to these changes varies between farmers.

Discussion and conclusion: While certain tasks has changed, also reducing risk for health complaints and injuries, new risks may arise, due to the increased complexity. The findings underscore the importance of how farmers are aware of their role as a being a manag. system factors like planning and design, as well as training has to be considered.
Better engaging patients in their care has many benefits. Much of patient care takes place in patients' homes, but we do know very little about how patients deal with their health and chronic illness condition(s) while at home and how the physical environment can have an impact on their care. Self-care can be defined as those actions that people undertake in the every-day health experience; disease management are strategies directed by clinicians to create observations or to adhere to care instructions. Personal health information management (PHIM) is a subset of self-care and disease management that can be conceptualized as a set of cognitive and behavioral tasks that patients perform toward meeting their health goals. In this study, we focus on how patients manage their personal health information management (PHIM) in the home.

Homes are complex sociotechnical systems. To enable repeated assessment of a set of constant stimuli, we have scanned 20 different households that we can recreate in a 3-dimensional virtual cave environment. In several sub-projects, we asked study participants to identify features in the virtual home environments that they consider useful for PHIM. Examples of such objects are a refrigerator door that people can use to put information about their diet on, a calendar to note doctor’s appointment on, a counter on which they assemble daily or weekly medications, etc.

On the one hand, using a 3D virtual reality CAVE has many advantages. For example, you do not repeatedly have to ask the owners of a house permission to re-visit the house and can better standardize the study procedures. On the other hand, we know relatively little about how much impact the 3D environment has on task load and simulation sickness.

In this study, we examine the relationship between time spent in a 3-D environment, experienced workload (as measured with the NASA TLX questionnaire) and simulation sickness (as measured with items from the Simulation Sickness Questionnaire (SSQ)).

Results show that performing tasks in 3D requires effort, and in particular mental workload. Results of the study also show that a very small number of participants suffers from minor simulation sickness complaints, such as dizziness, headache or eyestrain.

To summarize: virtual reality is used more and more often for all kind of purposes, varying from gaming to education and training. The technology is getting better, but immersion in virtual reality can still have some "side effects" such as simulation sickness. Further, the workload associated with performing tasks in virtual reality can have a negative impact on task performance.
About 9.2 million children visit the emergency department (ED) in the US annually because of trauma [1]. Pediatric trauma care is prone to safety concerns, e.g., missed injuries or care delays. For instance, 20% of pediatric trauma patients experience a missed injury[2]. Effective coordination for pediatric trauma patients in the ED is critical because many decisions have to be made quickly, often with incomplete information [3]. Delay or disagreement about ED disposition (i.e. consequent arrangement for ending a patient’s stay in the ED) can have negative consequences in the care process. Previously, we identified 53 roles actively involved in care of pediatric trauma patients during their hospital stay; this included 33 roles in the ED for level 1 (high acuity) patients and 18 roles for level 2 (lower acuity) patients [4]. Such large teams can benefit from team situational awareness (SA) for “sharing situational information and knowledge of the situation”[5]. In this study, we report preliminary interview data analyses on the challenges of disposition decision making in the ED for pediatric trauma patients and their impact on team SA.

Our analysis is based on 12 interviews with 1 anesthesia resident, 1 anesthetist, 2 ED nurses, 1 Director of Surgical Services, 3 OR nurses, 2 PICU nurses, 1 ED coordinator and 1 Child Life Specialist.

Three interviewees mention that, when the ED team makes a quick decision and agrees about next steps for the pediatric trauma patient, timely care is more likely and team members can proceed with next steps. For instance, anesthesiology staff has sufficient time to prepare the OR; ED nurses communicate with nurses in the OR and/or the pediatric ICU who can be ready to receive the patient. However, a quick decision may not allow the family time with the child (mentioned by 2 interviewees). As reported by 5 interviewees, the ED disposition decision making process is facilitated by the presence of a clear, strong leader that provides direction and facilitates agreement among the various disciplines involved in patient care. If the ED disposition decision is delayed, team members experience uncertainty as they are unsure about what they need to do or can tell to the family. To reduce that uncertainty, a nurse interviewee mentioned that she may interrupt the physicians who are discussing the ED disposition decision; therefore, creating an interruption.
Effective and timely decision about ED disposition can facilitate team SA not only among team members involved in the ED, but also team members in other hospital units, such as the OR and the pediatric ICU. Further research will expand the identification of system barriers and facilitators to ED disposition decision making, which can help to identify sociotechnical system solutions for enhancing team SA.
Feasibility evaluation for virtual reality simulation of human-machine collaboration – A case study of hand-over tasks

Type: Abstract Oral Presentation
Category: Manufacturing

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Over the past decade, collaborative robots that allow concurrent work with operators in a shared workspace have been gradually adopted in production lines, especially among medium-sized companies. It brings about higher flexibility and lower cost than traditional industrial robots. However, the direct interaction with human operators also raises more concerns of safety issues. So, the evaluation prior to the introduction is considerably important. Virtual manufacturing, a technique applied to production development through virtual simulation, is a common method to evaluate equipment and layout. Nevertheless, the interaction between human operators and robots had not been discussed much in related studies. Hence, the feasibility of simulating human-machine collaboration via virtual reality techniques will be investigated in this study.

10 participants were recruited to collaborate on a hand-over task with a collaborative robot in real and virtual environments. Considering the restriction of experimental environment, the Wizard of Oz experiment method was taken in the real environment condition. A FARO Arm controlled by the test giver was used to pretend that a collaborative robot was interacting with the participant automatically. Besides, a virtual experiment scene was built by using Unity. Participants wore a head mounted display (HTC Vive) and interacted with the Immersive Virtual Environment (IVE). There are six scenarios included in the experiment: real environment, IVE, IVE with haptic feedback for contacts, IVE with auditory feedback for contacts, IVE with visual feedback for contacts, and IVE with both auditory and visual feedback for contacts. It was aimed at not only investigating the difference between real and virtual environments in human-machine collaboration, but finding a more suitable method for such virtual simulations.

During the experiment, the joint coordinates and angles of shoulders, elbows and wrists will be captured by the motion capture system. The kinematic data were used to conduct principal component analysis and cluster analysis to identify different motion strategies performed by participants. The relationship between motion strategies and scenarios will then be studied with Chi-square analysis. If there is a significant difference, it may indicate that human-robot interactions in the IVE are not consistent with the real environment. In addition, presence questionnaire and simulator sickness questionnaire were also applied to measure and compare the perception among six scenarios. The scenario with higher sense of presence and lower level of motion sickness could be hence considered as a good alternative for simulated evaluation.
Taiwan is an island nation with the highest density of scooter-riding populations in the world. The major means of transport for the most road users was scooter (motorcycle) (45.9%), followed by car (23.7%), bus (8.8%), rail transport (6.9%), bicycle (4.1%), and other (MOTC, 2016). The scooter usage percentage for young riders (aged less than 20 years) was 47.4% and for seniors was 31.4% (MOTC, 2016). Young riders have much higher crash rates than older ones (ERSO, 2015). Moreover, aging is a hot global topic. Taiwan's National Development Council (2014) predicts the country will achieve aged society status by 2025, the council expects the elderly to exceed the 20% mark, which will see Taiwan become a super-aged society. Moreover, road traffic is responsible for a significant and growing share of global anthropogenic emissions of CO₂: Decreasing CO₂ emission is viewed as an important policy around the world (Lund and Clark, 2008). Electric vehicles (EVs) have received increasing attention because of their high-energy efficiency, low carbon emissions, fuel independency, and environmental friendliness. In order to improve the air quality and public health, increasing the penetration level of electric two wheelers (E2Ws) is one of the aims of Taiwanese eco-friendly environmental protection policy. However, the principal challenge associated with replacing gas-powered scooters with E2Ws is consumer fear of being stranded in an E2W. This fear is rooted in potentially insufficient battery performance and an insufficient charging infrastructure. The market share of E2Ws as a percentage of the Taiwanese two-wheeler market in 2016 was only 0.43%. The purpose of this paper is to investigate the characteristics of riders who own a two wheeler product, including scooter, bike, E2W, and other, explore the mental experience and examine the benefits and challenges of use. Here, an online survey design is used to recruit two wheeler owners, aged over 15 years, living in Taiwan. For the survey, fourteen adjective pairs, that were adapted from OCC model of emotions (Bartneck, 2002), used for describing emotions and ten items of System Usability Scale (SUS) were used to measure subjective assessments of usability. In addition, riding conditions, rider motivation, and riding style contribute to vehicle accidents (ERSO, 2015). These factors are designed in the questionnaire items as well. The survey is constructed using Google Forms, a free online survey software and questionnaire tool. In addition, the survey was distributed by e-mail, social networking site, mobile messaging app, and network news site. The survey was conducted over a 3-month period in 2017. The study is expected to explore opinions on UXs of two wheeler riders. Also, it is to further understand the potential needs of two wheeler riders and provide suggestions in product/service design for increasing user willingness to accommodate E2Ws.
Augmented reality (AR) combines real and artificial visual information. AR has become popular in various fields, such as teaching (Lin et al., 2105) or industrial tasks (Hou L et al., 2015). Science has addressed various issues related to the use of AR, such as visual acuity or color perception for targets presented in displays of AR devices (Livingston MA et al., 2009). Surprisingly, the literature lacks reporting on how visual performance is affected by AR devices when targets are presented in reality. For future applications, it is important to know the costs of AR in terms of effects on visual performance in reality. A reduced visual acuity for instance, could hinder visibility of details and therefore limit the application of AR.

We measured visual performance in 100 participants while they wore Microsoft’s HoloLens and compared results to the performance while participants took the tests in natural viewing conditions, i.e. without wearing the HoloLens. A battery of vision tests were presented by means of a Rodatest 302 vision screening device. The battery of tests included acuity (Landolt rings), contrast sensitivity (without and with glare), color vision, stereo vision and a phoria test (horizontal and vertical). A 3D printed forehead rest was in combination with the vision screener in order to match the viewing distance when taking the tests with and without the HoloLens in place. Half of the participants completed the vision tests a first time with the HoloLens in place. In order to enable best possible visual performance, the display of the HoloLens was switched off during measurements. The other half of the participants started with taking the tests in natural viewing conditions and then repeated the measurements with the HoloLens in place. Demographic and other participants’ data, like the known refractive error, were recorded by means of a questionnaire.

Results reveal an impact of the HoloLens on visual performance. A variance analysis considering the within subject factors vision test and viewing condition as well as age as a between subject factor revealed that visual performance depends on viewing condition, vision test, and on age. It is argued that differences in test resolution are in part responsible for variation in level of significance and effect size across the various vision tests. Performance in visual functions was found to improve when wearing the HoloLens in some of the elderly participants. A possible explanation of this finding is that elderly are subject to cataract, therefore benefitting from the reduced light level when wearing the HoloLens. Based on our findings, we estimate limits for visual demands of targets presented in reality when seen with the HoloLens in place. Findings suggest recommendations on the use of the HoloLens aiming to prevent visual stress.
Evaluating the load integration method of cumulative loading using an eccentric muscle model

Type: Abstract Oral Presentation
Category: Manufacturing

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Past research has indicated that exposure to cumulative loading is a significant risk factor in the development of musculoskeletal disorders (Kumar, 1990; Norman et al., 1998; Waters et al., 2006; Coenen et al., 2013). The general objective of these methods has been to sum the loading exposure for each individual task, calculated by multiplying the magnitude of the task loading times the task duration and developing an “area under the curve”.

An assumption of the “load-integration” cumulative loading model is that short time exposure to high forces will result in a similar level of damage as relatively long time exposure to low forces. However, based on the cadaver study of motion segment fatigue failure conducted by Brinckmann et al. (1988), Jäger et al. (2000) argued that a doubling of force produces a more injurious response than doubling of exposure time. More recently, a literature review conducted by Gallagher, et al. (2013) revealed a consistent force-repetition interaction in terms of MSD risk among different types of biological tissue. Implications of this analysis are that low-force loadings will result in a low rate of tissue damage and high-force loadings will result in a more rapid progression of damage in accordance with fatigue failure theory, which would tend not to support the load-integration approach.

To evaluate the efficacy of the load integration approach of estimating the cumulative tissue damage, an experiment with three different loading conditions using eccentric exercise of the elbow flexors of the non-dominant arm was performed (figure 1).

The loading conditions (High force-Low repetition[HL], Medium force-Medium repetition[MM] and Low force-High repetition[LH]) were designed to have the same area under the loading curve (figure 2).
Thirty (30) male subjects were participated in this study. They were divided into ten (10) groups. Within each group, the HL, MM, and LH conditions were randomly assigned to the participants. Maximum isometric voluntary contraction (MIVC) and relaxed elbow angle were collected at baseline and 2, 4, 8 days after the eccentric exercise.

According to the force-integration method, these three loading groups should end up with same cumulative damage level since the area under the curve is equivalent. However, the relaxed elbow angles between LH and HL group were statistically significant different, indicating increased transient tissue damage (p<0.05) (figure 3). The percent change in MIVC also demonstrated significant difference (p<0.05) between HL and the other two groups by day, indicating increased tissue damage and slower recovery (figure 4). The significant differences between HL and LH groups in this study indicate that load integration method may underestimate the impact of high force exertion on cumulative muscle damage. Results are also in agreement with fatigue failure principles with respect to development of tissue damage.
Figure 4. Percent change in MVIC by day and loading group.
Service-oriented value chain is becoming a dominant paradigm to explain companies’ current trend of transformation. This global shift towards service affects companies and organizations in different ways (Vandermerwe and Rada, 1998): it can be an extension of their business model (adding services to classic activity) or a move towards a service-based business model. This shift is even perceivable in an internal perspective when companies transform their support functions into service provider departments (mostly through the business partner trend). At firm level, this shift involves a dual transformation: first a transformation of work to fulfill the specific expectations of a service-based economics. Second a transformation of management (of this new work).

This paper aims at showing the necessity for ergonomics to apply its analytical grids to this strategical shift towards a service-based economics and its consequences on work. It therefore takes first a theoretical approach to define of the service-shift and then brings in case studies as illustrations of the different dimensions highlighted by the theoretical discussion.

In the theoretical section, the paper highlights the main specificities of a service-based organization (immateriality, co-construction with the customer, simultaneity of the production and the usage of the service) consistently with a functionality approach to service (Gaglio, 2011). These specificities are then referred to an ergonomical lens, using an activity-based perspective (Daniellou, 2005) to understand the impact on work. Three issues are more explicitly addressed: workers’ health and subjectivity and the role of management in a service-based organization.

The paper concludes with a discussion of the epistemological relevance of current analytical tools of ergonomics to address a service based economics. It then draws some perspectives on how ergonomics could fruitfully contribute to a better understanding of the “service worker” and to ensure the presence of a human factor sensitivity within this global evolution.
Background: A universal design of the work environment is common in many workplaces. However, such designs may be inadequate for people with disabilities who may need special work environment. Adjusted work environment for people with disabilities needs to allocate environmental barriers for employment. Objective: To examine the reliability and validity of the “Employment Barriers Questionnaire” (EBQ) which identifies occupational and environmental obstacles faced by people with disabilities when trying to obtain and maintain employment. Methods: This cross-sectional, convenience sample study included a total of 35 inpatient and outpatient subjects with physical disabilities. All subjects were recruited from a rehabilitation facility in the center of Israel. Of these, 18 were employed and 17 were unemployed during the study period. Their average age was 46.1 years (SD 10.6 years). Seven healthy employees who had substituted for some of the disabled employees during their absence were also recruited to the study. All subjects completed the EBQ, the “Short Form Health Survey Questionnaire”, and the “Work related Self-efficacy Scale”. To examine the test re-test reliability of the EBQ 18 subjects with disabilities filled out the questionnaire a second time. To examine the convergent validity of the questionnaire, the researcher performed workplace observations for 15 subjects (either the subject with disability or his/her substitute was observed), and then completed the occupational therapist’s version of the EBQ. Construct validity was determined by examining the differences in the results of the questionnaire between disabled employees and unemployed disabled subjects. Results: Internal reliability (α=.89-.95) and test re-test reliability (r=.87, p =.001; ICC=.91, p=.001) were high for most categories of the questionnaire except for the category of communication barriers. A moderate convergent validity was found for the questionnaire, which was expressed by a significant medium correlation between the two versions for some categories (r=.57-.86, p<.05). The construct validity of the questionnaire was manifested by a significant difference between disabled employees and unemployed disabled subjects in the number of barriers (t=3.96, p=.001), the degree of difficulty (z=2.71, p=.007), and the possibility of making adjustments (t = 3.22, p=.003). Disabled employees reported fewer barriers, a lower degree of difficulty and greater possibility for adjustments. Significant weak to moderate correlations were found between occupational self-efficacy and the perception of barriers (r=.34-.57, p<.05) and the perceived possibility of making adjustments (r=.34-.39, p<.05), and between health perception and the perception of barriers (r=.34-.50, p<.05) and the perceived possibility of making adjustments (r=.35-.49, p<.05). Conclusions: The EBQ may help identify environmental, physical, cognitive, and emotional barriers to the employment of people with disabilities. Therefore, it has the potential to enhance the integration of people with disabilities in the workplace by early detection of the barriers that prevent it.
[2720] Tread nosings and stair descent trailing foot slips

Type: Abstract Oral Presentation

Category: Others

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A current, incomplete, review by the author of case law reports of stairway slips and falls affirm accounts in the literature of falls being caused by slips of the trailing foot on tread nosings during stairway descent.

As for leading foot nosing slips, prior to nosing departure the trailing foot is inclined and therefore in tangential contact with the nosing. The issue to be explored in this study is whether trailing foot slips can be considered as “overstep slips”. The study will also investigate the relevance of many of the factors identified in a separate study of leading foot overstep slips; the factors include:

- Inclination of the outersole to the tread.
- Varying contact position on the nosing radius, and varying ground reaction force (GRF) angle, with varying outersole inclination.
- Varying GRF and outersole inclinations with varying goings and risers.

The study will employ the author's previous observations of public stairway use to investigate the relative roles at nosing contact of the foresole compared with the part of the outersole posteriorly it. The effect of heels on trailing foot nosing slips will also be explored.

Key tasks for this study are to determine contributions to trailing foot nosing slips of: distance between FMH and HTP; GRF angle and; slip distance and velocity. It will also investigate the influence of nosing profile, texture and compressibility; FP texture and compressibility; and heel shape, protrusiveness and area with respect to slip progression.

The study continues from previous investigations by Hunter into the slip-resistant role of tread nosings (2011, 2013, 2015). It will use a later version of Hunter’s 2013 prototype tribometer that measures GRF angle; slip distance, speed and velocity and; simulates foot articulation at the metatarsal heads and changed GRF angle at forefoot contact with and departure from nosings.

References


Tread nosings and stair descent overstep slips

Type: Abstract Oral Presentation
Category: Others
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This study commences on the premise that: a) many falls during stairway descent are from "overstep slips"—due to "excessive" oversteps, defined here as when the outersole at the foot's first metatarsal head (FMH) is too near or anterior to the horizontal tangency point (HTP) of the nosing[1] and; b) regardless of overstep extent, typical inclinations of the outersole[2] cause it to contact only, and tangentially to, the nosing. The study continues from previous investigations by Hunter into the slip-resistive role of tread nosings (2011, 2013, 2015a).

The study proceeds based on the following:

• Inclination of the outersole posteriorly of the foresole (FP)[3]—because just prior to contact, the foresole is obtusely angled[2] to the FP and inclined to the tread[3];
• Greater FP inclination with increasing protrusion (height) of heels.
• Varying contact position on the nosing radius, and varying ground reaction force (GRF) angle, with varying FP inclination (the GRF angle is with respect to the nosing contact tangent).
• During a slip, decreasing inclination of the GRF if the initial contact is on the convexity of the foresole and FP[2]
• Inclination of the GRF just prior to nosing contact—because forefoot roll-down (with reducing GRF angle) does not occur with overstep slips.
• Lesser initial GRF and FP inclinations for wider treads than for narrower treads[3].
• GRF angle determines slip resistance and is a function of outersole inclination at nosing contact, and the angle between the body's centre of mass and its centre of pressure on the nosing.

The study's goal is to investigate the relationship with overstep slips of: distance between FMH and HTP; GRF angle and; slip distance and velocity. It also investigates the influence of nosing profile, texture and compressibility; FP texture and compressibility; and heel shape, protrusiveness and area with respect to slip progression.

A later version of Hunter's 2013[2] prototype tribometer will be used to measure GRF angle, and slip distance, speed and velocity. It simulates foot articulation at the metatarsal heads, and changed GRF angle at forefoot contact.

Preliminary results in dry conditions with a smooth continuous outersole on smooth firm, and carpeted nosings indicate strongly consistent increase in slip distance and velocity with increase in overstep distance, with the rate being greater for the carpeted nosing than for the smooth firm nosing. For example, with the FMH at the HTP, the velocity was 520 mm/sec on the smooth firm nosing, and 820 mm/sec on the carpeted nosing. With the FMH 30 mm anterior to the HTP, the velocities were 775 mm/sec and 1250 mm/sec respectively. All cases with the FMH anterior to the HTP resulted in complete departure of the foot from the tread.
Case law and stairway descent overstep slips

Type: Abstract Oral Presentation

Category: Others

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On-line case law reports[1] were examined for causes of slips-and-falls during stair descent to establish evidential support for the author’s previous studies (2015) that indicated a low risk of slips on treads during descent, and which therefore prompted contemplation of the role of “overstep slips”. A secondary purpose was to appraise the value of case law reports for slip-and-fall explanation.

Search results to date are shown in Table 1.

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<td>38 (23)</td>
<td></td>
</tr>
</tbody>
</table>

Proportion of initial search result     41% (25%)

Table 1: Search results

Twenty-three cases (25%) satisfied all the search criteria. Of this proportion, the occurrence of overstep slips was deducible with the degrees of confidence shown in Table 2. Of the candidate slips, 9% could be attributable as oversteps slips with a high degree of confidence, 30% with moderate-to-high confidence, and 57% with low-to-high confidence.
Table 2: Deduced occurrence of overstep slips

Tread width, in dimensions or descriptions such as “narrow”, was infrequently reported, as was footwear, and was therefore generally unavailable for slip-and-fall explanation. Females were represented twice as often as males; however, with the limited footwear description, this was of little explanatory value. Surface matter was absent for the deduced overstep slips.

The 9%, 30% and 57% deducible proportions of overstep slips suggests a significant role for overstep slips, although this assessment is dependent upon interpretive skill.

Interpretation is difficult because of the sketchy recall by people who experienced slips-and-falls, substantially because it was required several years after the event, and because the case law reports attend primarily in establishing liability; hence, details of causation are pursued only as far as necessary for this and are therefore typically insufficient for studies such as this. For the same reasons, overstep slips might occur more often than estimated here.

In addition to leading foot overstep slips, the data revealed four instances of trailing foot overstep slips. If added to leading foot overstep slips, the above estimated proportions of slips on nosings increase to 15%, 41%, and 78% respectively.

[1] Nearly all cases were appeals against the judgement of a lower court.
Do workers with previous disabling neck-shoulder symptoms show higher trapezius muscle activity during computer use?

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Background
Previous disabling symptoms have been identified as the most important risk factor for the onset of neck-shoulder symptoms (Huysmans et al. 2011). One of the proposed underlying mechanisms is that previous disabling symptoms may cause a remaining higher trapezius muscle activity contributing to an increased risk of recurrence of symptoms in the future. We aimed to investigate whether workers with previous disabling symptoms, but who are symptom-free at the time of measurement, show higher trapezius muscle activity during computer use than workers without previous disabling symptoms.

Methods
Data were used from the PROOF study, a field study in which neck-shoulder muscle activity was measured in 117 office workers, who had no symptoms at the time of measurement (i.e., they were symptom-free for at least one week), while they performed their own computer work at their own workstations. Based on their self-reported disabling symptoms in the past year, workers were divided into four groups; (1) no disabling symptoms in the past year (n=86), (2) disabling symptoms in the past year, but not in the past three months (n=10), (3) disabling symptoms in the past three months only (n=10), and (4) disabling symptoms in the past year, including the past three months (n=11). By using electromyography we measured muscle activity in the left and right trapezius, calculated the mean values during computer use, and normalized these to each participant’s maximum voluntary contractions (MVCs). ANOVAs were used to test for between-group differences on the mean left and right trapezius muscle activity.

Results
A significant between-groups effect was found for right trapezius muscle activity (F=3.267, p=0.024), but this was not statistically significant for left trapezius muscle activity (F=1.904, p=0.133). Bonferroni post-hoc testing showed that workers with disabling symptoms in the past three months only (group 3) had a significantly higher right trapezius muscle activity (mean=8.9%MVC, SD=3.5) than workers without disabling symptoms in the past year.
(mean=5.8%MVC, SD=3.0) (group 1). Mean values in group 2 and 4 were 6.6%MVC (SD=2.4) and 6.8%MVC (SD=2.3), respectively.

**Conclusion**

Workers who were symptom-free at the time of measurement, but reported having had disabling symptoms in the past three months, showed higher right trapezius muscle activity during computer use than workers without disabling symptoms in the past year. Findings from our study partly support a mechanism of higher muscle activity contributing to recurrence of symptoms, particularly in those with recent disabling symptoms.
Stressful working postures are associated with increased risks of work-related musculoskeletal disorders (WMSD). The reduction of stressful working postures are necessary for the safety and health of workers and are also related to increased productivity and worker satisfaction. The evaluation and control of work-related postural stress are currently achieved through a process that requires observation, analysis, and redesign (the OAR approach). The current OAR approach has various limitations, three of which are described as follows: 1. it does not take into account inter-individual variability in postural stress; 2. only a limited number of workers can be observed, due to time and space constraints; 3. the existing OAR approach is reactive, and is applied after the posturally stressful work tasks have occurred. This research study proposes an Avatar-based Posture Analysis and Design (APAD) approach as an alternative to the OAR approach. In the APAD approach, digital human figures, called avatars, are utilized to simulate actual, individual human workers in anthropometric characteristics, physical capacities, and postural discomfort perception. The APAD approach requires the knowledge of the stresses that a human avatar (corresponding to a particular individual) experiences in different working postures, along with the human avatar’s range of feasible postures. Two system components were conceived to supply the above knowledge: 1. an individual-specific posture-stress mapping (PSM) function to predict the stress obtained from a certain posture and 2. a feasible posture finding (FPF) algorithm to approximate the set of feasible postures that an avatar can adopt in the digital environment. This paper describes the process for the modeling of individual PSM functions by collecting individual subjective postural stress responses. 6 participants were asked to perform short-period static holding postures for 108 combinations of posture and hand load weights. Each participant then rated the posture using the Borg CR10 scale, to quantify the perceived postural stress response. The empirical data will be utilized to derive individual PSM functions, which are expected to exhibit large individual differences in the way postural stresses are determined from biomechanical stresses. The PSM functions will be evaluated with the use of RMSE measure within a cross-validation scheme and are expected to produce a small number of fitting errors. The initial results from the current study would serve as a basis for creating a large set of avatars that perceive postural stresses in a way similar to actual human counterparts. Such avatars could be used to simulate various work situations in the digital world to aid in the design of less stressful and ergonomic workstations and work tasks. This method overcomes the limitations of the OAR method, and thereby, enhances the practice of work task design.
For the past few years the cultural and technological progress allowed the premature
newborns to have more possibilities to survive. Indeed their biological frailty lead them to
have invasive surgeries aimed to support all the undeveloped vital functions. Not all the
infant born in hospitals that can provide appropriate treatments, but the 2-2.5% of the
newborns needs to be transferred by ambulance or by helicopter. By a review of the
relevant scientific literature it has been possible to analyze problems related to the
transportation risks and to possible property damages or injuries due to an wrong use of
products.
The aim of this research is to ensure safety and a correct human-machine interaction,
during all the transportation phases. The target is to give confort to the newborn, improving
his living conditions, but also to give to the healthcare professionals a better work
condition, facilitating their interaction and reducing errors. About these issues, this
research used theories and methods of the “Human Centered Design”, focusing on: needs
and expectations of direct and indirect users (healthcare professionals, family, newborn),
skills and different points of view of professionals involved in design or planning of the
products/services.
By field surveys (Direct observation of activities; Scenarios; Interviews and questionnaires;
Task Analysis) conducted at the University Polyclinic “Meyer” based in Florence, Italy, it
has been possible to collect useful data to solve some of the problems related to the
neonatal transportation, by combining users needs with technology.
The collected informations allowed to analyze users behavior, their needs and the
frequency of errors during the performance of tasks, evaluating critical issues of actual
products/systems and defining new requirements. It has been possible to understand the
user-current incubator interface and also to evaluate their emotional impact on users:
indeed incubators could be very unwieldy and hard to manage during transportation. This
approach lead to developing concrete solutions for healthcare professionals needs, turning
them into real design solutions aimed to improve the actual scenario.
By the obtained results it has been possible to setting up new solutions which lead to the
design of a new incubator for premature or pathological newborn transportation inside and
outside the hospital. The incubator allows to improve the infant transportation service
through a better organization of the essential components and the possibility to monitoring
and communicating real time data.

Keywords: design for health, medical devices, human centered design, safety, Medical
errors
High end stereo design: The value analysis applied from the need for auditory comfort.

Type: Abstract Oral Presentation
Category: Others
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The term high end is used to categorize high quality products, designed and built to last for years without lacking in performance even after a certain period of time. Because their high performance they are considered high standard, luxurious and sophisticated equipment, opposed to mass products, thus, a high value is applied to them. In the field of audio, the high-end expression, released in 1950, motivated by the public who enjoys the music of high fidelity and sensitivity of reproduction. The high-end system allows you to separate all the different types of sound, bass and treble, with the best possible audio quality, close to the real sound. The audiophile is a differentiated consumer who has in-depth knowledge of the theme. These people are gifted with very demanding ears when it's about audio reproduction, despising the presence of any type of unpleasant sound. The select audience moves a millionaire market, motivated by the comfort of hearing and the unique experience between the user and product. Consequently, the purpose of this work is to analyze from the need for hearing comfort, the high value applied to the design of high end stereo. For this, the research followed a methodological reasoning of basic nature, of qualitative approach and exploratory character. Based on the american engineer Lawrence D. Miles, we can define a value analysis as a methodology that consists of decomposing a product or service into main functions and outline the most appropriated alternative to reduce costs, giving rise to the notions of value chain and the value added to the product or service. From the results obtained in the research, it is evident that high-end audio products, besides having a high added value in the market have benefits beyond satisfactory for audiophiles and consumers in general. Because of the best quality sound they are free of unpleasant sounds, these, when accumulated, produce psychological and physiological auditory problems, most of the time irreversible.
Ergonomic design of interfaces for people with dementia

Main symptoms of people with Dementia (pwd) are cognitive impairments, resulting in limited interaction with technical devices. The ergonomic design of products often only considers users without these impairments. Therefore, daily products are insufficient adapted to needs of pwd. The aim of this study was the development and evaluation of human-machine interfaces of an auditive entertainment system for pwd.

With a literature research basic requirements of pwd towards technical systems were identified. Subsequently, these requirements were transferred to qualitative user requirements. The implementation offered three prototypes, which were evaluated with 14 pwd (84 ± 11 years). Each prototype with a rotary, rocker switch and press button, respectively. The Mini-Mental-State-Examination and the assessment of executing Activities of Daily Living (ADL) were used to classify subjects into dementia severities and care levels. A usability test considered potential differences between the control devices concerning perceptibility and operability. For this, one-factorial, three-stages, univariate measurements were carried out three times. Interactions of pwd with the control devices were assessed with an assistive- and interaction-scale. These describe the assistance required for an intended handling and occurred interaction-mistakes. Following, the usage of the system was examined in a real context of use. Therefor each subject received a prototype with individual music. To capture the characteristic of usage, the actuation of the control device were saved in log-files.

The literature research resulted in the following basic requirements for pwd towards technical systems: simplicity, familiarity, transparency, autonomy, personalization and safety. Examples for resulting user requirements are an independent operating with the system and receiving feedbacks by an intended operation. The implementation of user requirements resulted in prototypes that can only be turned on and off by pwd. For this interface, the usability test examined the three control devices. The majority of pwd didn't need any assistance for spotting all control devices. For an intuitive operation the rocker switch showed significant less mistakes in interactions than the rotary switch (p<0,05). In this regard, the differences between the rocker switch and the press button were not significant. Distinctions in needed assistance for intended operation between dementia severities and care levels couldn't be proved significantly nor descriptive. Results of the field study showed frequent use of the system.

The basic and user requirements can be transferred to further technical systems. As a result of the usability test the rocker switch exhibits the best usability. On the one hand, due to its asymmetrical design, which suggest the actuation “pressing”. On the other hand the tactile, visual and acoustic feedback confirms the user in his operation. To sum it up, an inclusion of pwd into development-processes is possible and can lead to requirement-oriented and ergonomic design of interfaces.
The world's population exceeded 7 billion people. And it is increasing now. The number of persons aged over 60 is expected to increase from 841 million in 2013 and to 2 billion in 2050. The trend of aging in Asia is rising from 10% in 2009 to 30% in 2050. Especially in Japan, the population proportion of elderly people exceed 30%, and it is the highest in the world. Therefore, care for the elderly people plays an important role. In an aging society, it poses many problems both to caregivers and to care-receivers. For example, long-time care workers are suffer from low back pain. Therefore, it is important to reduce the burden on caregivers. In order to alleviate the burden of transfer caring, there is a method using a slide board. The caregiver have to lift care-receiver in a normal transfer caring. But, in transfer caring by a slide board, it is possible to move a care-receiver without lifting it. So, the caregiver's body of the burden on is reduced. However, using a slide board during transfer caring is possible put a burden on the care-receiver, so training is necessary to use it. Therefore, finally, the purpose is to propose correct usage of the slide board when caregiver transfer caring by comparing experts and non-experts persons. In this study, we focus on the comfort of the care-receiver, experiment and evaluate by comparison between expert and non-expert caregivers. In the experiment, the caregiver is asked to simulate the process of moving the care-receiver from the wheelchair to the bed. The device used in the experiment is MAC3D SYSTEM, an optical motion capture system manufactured by Motion Analysis Corporation. When capturing data, the working frequency of the device is set at 120 Hz. In the experiment, we install 21 infrared reflection makers on the expert caregiver, 27 on the non-expert caregiver and 7 on the care-receiver. All experiments related to this research were conducted with the participants’ consent. Coordinate data of each time of the each marker was collected, from the data of motion capture. I focused on the head of the patient during transfer caring, from the viewpoint of evaluation of comfortable. From the results, the movement of the head was divided into three directions of normal direction, tangential direction and Z-axis direction and analyzed by each jerk method. Clarified the difference between expert and non-expert caregiver.
The use of social networking sites (SNSs) has grown exponentially. Some previous research indicates that excessive SNS usage can lead to symptoms associated with addiction. We conduct our research to assess the symptoms of excessive SNS usage by studying user behavior in SNSs. We divide our research into three main stages: (1) collect SNS user behavior data; (2) clarify the characteristic of SNS usage and their relationships; (3) detect symptoms of excessive SNS usage.

Understanding how people behave in SNSs helps for detecting and identifying the symptoms of excessive SNS usage. In our previous studies, we developed a data collection application as a tool for aggregating data from questionnaire, Facebook and Twitter. We experimentally collected data from undergraduate students in Thailand and statistically analyzed them to identify the factors associated with SNS addiction. We employed modified Internet Addiction Test (IAT) and Bergen Facebook Addiction Scale (BFAS) for measuring SNS addiction. Our analytic results identified the differences between excessive and normal users among undergraduate student in Thailand.

In this article, we aim to find the factors correlated with addiction components. The questions of IAT and BFAS reflect the addiction components such as salience, mood modification, tolerance, withdrawal, conflict, and relapse. We analyze the questionnaire and Facebook results to identify the effective factors associated with each addiction component by various methods. Correlation analysis is one example to clarify the relationship between SNS variables and addiction components. The analytic results showed the effective factors for each addiction component. The detail will be described in camera-ready manuscript.

We will use the analytic results to construct the SNS addiction models to detect the symptoms of excessive SNS usage. The outcome of this research is applicable for developing prevention strategies to increase awareness of the risks of excessive SNS usage.
The Efficacy of Eye Blink Rate As An Indicator of Sleepiness: A Study of Simulated Train Driving

Type: Abstract Oral Presentation
Category: Transport

Hardianto Iridiastadi

1 Institut Teknologi Bandung, Bandung, Indonesia

Despite the steady decline in the number of train accidents in Indonesia, train accidents will remain an important national issue. This is due to the fact that the number of railway network has grown considerably resulting in greater operational complexity. Fatigue among train drivers, in particular, has been considered as a major contributing factor in safe operations of railway transportation. Currently, however, there is no system in place that can monitor driver fatigue in real time. This study aimed at evaluating the efficacy of eye blink rate as fatigue indicator during train operations. A total of 12 male participants were recruited in this investigation, and asked to perform driving tasks (continuously for 4 hr) in a train simulator. Each participant was asked to have sleep durations of either 2, 4, or 8 hr the night prior to the experiment. A video camera was utilized to record the driver’s face continuously throughout the experiment. Based on the recordings, the frequency of eye blink was determined every 20 min. Karolinska Sleepiness Scale (KSS) was also employed to help assess the degree of sleepiness perceived throughout the experiment. Results of this study indicated that sleep deprivations were associated with differences in initial blink rates. In general, there was an inverted U-shaped pattern of blink rate for all task conditions. Blink frequency of around 40 to 50 blinks per minute was observed at the beginning of the experiment, and peaked at roughly 45 to 60 blinks per minute after two hours of driving. There was then a decline of this measure, reaching at about 40 blinks per minute at the end of the experiment. Normal sleep duration (8 hr) was characterized by relatively flatter pattern. Findings of this study demonstrated that it was somewhat difficult to use eye blink rate as a measure of fatigue per se. However, it was found in this study that a decrease in blink rate occurred after the KSS reached a value of 5 – 6. Driver sleepiness, therefore, could potentially be assessed by observing patterns of blink rate. It is suggested in this study that the frequency of eye blink could be used for the purpose of assessing fatigue and sleepiness, although its use within the context of real-time monitoring should be done with caution. Further research needs to be conducted that validates the use of this measure in actual field settings.
Nowadays, the different software for ergonomic evaluations are gaining greater relevance in the field of ergonomics. These ergonomic assessment software allow ergonomists to perform simulations and adapt the product design before it is produced. It also enables the recording of the subjects of study through different technologies, and the evaluation of their behaviour. However, regardless of the software being used, there are many dimensions of data that should be shown to the ergonomists both virtual and real cases.

From all the available data the ergonomists usually focuses on the different design solutions, the anthropological differences among the subjects of study, the different parts of the body and the different types of evaluations. The ergonomists also need to know the behaviour of each variable along time. This, often requires the ergonomists to input the information manually, which makes the evaluations slower. In addition, each company uses its own evaluation methods, therefore the software must be flexible. All of this translates into an increment of the difficulty that involves the creation of an interface that considers all the necessary tools the ergonomists require being at the same time user friendly.

This article is focused on the structural design for an intuitive interface for an ergonomic evaluation software that possesses the required tools to analyse both virtual and real cases at the same time that remains friendly to the user.
INTRODUCTION

In recent times we hear more often talking about accessibility and "design for all", but most people combine accessibility as something inherent just to people with disabilities and not as a new way of experiencing everyday reality and the ability to make the environment built comfortable and usable by everyone, including disabled people.

This also applies to vertical transport such elevators, platforms and also for escalators and moving walkways. In the last two years the race for accessibility of the built environment has been born increased at European level, but everything is mostly based on disability. A swarm of experts dissert among themselves, confronting each other but often contradicting each other. The result is an
avalanche of documentation and rules that ultimately complicate rather than clarify the concept of accessibility.

STANDARDS related to vertical mobility

Finally, the revision of two standards began, one at ISO level and the other at CEN/TC10 level. The two standards are EN 81-70 under the CEN/TC10/WG7 and ISO 21542 under the ISO/TC 59/SC 16. The revision of EN 81-70 which will be published in 2018 has achieved excellent results on accessibility with innovative content and will soon begin a study on "contrast" in order to solve the last controversial point. The revision of ISO 21452 is still at the beginning and it will take a long time to complete the work, but we are sure that the experts involved in the work will achieve an excellent result.

CONCLUSIONS

A forum dedicated to the standards of lifts will highlight also all the innovations made in EN 81-70 respect to the old standard in order to make the lifts accessible.

The lift standards are always evolving and a close relationship between experts at the international level and the various associations including those of the disabled will improve them to make the lifts and vertical platforms increasingly accessible.

References:

CEN-CENELEC (2017) PrEN 17161 "Accessibility following a Design for All approach in products, goods and services – Extending the range of users”

CEN-CENELEC (2017) PrEN EN 17210, "Accessibility and usability of the built environment – Functional"
requirements”

CEN-CENELEC (2017), PrEN 81-70 “Safety rules for the construction & installation of lifts - Particular applications for passenger and goods passenger lifts - Part 70: Accessibility to lifts for persons including persons with disability”

ISO (2011), 21542 “Accessibility and usability of the built environment”

Employees' Views about the Impact of the Economic Crisis on Occupational Safety: A Pilot Study in the North of Portugal

The European Union faced an economic crisis, which had a significant expression in Portugal. The financial unsustainability of this country led to austerity measures, which resulted in negative impacts for organizations and families. As a result, inadequate occupational safety programs and a higher predisposition of the employers and employees to accept risk scenarios were expected. However, little is known about the consequences of this issue. This paper is a preliminary analysis of the impact of the economic crisis on occupational safety in North of Portugal.

This paper aims to analyze the views of the employed population about the influence of crisis on occupational safety, mainly in what regards to risk acceptance, management’s safety commitment and changes on the level of risk exposure. Job security and its relationship with workers’ risk acceptance were also analyzed.

A self-completed questionnaire named External Environment Questionnaire (EEQ) was applied in 2013. A total of 510 questionnaires were filled by Portuguese employees of eight cities from the North of Portugal and considered in the analysis.

The results indicate that the crisis has an important impact in the financial conditions of the workers and an important effect on job security. They point out the importance given by workers to the preservation of their job during an economic crisis scenario, making them willing to jeopardize their safety to maintain their current job. Moreover, companies were seen by workers to compromise their safety performance in a crisis period.

A strategy of the authorities and of the companies to manage safety issues in a crisis context is need. Future researches will be performed, including internal environment.
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A strategy of the authorities and of the companies to manage safety issues in a crisis context is need. Future researches will be performed, including internal environment.
This study is a part of an innovation project carried on in the ErgoLab, the Ergonomic Laboratory of Fiat Chrysler Automobiles sited in Turin, to evaluate the use of a passive exoskeleton for upper limbs in manual tasks of the automotive production line.

The introduction of innovative technologies into a production environment is not always effective, because operators often don’t use them. For this reason it is important to define an experimental phase with future users in order to make them confident with and incline to accept the innovation.

With the aim to evaluate Usability and Acceptance of a passive exoskeleton, the testing protocol included different data gathering techniques: observation and video during simulated working tasks, interviews, TAM2 questionnaire and a conclusive focus group.

Overall results showed that operators judgment of the exoskeleton is positive and they became aware that exoskeleton allows in carrying on working activities with lower physical effort. The device is perceived useful especially in supporting tasks where precision is highly required. The experimental assessment showed a good interaction human-device, but the operators involved in the tests highlight that work-device interaction could be a critical point. More in deep, workers referred perceived ease of use and results demonstrability. Focus group results showed compliance to individual results: operators state that exoskeleton is useful to carry on specific activities, but deeper analysis about the use condition is needed.
[1571] Readability and aging effects of Japanese sentences

Type: Abstract Oral Presentation
Category: Others
Nana Itoh¹; Ken Sagawa¹
¹National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

Introduction

Reading is very common and important activity to get correct information for older adults, such as instructions of medication, instruction manual, and insurance agreements. They are, however, not always designed to be readable for people at any age and at any viewing condition. Despite this importance, there is no general method to design layout of sentences with regard to character space and line length for better visibility, and ageing effects.

In our previous study, the method to estimate minimum legible font size was developed to serve a useful method to scale the legibility at supra-threshold level. Now in ISO TC159, standardization of minimum legible font size as a function of age has been considered but it is not clear yet how to design sentences especially for older people and people with low vision.

This study investigated the readability of sentences, especially regarding how character spacing and line spacing affect on readabilities including aging effects. In this study, Japanese sentences were used as a sample of consideration of good layout of sentences for older adults.

Method

A total of 192 of Japanese sentences with variable font size, variable line length, variable inter-character spacing, and variable inter-line spacing, were presented to observers in 0.5 m viewing distance, and asked them to judge the sentences as to the following five impression factors.


Results and discussion

The results showed that the effect of character size on the readability is apparent in such a way that the larger the size the easier to read the sentence. From the analysis of principal component, the first principal component was concerned with “Readability” and using the
score of this component, effects of inter-character spacing and inter-line spacing and those of aging were analyzed.

In case of older adults, short line length was easier to read and long line length was more difficult to read than younger adults. It seems that line length was more important for older adults in terms of readability.

It was found also that appropriate line length had strong effects on inter character spacing. When there is no character spacing, 40 characters of 18 point size in one line (28 degree of visual angles) was the most readable.

These findings could provide design considerations of sentences for older adults.
Introduction:

Nurses' duties have become more diversified and increasingly complex with Japan's ultra-aging population and advancements in medical technology. Additionally, the long working hours, the enormous workload, the chronic shortage of human resources, and night shifts place a huge physical burden on nursing staff. These factors have contributed to a job turnover rate of around 11% for nurses in Japan. The rate has been around the same for the last decade. In a bid to retain highly skilled and talented employees for the long-term and to enable them to demonstrate and build on their skills, there is a need to improve job satisfaction.

When looking at corporate organizations, health management is stealing the spotlight. This means that employees' health management is viewed from a corporate management perspective, and companies are taking strategic measures to maintain and promote well-being and job satisfaction of their employees. There are also many studies on the link between employees' exercise habits and their job performance. For instance, previous studies show that regular exercise is an important factor in feeling satisfied with one's work/life balance, and it is also seen to be beneficial for one's mental health. However, there is little research into the relationship between the exercise habits and job satisfaction of nurses. This study aimed to ascertain the exercise habits of nursing staff and determine how their exercise habits relate to their overall job satisfaction.

Methods:

A paper-based survey was conducted at a university hospital located in the Tokyo metropolitan area. The survey consisted of a face sheet and questions about respondents' job satisfaction and exercise habits.

Results:

Of the total 659 respondents, 304 nurses responded that they had exercised more than once in the last year. There were 40 respondents who had exercised between 1 and 2 times in the last year, 62 respondents said between 6 and 11 times in the last year, and 16 respondents said more than twice a week, with only 5% of respondents saying that they had a regular exercise routine in place. When comparing the average job satisfaction score with exercise frequency, the group that exercised once a week had the highest job satisfaction score of 3.41 (SD = 0.37). It was significantly higher than the job satisfaction score (3.19, SD = 0.41) for the group that did not exercise (p < .05).

Conclusions:
The results of this study indicate that nurses who exercise once a week have higher job satisfaction than nurses who do not exercise regularly. It is hoped that further research will be conducted into the possibility of enhancing job satisfaction by promoting regular exercise among nurses, through initiatives that encourage nurses to find more opportunities to exercise as well as find exercise companions.
Biomechanical risk factors for surgically treated ulnar nerve entrapment in a cohort of Swedish male construction workers.

Type: Abstract Oral Presentation
Category: Others
Jennie Jackson¹; Olsson David¹; Punnett Laura²; Burdorf Alex³; Järnhorm Bengt¹; Wahlström Jens¹
¹Umeå University, Umeå, Sweden; ²University of Massachusetts, Lowell, USA; ³Erasmus University, Rotterdam, Netherlands

Background: The literature on occupational risk factors for ulnar nerve entrapment (UNE), also called cubital tunnel syndrome is sparse.

Objectives: The aim was to study the association between occupational biomechanical exposures and UNE.

Methods: The occurrence of UNE was examined prospectively in a cohort of 229 689 Swedish male construction workers who participated in a nation-wide occupational health surveillance program between 1971 and 1996. UNE case status was defined on the basis of a surgical release of ulnar nerve entrapment; case data were obtained from a national out-patient database for a 13 year observation period (2001-2013). Individual risk factors considered were smoking status, BMI and age. Biomechanical exposure estimates were assigned at the occupational group level using a job exposure matrix developed specifically for the study and included 10 ergonomic (force/posture/repetition) and 2 hand-arm vibration exposure parameters determined a priori to be relevant to UNE. Relative risks (RR) for all biomechanical factors were modelled using negative binomial regression analyses and adjusted for age, smoking habits and BMI.

Results: There were 555 cases of surgically treated UNE in the cohort and the average annual incidence was 19.2 cases per 100,000 person-years. Smoking status (ever vs. never smoker RR=1.28, 95% CI=1.07-1.54) and BMI (≥25 kg/m² vs. <25 kg/m² RR=1.60 , 95% CI=1.34-1.91) were associated with increased risk of UNE.

Increased grip force (RR=1.54, 95% CI =1.24-1.92), hand-Arm-vibration (RR=1.35, 95% CI=1.07-1.71) upper extremity load (RR=1.63, 95% CI=1.30-1.92), and increased frequency of hand tool use (RR =1.37, 95% CI=1.09-1.71), elbow flexion and extension (RR=1.36, 95% CI=1.10-1.68), and static work (RR=1.36, 95% CI=1.12-1.65) were also associated with increased risk of UNE.

Discussion and Conclusions: Our findings demonstrate that multiple biomechanical factors were associated with increased risk of UNE. Many of the identified risk factors involved elevated hand grip force (grip force, upper extremity load, and frequency of hand tool use and hand-arm vibration) which may indicate it is a key etiological aspect of UNE.
INDUSTRIAL ERGONOMICS - ANGEL WINGS AT 3 STOREYS

How a collaborative in-house redesign of crane control layout improved upper limb position for overhead crane drivers.

Type: Abstract Oral Presentation

Category: BUSINESS CASE - Manufacturing

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Background: Operating old equipment in a 21st century manufacturing environment requires thinking beyond replacement with new technology. An overhead crane was identified as a high-risk crane for musculoskeletal injury during a risk assessment for change from 8 to 12 hour shifts. Administrative controls for driver relief were put in place. A risk assessment review occurred after a crane driver returned to work post shoulder surgery with physical restrictions. The shoulder injury was incurred in a previous position. The purpose of the project was to improve crane driver ergonomics through redesign.

Demographics: The workforce included 32 male crane drivers covering 4 shift crews, working 12 hour shifts in a 24/7 operation. The average operator age was 49 years of age. The oldest driver was 72 years of age.

Method: A project team included ergonomist, operations manager, crane maintenance engineer, crane electrician, shift supervisors and crane driver representative from each crew. Ergonomics tools, were applied to examine the existing work including observational data, interview, Rapid Upper Limb Assessment Tool (RULA), mock up modelling and workforce participation. A cross section of drivers were interviewed by the ergonomist. Questions included:

- “What are your main concerns when driving the crane?”
- “What are the most frequent/critical control movements?”
- “How would you improve driver comfort?”

Rapid Upper Limb Assessment tool (RULA) was used to ascertain potential impact on driver upper limbs. Scores ranged from 7 (further investigation and change required), to 3 (further investigation and changes may be required). Observations included poor seated posture when reaching forward to controls on the left and right hand side, while the hoist controller on the right hand side (RHS) caused upper arm extension and abduction with elbow flexion. Recommendations were based on the hypothesis of control layout changes influencing seated position and improved upper limb posture. This was incorporated in drawings and a mock up model. Feedback was collated from drivers.

Results: Final changes included rotating the magnet control on the LHS by 180° and relocating the hoist control on the RHS. Redundant controls were removed. The injured worker was signed off medically to operate crane A. Drivers interviewed post implementation were positive about the changes.
Discussion: Re-positioning controllers through application of ergonomics and engineering design in the absence of crane replacement, can be beneficial to workers and financially significant for the business.
Past and future challenges for railway research and the role of a systems perspective

Type: Abstract Oral Presentation
Category: Transport
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It has long been called for a systems perspective in Human Factors & Ergonomics (HF&E) with the argument that humans and their actions need to be understood within their contexts (Wilson, 2000). In this paper, we will show illustrative examples from past railway research and argue why a systems perspective is needed for efficient and coordinated processes involved in organizing and executing work in the domain of train traffic.

With its technology-intensive environment, the safety-critical decisions, and the extreme work conditions that often result in sudden shifts between high cognitive load and periods of very low cognitive load, train traffic involves complex, dynamic processes that pose many research challenges. Prior train traffic research has focused on either traffic control or train driving. In this paper, both these central roles will be in focus. While train traffic controllers are engaged in a remote control process of executing train paths, points, and signals; train drivers operate the trains and turn the time schedule into reality. Based on this, we propose that the train traffic research will not reach its full potential unless railway research considers these two roles as interdependent entities of the same socio-technical system. We argue that a systems perspective is needed to understand what work tasks are done, how they are done, and how these tasks need to be supported and mediated by technology now and in the future.

Rogers and Ellis (1994) argue that much work activity is cognitive. It is therefore essential to study cognitive and social activities of professionals in train traffic. Rogers and Ellis suggest the theoretical framework of Distributed Cognition (DCog) in order to study coordination mechanisms and information flow in complex socio-technical domains. DCog views cognition as a socio-cultural process which is distributed in socio-technical environments (Hutchins, 1995). DCog offers also a shift from studying individual cognizers to studying individual cognizers as part of a whole, functional system.

We suggest that the past challenges in train traffic research can be addressed by the application of the systems perspective of DCog. With the use of examples from our own research group, we summarize the lessons learned with the purpose to pave the way for a discussion about the benefits of applying DCog for studying socio-technical systems in general, and the train traffic system in particular. Our aim is to shift the perspective in train traffic research to focus on understanding the organization of the complex cognitive system, emphasize how cognitive work is done, and highlight the situated context of work. We argue that this approach will provide the theoretical filter to enable researchers to describe how cognitive resources within the socio-technical system of train traffic are used to accomplish a successful traffic flow.
From prescription to regulation: what workers' behavior analyses tell us about work models

Type: Abstract Oral Presentation
Category: Manufacturing

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In 2004, the PSA Group, a French automobile manufacturer, developed the PSA Excellent System. This organizational system is based on the Lean Manufacturing principles and aims to optimize vehicle production. One of the pillars of this system is the follow up of a "work standard" designed by the . This standard is then passed on to the production teams to guide vehicle manufacturing. In theory, work standards allow for the balancing of shifts, i.e. the organization of tasks that can be performed by operators within a given time frame. The objective here is to ensure that the operators' performance and health are maintained.

Despite this approach, errors and complaints on the assembly lines have emerged. In order to understand these phenomena, we carried out a detailed analysis of the operators' activity on the workstations concerned. For the data collection, we adopted a bottom-up approach by combining several methodologies: hierarchical analysis of the prescribed and actual operators' tasks (with Task Architect), filmed observations, behavioral codings (with The Observer XT) and interviews with the operators and methods engineers.

Analysis of the data revealed discrepancies between work standards and actual tasks. These differences could be explained by two types of regulation. First of all, there is an "anticipated regulation" that comes from the production teams and takes into account manufacturing constraints. This regulation is common to all operators as it is transmitted to them during the training phase. It includes strategies for reorganizing the activity so as to deal with the instability of the workstation (caused by variations in cycle times linked to customer orders) combined with synchronization of the operator with the machines (when the operator can only use his tools at a precise moment in time). Secondly, there is an "individual regulation" that allows operators to deal with the occasional production-related contingencies.

Although these regulations are essential to the production, they are sometimes costly for operators because they involve additional actions, control tasks and know-how that are not taken into account in the design of workstations. Similarly, they escape the methods engineers and are symptomatic of a dichotomy between the Lean Manufacturing rules shaping workstation design and real production constraints. In this way, we will attempt to identify these constraints with the ultimate goal of improving the PSA Excellent System's predictive performance models.
Due to recent advances in terms of affordability of the eye-tracking technology and the implementation of smarter algorithms gaze control tends to become one of the future innovative interaction methods in various professional application fields of surgeons and technician's e.g. Technological progresses enable designers implement this interaction method more usable. Still there are some challenges which must be focused initially. Therefore the methodological approach of identifying gaze gestures was tested in this experimental study by adjusting specific design parameters.

One of the main aspects is to ensure a usable and intuitive gaze control while ensuring secure and error robust interactions. Therefore, one of the most demanding difficulties, arising out of the user, is the dilemma of executing unintended actions by just looking at the interface. This immersion syndrome was determined by Jacob (1991) as the Midas Touch Problem. The observation of various approaches in this research field, which were driven by the attempt of finding an appropriable solution for this dilemma, results in the development of gaze gestures as the most promising method. This interaction method uses unique but also simple gaze directing gestures to support the intuitive interaction and avoid misinterpretation of the gaze behavior by the system on the other hand. These gestures are defined by many separate gaze sections which have to be consecutively conducted to make unintended executions in the interface as unlikely as possible.

Discrete gesture sets for continuous interaction and navigation in a menu based interface have already been tested by the according gaze gesture detection algorithm in first investigations (Jenke et al. ZFA 17.10.2017). The results lead to further important studies which focus the optimal size of gesture sets as well as the implemented metaphorical presentations and heuristics affecting the appearance of such included gestures. Existing GUI-guidelines were supplemented by both contextual technical and human boundaries and capabilities regarding this gaze based interaction method. The resulting approach of characterizing and categorizing gaze gestures by the aspect of their mutual influence and dependence presents the focus of this ongoing work.

Besides gaze gestures, past studies have shown that design parameters which are influencing the represented interface contents turned out to be an important aspect to resolve in an intuitive interaction. The layout of the represented information content in gaze controlled interfaces can be defined by several design parameters. The first results for the parameterization of structure and shape of gaze controlled interfaces have been expanded by further experimental studies by means of the developed gaze gesture test bench. The resent study represents a further step towards the design parameterization of gaze controlled interfaces which is vital to implement gaze control into actual technical applications.
Effectiveness of onsite occupational health clinics in management of work related musculoskeletal disorders in 12000 information technology professionals

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Human Factors and Ergonomics Domain: Organizational Design and Management

Productive Sectors and Services: Building and Construction

Introduction:
The prevalence of work related musculoskeletal disorders (WRMSD) in Information Technology (IT) companies has been reported to vary from 75% to 78%. Onsite clinics play a crucial role in the provision of occupational health services. However, the effectiveness of onsite clinics in the management of WRMSDs is an under studied area. The aim of this study was to find out the outcome of management of WRMSDs in onsite occupational health clinics in an IT company over a 11-year period.

Methods
A retrospective analysis was conducted from 2006 to 2017, covering 12000 employees of a single multinational IT company with software development centres in an Industrially Developing Country. The employees (8574 males and 3426 females, between the ages 20 to 60 years), were diagnosed by an experienced occupational health physician (OHP) to have a WRMSD in specific regions following extensive usage of desktop and/or laptop computer. All the employees then underwent an ergonomic workplace analysis and protocol based rehabilitation for the WRMSD by specially trained occupational physiotherapists. The employees were reviewed by the OHP monthly and at the completion of rehabilitation.

Result
Most the employees fell under the category of software and application engineers (54%), managers (33%) and technical support staff (7%). 63% of the employees used laptops, 30% used desktops and 7% used both. A total of 58% of the employees worked for at least 5-9 hours per day and 42% for 10-14 hours per day. Most of the male workers complained of low back and radiating pain in upper or lower limbs, compared to female workers who complained predominantly of neck and shoulder pain. Both the population had eye strain and increased fatigue in common. 80% had overall body pain, 67% neck pain, 58% lower back pain, 46% shoulder pain and others with upper arm, thigh, knee and foot pain. 75% were diagnosed to have Myofascial Pain Syndrome, followed by Thoracic Outlet Syndrome (43%), Fibromyalgia (34%), Tendinopathies (15%) and Type 1 Complex Regional Pain Syndrome (8%). After the rehabilitation, the VAS
scale showed significant reduction in pain levels (p<0.01). 74% had reported reduced productivity due to the WRMSD, which improved markedly after the rehabilitation. 94% of workers reported complete resolution of symptoms and 6% reported partial resolution of symptoms but could work without restriction. No employee had to take leave for more than 7 days or leave the job due to WRMSD.

**Conclusion**

The onsite occupational health clinics was effective in the management of WRMSD in the IT companies. A comprehensive ergonomic programme that involves primary prevention of WRMSD through ergonomic changes in jobs, early detection of WRMSDs through surveillance, and early treatment of WRMSDs with an emphasis on early return to modified work is recommended.
Thermal comfort differences with air movement between students and outdoor blue-collar workers

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• Human thermal comfort is usually affected by ambient physical parameters and human physiological conditions. Difference of thermal comfort requirement between different human groups in non-neutral environment exist, due to different body physiological conditions and thermal experience. However, most previous thermal comfort studies were basic on the data from college students, whose results may different from the labors. Increasing air movement is an effective and low-cost method to improve thermal comfort in hot-humid environment, which is widely used by low-income labors (which is called "bangbang") in Chongqing, China. Thus, this study aim to evaluate outdoor blue-collar workers’ thermal responses to air movement in warm and humid environment, and compare the responses to air movement between the two different groups.

• The experiment was carried out in a climate chamber with 12 chosen healthy college students and 12 outdoor blue-collar workers. Nine conditions with air temperature at 28°C, 30°C and 32°C, while relative humidity at 50%, 70% and 90% were conducted. Subjects in each condition experienced three levels of air movement for 20min which produced by an electric fan. Both physiological parameter and subjective responses of the subjects were measured, including skin temperature, thermal sensation vote, draft and so on.

• The research shows that air movement can significantly improve the thermal sensation in hot-humid environment. But the upper threshold of the acceptable temperature and humidity is different between the two groups. The upper limit of students is 30°C/70%, while the outdoor blue-collar workers could maintain their thermal comfort with air movement even in 32°C/90%. Outdoor blue-collar workers are not sensitive to changes of the temperature compared to the students. When the temperature raise from 28°C to 32°C, the thermal sensation vote of outdoor blue-collar workers increase about 0.5, while the value of students increase about 0.7. By analyzing the relationship between the draft vote and air velocity, we find that the draft vote is similar between the two groups. But the acceptable ranges of air velocity are different, the range of the outdoor blue-collar worker (0.7m/s-2.89m/s) is wider than the students (0.9m/s-2.76m/s).

• The results show that outdoor blue-collar worker are not sensitive to the changes of the environment and need less air velocity to maintain thermal comfort than the students in the hot-humid environment. Besides, the ranges of comfort air velocity under different conditions are showed in this article and the thermal comfort zone of the outdoor blue-collar worker was built.
Proposal of a methodological model for the design of a complex dynamic working environment in the forestry sector, to generate an emotionally light habitat

Type: Abstract Oral Presentation

Category: Others

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The research is aimed at proposing a methodological model for the design of a complex dynamic working environment in the forest sector, incorporating methods derived from affective engineering (Nagamachi, 1995, Prodintec, 2011), to generate an emotionally light work environment. The research scenario corresponds to the coordination and control centers of forest fires in Chile, whose management has an important economic and environmental impact, because the forestry sector constitutes the second export product of the country (CONAF, 2015).

These centers, conceptually defined as complex dynamic environments, require mutual visibility of team members, multidimensional interaction and the possibility of self-organization, through flexible and informal restructuring mechanisms (Maureira, 2015). This means that the optimization of the conditions of the space and its content, could contribute to improve the performance required for efficient and harmonious decision making in demanding situations. Unfortunately, their operators have not been involved into the design process of their work environment, even though they are the ones who know best about the functional and emotional benefits required. In this way, it is perfectly coherent to raise the need to generate better working environments, to contribute to a value chain that protects a relevant part of the country's heritage, but also by providing better psychological comfort conditions to operators. According to authors (Sørensen, 2008, Mehrabian, 1976, Alesina & Lupton, 2010, Amabile, 2012), integrating users in the process of ideation of their environments leads to the generation of spaces more in line with their emotional satisfactions.

The methodological approach includes an active operators participation by: a) the application of methods and instruments specific to affective engineering to capture the emotions of individuals in front of simultaneous and varied stimuli; b) the use of technological equipment to diagnose and define the characteristics of the space and the objects that appear in it; c) design of proposals; d) evaluation of the proposals by the users; e) final proposal design and f) user studies in Living Lab.

Until now, at a generalized level, the methods of affective engineering have been proposed for passive observation (Desmet, 2009), that is, referring to the emotions that users feel against independent and inanimate material stimuli. The novelty of this research is the possibility of defining a methodological model based on the study of dynamic environments, generating as a result a proposal that contributes both directly into this field and to the theoretical and empirical basis built by the international scientific community. The comfortable and efficient working environments design, through a methodological model could be extrapolated to other contexts.
Affordable, abundant, and reliable electricity generation is essential to fueling a nation's robust and globally competitive economy. Commercial nuclear power plants (NPPs) in the United States (U.S.), account for approximately 19% of reliable and cost-competitive base load electricity generation. Other technologies that reduce reliance on fossil fuels and provide base load electricity cost-competitively at a national scale are still under development. Thus, without suitable replacements for nuclear power, the generating capacity of nuclear energy in the U.S. must be continued through the safe and efficient operation of commercial NPPs. The U.S. Department of Energy’s (DOE) Light Water Reactor Sustainability (LWRS) research and development (R&D) program provides the technical bases for the long-term, safe, and economical operation of NPPs. One area in the LWRS program is the Advanced Instrumentation, Information, and Control Systems (II&C) Technologies pathway, which includes human factors R&D, human factors engineering (HFE), and ergonomics to enable the modernization of the instrumentation and control (I&C) technologies in NPP main control rooms (MCRs). DOE researchers, including ergonomics specialists at Idaho National Laboratory (INL) have collaborated with numerous commercial NPP utilities over the last few years on control room modernization. This paper summarizes the reasons for, and difficulties with, modernizing commercial NPP MCRs in the U.S., and in particular, how merging highly reliable and complex analog technologies that were built to last with new, advanced digital I&C technologies presents unique ergonomics safety and health challenges that need to be overcome with novel R&D solutions.

Keywords
Safety & Health
Nuclear Power Plants
Control Room Modernization
Digital Instrumentation & Control Systems
Light Water Reactor Sustainability
Human Factors Engineering
Ergonomics
In developing countries especially with high rates of unemployment, it is tempting for employers who build up small and medium-sized industries to disregard health and safety. Labour inspectors are scarce and have limited resources. Surveillance of occupational conditions is often lacking. Therefore, ergonomics must be promoted not only as a means of improving safety but also to fulfill other management goals, such as higher productivity and must stem from local initiatives to be effective. Industries increasingly require higher production rates and advances in technology to remain competitive and stay in business.

The paper shows our experience on a building site where ergonomics is integral in complementing safety to assure wellness. THERE WAS SUBSTANTIAL REDUCTION IN INJURY RATE AND PRODUCTIVITY WAS ENHANCED. The results bring out the main difference in application of ergonomics and Safety.
The impact of a combined workplace ergonomic and exercise versus health education intervention on worker productivity and severity of neck pain in a population of office personnel with neck pain: preliminary results of a cluster randomized trial

Type: Abstract Oral Presentation

Category: Others

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Background: With more than 50% of office workers experiencing neck pain at some stage of their working life, the burden on industry in terms of lost productivity and personal suffering is significant. Due to the recognised link between health and productivity, health initiatives at the workplace are gaining momentum. The aim of this study was to test the impact of a workplace-based best practice combined ergonomic and exercise intervention on work productivity and severity of neck pain in a population of symptomatic office personnel.

Design: A two-arm one year prospective cluster randomised trial was conducted in 14 private and public organisations in Brisbane, Australia (ACTRN#12612001154897).

Methods: Office-based employees (n=200) meeting the criteria for neck pain were randomly allocated to receive a progressive neck specific exercise program three times per week (n=91) or weekly health education information sessions (n=109) for 12 weeks. Both groups received an individualised ergonomic assessment and intervention of their workstation prior to allocation to either intervention arm. All interventions were conducted in the workplace during work hours. Data was collected from individuals through online surveys and physical assessments at baseline, immediately post- and 12 months after commencement of the interventions.
The primary outcome of health-related productivity loss due to sickness absences and impaired work performance was estimated with the Health and Work Performance Questionnaire. The secondary outcome was severity of neck pain during the last seven days recorded with a 10-point Numerical Rating Scale (NRS) ranging from 0 (no pain) to nine (worst possible pain). Those reporting ≥ 3 on the NRS (0-9 scale) were included as symptomatic cases. Generalised linear models investigated the impact of the interventions on the primary and secondary outcomes. Intention-to-treat (ITT) analyses was undertaken.

Results: The exercise group participants had lower rates of sickness absenteeism at 12 months compared to education group participants with 0.7 days (SD=1.0) versus 1.4 days (SD=3.1) (p-value = 0.012), respectively. There was a within-group increase in sickness absenteeism at 12-week follow-up for the exercise group of 0.6 days (p <0.001) and at the 12-month follow-up for the education group of 0.6 days (p <0.001). No significant effects were observed for impaired work performance (sickness presenteeism) and the monetary value of health-related productivity loss. A significant reduction in the severity of neck pain of approximately 50% was achieved in both groups at 12 weeks, which was maintained at 12 months with no between-group differences.

Conclusion: A combined workplace health program involving specific exercise and ergonomic intervention had a positive impact on sickness absenteeism at work in the long term but not in reducing neck pain in office workers.
Some of the most critical aspects of healthcare are performed in the home environment. This is particularly true for patients managing chronic illnesses, which are often accompanied by strict and detailed at-home regimens and activities called self-management. A subset of self-management, personal health information management (PHIM), refers to actions such as the storage, organization, tracking, recording, and seeking of information related to one’s health. For patients managing chronic illnesses such as arthritis, coronary heart disease, and – in the case of the present research – diabetes mellitus, PHIM is an integral part of daily life. In order to both understand and meet the needs of the growing population managing chronic illness at home, we must better understand the work of PHIM.

However, we cannot understand patient needs without understanding the context in which PHIM is performed: the home environment. Currently, the home represents one of the least understood healthcare settings, and the implications of managing PHIM within the home have not been systematically investigated, with a few notable exceptions. In the present study, our objective is to provide preliminary evidence on how PHIM is performed in the context of the home environment. Specifically, we investigated which household features are most useful to the performance of PHIM.

The present study is a subproject of a parent project, vizHOME, (AHRQ R01 HS022548, www.vizhome.org). The study consisted of 60 participants (N=60) who had been told they have diabetes. Participants explored five separate rooms within accurate, 3D virtual replicas of actual household interiors and were asked to identify the first- and second-most useful features for performing three examples of PHIM tasks.

We found that the five most useful household features for the performance of PHIM, across three different tasks, are: computer, endtable, nightstand, desk, and dining table. To explain these results, we appeal to the concept of affordances, or the idea that a feature’s usefulness is determined by the discrete properties, real or perceived, which it offers the end user. Our results suggest that features which offer the affordances of physical support and storage (e.g., nightstands, desks) are highly useful for PHIM, and that features offering cognitive support, content presentation, and communication surpass others in usefulness. We suggest here that a detailed study of affordances,
including which affordances make a feature maximally useful for PHIM, is the natural and necessary next step to designing features to ease the burden of managing chronic illness at home.
New technology is dramatically changing the workplace by allowing companies to increase efficiency, productivity, quality, safety, and profitability. An effective new technology implementation is required for companies to compete successfully in the marketplace. Time and money wasted on unsuccessful and improper new technology implementation is contrary to the overall goal of improving the competitiveness and profitability. Teams and teamwork have been recommended as a way to improve efficiency, productivity, quality, safety, profitability, and employee satisfaction. New technology challenges the current implementation methods and techniques. To effectively utilize these new technologies it is best to consider all the factors involved in the implementation process; most importantly the individual human elements involved. It is recommended to utilize a cooperative team oriented approach to new technology implementation, which relies on obtaining employee input and participation throughout the entire process. Therefore the new technology can be implemented in the most effective way possible.

Teamwork has been recommended to organizations as a way to improve productivity, quality, and employee satisfaction (3).

The model to be utilized is based on achieving balance between the various implementation elements. This model is known as the Balance Model (6) and integrates the psychological and biological theories in an ergonomic framework.

Teamwork is one form of work organization that can have a positive effect on the various elements of the work organization; especially on the human elements; such as performance, productivity, motivation, attitudes, and health. Autonomous work groups (i.e. teams) have the authority to make work decisions, which resulted in increased personal commitment, improved cooperation, reduced absenteeism, and increased safety (7).

The advantages of using teams and employee involvement are to increase the potential for improving efficiency, productivity, quality, safety, profitability, employee satisfaction, and acceptance of change. Employee involvement affects the five major determinants of organizational effectiveness which are: motivation, satisfaction, acceptance of change, problem solving, and communication (2).

Teamwork has been used in the implementation of participatory ergonomics in order to improve the working conditions for the employees (4).

The concept of employee participation in new technology implementation is to satisfy the employee’s needs and therefore increase motivation and acceptance of the new technology to be implemented. Creating the proper environment to motivate employees and causing them to work harder will result in increased individual employee performance (5, 3, 1).
This model, involving teams and teamwork, was utilized on a new technology implementation in a manufacturing assembly facility.

This model, involving teams and teamwork, explains a way that new technology implementation can be successful. The advantage of this model is that new technology can be implemented with a holistic “big picture” view of the project. Teamwork, participation, and employee involvement are critical to the successful implementation of new technology.
Mapping Center of Pressure During Standing Reach Tasks

Type: Abstract Oral Presentation
Category: Manufacturing

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Background. Determining whether a standing operator is able to reach a target hand location is one of the most common assessments made using digital human models. Previous work has determined that the requirement to maintain balance is one of the most important parameters affecting the accuracy of posture prediction algorithms. A systematic quantification of center of pressure (CoP) excursion behavior through a standing workspace across a range of anthropometry has not been previously reported, although some research suggests that people tend to maintain their CoP in a functional stability region lying well within the perimeter of the base of support.

Objective. The objective of this work was to obtain normative data on CoP excursion behavior through a series of standing maximal reaches.

Methods. The effects of foot placement and target location were quantified in a lab study of ten women and men with a range of body size. Participants performed a series of maximal reaches, which were recorded using a force platform and motion capture system. Foot placement condition test conditions were self-selected within notional constraints. Side by side stance was characterized as a comfortable stance at preferred width, and narrow tandem stances involved the right/left foot forward, at tandem width with natural splay. The standing workspace was characterized by targets presented through a range of azimuth angles, approximately -90° (right) to +45° (left), at 45° interval increments, relative to the reference mid-sagittal plane (0°). Vertically, targets were presented at three task heights chosen to span the range of working heights common in industry. Target heights were defined as a percentage of the participant’s stature: low (41% of stature), medium (63% of stature) and high (1.10% of stature). The horizontal location of the grid was scaled using initial measurements of each participant’s maximum reach performed at each vertical height and azimuth angle. Horizontal target distances were set at 50%, 80%, 85%, 90%, 95%, 97.5%, 100% and 102.5% of the individual participant’s demonstrated maximum reach capability in the particular foot placement.

Results. Participants center of pressure displacement increased with the kinematic constraint of the task, but the CoP excursion was greatly affected by foot placement and target location.

Interpretation. The overall goal is to develop a quantitative model of center of pressure (CoP) excursion that can be integrated into DHMs. These measures and concept can be used for design to improve prediction of standing kinematic reach tasks typically observed in industrial tasks and ergonomic assessments.
Since the Fukushima accident, High-Risk Organisations are questioning their ability to cope with extreme and very rare accident situations, over and above those covered by the current design of technical and organisational urgency schemes.

Because of the unforeseen nature of the situations, off-site crisis cells are implemented in order to focus on situation sensemaking and anticipate potential consequences and future states of the facility. During crisis management, these crisis cells are responsible for the anticipatory activity by remotely analysing the situation and proposing possible action schemes.

In the organisation under study, the off-site crisis cell, the National Technical Support Team (NTST), has to provide its expertise to the Site by proposing a diagnosis and a forecast of the development of the situation. It shall also provide information and recommendations for action to the Site (which remains in charge of the actual management of the plant).

What is needed to train crisis team members to cope with unforeseen, unique, and high-risk situations? What skills dimensions need to be developed to prepare the crisis team to cope with and manage such situations?

Preparing teams cannot mean trying to expand the range of known-beforehand situations, since crisis situations are by definition unpredictable. It means enhancing deep reasoning abilities and developing appropriate group work competences. This can be done through simulation and debative debriefings.

The aim of this communication is to present the design of a reflexive training device for crisis management, tested in the nuclear industry. This reflexive training device has been designed for the NTST.

The device aims at developing 1) the efficiency of its recommendations design process destined to the Site, its temporality, and deliberation about the alternatives; 2) the teamwork inside the NTST and with the simulated stakeholders (e.g. the site, the national command post).

To achieve these educational goals, the simulation technical device and the post-simulation activities were designed simultaneously. For instance, a simplified technical device was...
designed in order to focus on the NTST, its work environment and the requests of the other stakeholders. Debriefings sessions were collective and multi-focused. They were conducted by a peer, to promote debate between experts and cross-learning.

This reflexive training device was tested with one NTST team. Results show that it has allowed participants to debate some teamwork dimensions, such as the recommendation process, its complexity, the roles and missions of each NTST member, and to identify new ways of functioning for others situations.
Objective

More than 5,000 people committed suicide in 2016 in the UK and suicide is the leading cause of death among young people aged 20-34 years (ONS, 2016). Prevention of patient suicide is a major challenge for mental health services. A current focus of suicide prevention is in risk assessment methods which are used to identify risk factors and initiate appropriate treatment. However, risk assessment does not remove the uncertainty around the potential for suicide (Mulder, 2011). This study applied both safety I and safety II approaches to gain an understanding of the detection and response process for suicide prevention in community mental health care. Outputs from each approach are compared.

Method

For safety I, forty-one suicide incident reports were analysed using a systemic analysis approach. For safety II, interviews with 20 community-based mental health professionals (3 managers, 11 crisis team staff, 6 community team staff) were conducted asking their know-hows to successful suicide risk detection and response.

Results

The key issues found in the analysis of incidents (safety I) were:

- an inherent weakness in the interactions between patient and clinician with the presence of uncertainty in the risk detection (17 cases)
- Poor patients’ engagement with services including non-attendance and non-compliance (11 cases)
- Reliance on patients self-presenting in crisis and declining the offered support options (4 cases)
- Delay in treating new patients, with suicides occurring while on waiting lists or having only had initial assessments (7 cases)
- Coordination, communication and process issues within services interrupting patient care (7 cases)

The interviews with staff (safety II) revealed a complex decision-making process with the presence of uncertainty and trade-offs between patient clinical need, patient desire, legal and procedural obligations, and resource considerations. The interviewees were also asked about what helped them to be successful which revealed a strong theme on the importance of peer-support.
Conclusions

Safety I approach identified patient engagement issues and highlighted a problem to a care model reliant on patients adhering to care plans and presenting at times of crisis. Two questions were also raised as to whether the system has the resources to accommodate different patient needs and how services can fit to patient desire. On the other hand, safety II approach found the importance of peer-to-peer learning and support for successful detection and response to suicide risk. The results of this study indicate that safety II approach provides valuable insights into how to strengthen the system performance without challenging systemic issues, while system I approach identifies systemic issues and raise questions how to address them. These findings suggest the potential benefit of applying both approaches to quality and safety improvement in healthcare.
System diagrams for healthcare incident investigation: ease of understanding and usefulness perceived by healthcare workers

Type: Abstract Oral Presentation
Category: Healthcare

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Background

There is growing awareness of the problems of root cause analysis (RCA)-based investigation in healthcare. For example, the five whys framework and fish bone diagrams within RCA promote a flawed reductionist view, which can easily result in a blame culture and action plans focusing only on staff retraining. The need has been highlighted for use of alternative system diagrams, but healthcare might require a particular balance between practicality and utility, about which little is known.

Aim

The objective of this study is to evaluate how healthcare workers perceive ‘ease of understanding’ and ‘usefulness’ of three system diagrams: AcciMap, Hierarchical Control Structure Diagram (HCSD) and Causal Loop Diagram (CLD).

Methods

A two-hour workshop was organised to present three system diagrams (origin, concept, structure and examples) and evaluate healthcare worker’s responses using a questionnaire and group discussion. Twenty healthcare workers (twelve clinicians, six healthcare managers and three improvement researchers) attended; they had average 19 year working experience in healthcare and 90% of them have involved in healthcare incident investigations. The four aspects were evaluated by asking their level of agreement (five Likert scale) with statements on ease of understanding, usefulness for analysing contributing factors and usefulness for identifying recommendations and intention to use.

Results

In terms of ease of understanding, both AcciMap and CLD were considered equally positive by 80% of participants, while HCSD was considered much less easy to understand (35% positive). In terms of utility, AcciMap was considered more positive (75-90%) than the other two diagrams (44-65%). Consequently, the participants’ intention to use system diagram was in order of the following preference: AcciMap (60%); CLD (25%); HCSD (15%).

The participants’ qualitative comments for each diagram include: AcciMap is considered useful particularly for carrying out high-level aggregated analysis of a cluster of incidents and highlighting common causation, but need some more clarity on how to define interactions (strength, certainty, hypothesized, etc); HCSD is considered useful since the same control structure can be reliably reused once created, but its control-focused
structure is considered unfit for healthcare where complexity is managed by professionalism, not by control; CLD is seen as useful particularly for understanding in-depth dynamic interactions of certain contributing factors, but not necessarily all the contributing factors.

The participants also made the following general comments. First, more practical evidence of effectiveness of these methods will be required before considering using it more widely in practice. Once convinced the effectiveness, they will need more training/software tool first. If the use of any system diagram requires significant amount of additional human resources, it will be very challenging. The use of the system diagrams might help identify system-level issues, but people might be reluctant to admit them, which, they feel, cannot be improved.
Introduction
Occupational health and safety is related with economic activities undertaken in the country. As the economic activities grow and expand, occupational injuries and diseases are more likely to increase among workers in different sectors of economy such as agriculture, mining, transport, and manufacture.

Most manufacturing industries in Nigeria are using labour intensive in their operations and un-ergonomic practice which result in MSDs among workers. MSDs are the most common injuries related to poor ergonomics. If these injuries are taken lightly, these will progress to permanent problems. Ergonomic intervention in industries reduces MSDs among workers. Wellbeing of workers increases productivity, revenue, and reduces rejection cost which would greatly help the economy of the country.

Objective
To describe the status of ergonomics Interventions in Manufacturing Industries in Nigeria

Methods
Sixty seven manufacturing industries were randomly selected from Beverages, Nails and Bolts, Paints, Chemicals, Furnitures, Electricals and Printing press. Five management staff and 20 employees were interviewed in the sampled manufacturing industries.

Findings
Most manufacturing industries in Nigeria are using labour intensive in their operations and un-ergonomic practice which result in MSDs among workers. MSDs are the most common injuries related to poor ergonomics.

Conclusions
The ability to quantify as well as quality the cost benefit of ergonomics improvement initiatives is a critical skill that will differentiate those ergonomists who are viewed as being a source of value to the bottom line from those who are viewed as a corporate irritant. It is also observed that the ergonomics intervention improves wellbeing of workers which ultimately increases productivity, revenue, and reduces rejection cost.

Keywords: Ergonomics; Manufacturing; Productivity; Quality control; Training
Hand anthropometry of aging rural agricultural workers in Thailand

Type: Abstract Oral Presentation

Category: No productive sector applicable

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Abstract

Background: Agricultural workers perform most of the agricultural operations manually. Hand tools are also extensively used for various farm activities starting from seedbed preparation to post-harvest operations. The mismatch between the hand size of workers and the size of hand tools need to be concerned. It can lead to various musculoskeletal complications, especially aging workers. The purpose of this study was to gather the information regarding hand anthropometry among aging agricultural workers in Thailand.

Methods: A cross-sectional survey was carried out on agricultural workers aged 60 years and above residing in all sub-districts, Nong Suea district, Pathum Thani province, Thailand. The convenience sampling method was used to select the subjects. Nine dimensions of hand anthropometry relevant in design of agricultural hand tool were measured. Mean, standard deviations, coefficients of variation and percentile values for each hand dimensions were estimated.

Results: A total of 223 aging workers were 71 men and 112 women with the average age of 70.55 years (SD=7.77) and 68.80 (SD=6.71), respectively. The result indicated that there were differences between the dimensions of hand for men and women and revealed that men are larger than women. Moreover, there were a comparison made between some measurements of other countries.

Conclusions: These findings were found that in all of the hand dimension, the means for male appeared larger than female. The hand size differences suggest that some equipment or hand tools may not comfortably fit the hand of both male and female among aging workers. Therefore, these data will be useful for designing and developing ergonomic products that will cater to the special needs of aging workers in order to reduce drudgery and increase efficiency, safety and comfort. Aging workers with anthropometric differences and agricultural equipment should also be considered.

Practitioner summary: The findings of this study provide a values of hand dimensions in aging population of Thailand. Implementation of hand dimension measurements to reduce the mismatch between the aging workers and their work performance is crucial for not only in designing hand tools, but also in designing equipment for handicapped individual.

Keywords: Hand anthropometry; Aging workers; Hand tools; Safety; Thailand
Examining the effective rear view for drivers by the 3-D virtual experiment

Type: Abstract Oral Presentation
Category: Automotive
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Introductions

In November 2015, the UNECE World Forum for Harmonization of Vehicle Regulations changed global regulation for automobile production, and cameras and monitors then became available as the substitute for mirrors. Therefore, it has been suggested that this change would enable automobiles to display the rear views with different methods, which had not been possible before then. Meanwhile these new methods should have huge influences on human spatial perception. Hence, this study was designed to reveal how human spatial perception would change by the difference of display methods of the rear views under dynamic environments. The purpose of this study was to make driving safer and more fun by proposing the best display method of the rear views.

Methods

Participant operated the simulation of driving on the screen covering their entire vision. They are assigned to do three tasks: to avoid hitting against other automobiles from all directions, to pass through the given ten points in order and to reach the goal. We recorded their operation logs, eye movements, electrocardiology, hemodynamics by fNIRS and questionnaires about spatial perception after every task. Each of the conditions is described below:

A: driver’s person view (car’s rear sides are filled) and two normal-positioned side rear monitor
B: driver’s person view (car’s rear sides are transparent) and two normal-positioned side rear monitor
C: Third person view and two normal-positioned side rear monitor
D: driver’s person view (car’s rear sides are filled) and two next to-positioned side rear monitors
E: driver’s person view (car’s rear sides are transparent) and two next to-positioned side rear monitors
F: Third person view and two next to-positioned side rear monitors
G: Wide angle driver’s person view which combines side rear monitors
In comparison with driver’s person view, participants could avoid the collision with other automobiles more often with the third person view because these views were superior in its positional relationship with others. When the rear part of the automobile was made transparent, the number of glances for the side windows, at which the drivers took, was reduced while the number of collisions with others was also decreased. In addition, it was found that they were able to recognize the rear space more correctly when they had the wide angle view than the separated views. With the narrow bird view, they were delayed to be aware of others approaching. On the other hands, the broad bird view enabled them to notice others more quickly, but at the same time, their attention toward the front view was decreased, because there was a tendency to put more focus on the bird view.
Time Perception as a Measure of Psychological Flow: A Meta-Analysis

Type: Abstract Oral Presentation
Category: Sports Entertainment and Leisure

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Introduction: To experience a state of flow during a particular task, it appears necessary for an individual to become ‘immersed’ in the environment around them (Csikszentmihalyi, 1975; Jackson & Marsh, 1996). Through the immersion of the task, individuals often experience an altered sense of time. Thus, subjective time perception is thought to be a characteristic of the overall experience of flow. The body of research on flow since Csikszentmihalyi’s (1975) early studies has produced several models of flow, which rely on qualitative assessments to measure the components of flow. However, one component, time perception, can be measured quantitatively. Therefore, the purpose of this meta-analysis was to search the literature in order to identify the data pertaining to flow and one’s sense of altered time perception.

Method: Two search terms were selected for the analysis: 1) Primary search terms (i.e., time perception) and 2) Secondary search terms (i.e., psychological flow). Eight-Five (n = 85) articles were coded individually by two researchers and included analysis. The included articles were based on the results of consensus coding after researchers independently coded the articles.

Results: Overall, the 85 articles included in the analysis resulted in 989 separate effect sizes. We categorized both the independent variables (i.e., aspects of flow, total flow, and environmental differences) and the dependent variables (i.e., total flow and transformation of time) and examined the relationships between these variables using Pearson’s correlation coefficient.

There was a positive, significant relationship between individuals’ aspect of flow and their distortion of time (r = .32). However, there was no significant relationship between one’s total flow experience and how people estimated a distortion of time (r = .06) or the ratio between individuals’ estimation of time versus the actual time elapsed (r = -.14).

Discussion: The perceived transformation of time in this targeted meta-analysis been determined to be an important representation of flow and possibly the only dimension of flow that can be measured objectively. Our results indicate that the three aspects of flow each individually correlate with transformation of time, while flow as a whole does not. Given these findings, it is worth investigating the possibility that of Csikszentmihalyi’s original antecedents, characteristics, and consequences of flow, time perception is affected in different ways, and that the transformation of time is not simply an aspect of flow. The fact that it has thus far been characterized as one dimension of flow, and not studied as an aspect of flow separate from the other dimensions, creates a gap in the literature that can only be addressed through further targeted empirical efforts.
Multimodal interfaces are the result of combining multiple modalities in a meaningful way to support efficient, safe, and satisfying interaction. However, even though the pros and cons of multimodality have been investigated in several studies, many challenges remain in designing multimodal interaction, such as choosing which modality for which interaction and deciding how (or not) to combine modalities in a meaningful way.

The paper presents an approach to the design of multimodal interaction based on the notion of ‘basic operations’. Basic operations here signify the fundamental parts that make up an interaction task (such as ‘activate’/’deactivate’, ‘choose’, ‘confirm’, etc.). The rationale is the search for a generic, structured approach instead of a design based on unique choices, task by task, and with the risk of facing non-coherent interaction and sub-optimisation.

Two studies were completed to test the concept. Study A involved 20 participants (men and women, between 20 and 65). The purpose was to find out how users choose to complete predefined basic operation as well as their preference for modality. The participants were asked to demonstrate their spontaneous choice using one of three pre-defined modalities (speech, gesture, or haptics) in response to 12 different scenarios involving 6 different basic operations. However, a task may consist of combinations of several basic operations. Study B therefore investigated what happens when several basic operations are combined in a predefined (fixed) order based on the preferred choice of modality compared to a redundant approach. Also in this study involved 20 participants (men and women, aged 22 and 53). In this case, the participants completed four tasks following different procedures (unimodal which formed the reference, fixed and redundant).

The results from studies A and B indicate an interdependency between preferred modalities and basic operations, since the participants tended to choose the same modality for a specific basic operation independent of task. In addition, the participants desired consistency, i.e. to use the same modality for the same basic operation. These results would thus support the notion of a basic operation approach to multimodal interaction. However, the studies also revealed that the transition between modalities across operations was considered cognitively demanding, partly depending upon the order in which the different modalities were to be used. Furthermore, overall the participants preferred redundancy, i.e. participants preferred to be able to choose modality rather than be limited to predefined choices.

Based on the experimental studies, the paper discusses and assesses the feasibility of a structured approach - based on the notion of basic operations - to multimodal interaction design, its pros and cons, and the factors that influence users' preferred choice of modality in completing operations that make up tasks.
Is observed resident handling associated with frequently measured low back pain? - A prospective workplace study among Danish eldercare workers in the DOSES cohort

Type: Abstract Oral Presentation

Category: Healthcare

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Background: Danish eldercare workers have a high prevalence of low back pain (LBP). One important cause for LBP in eldercare workers may be their manual handling of residents. However, the association between resident handling and LBP are characterized by mixed findings, possibly due to the predominant use of self-reported exposure measurements and inadequate follow-up of LBP.

Objectives: The objective of this study was to examine the association between observed resident handling and monthly reported LBP over a one year follow-up among Danish eldercare workers.

Methods: This is a prospective observational workplace study with 1 year follow-up on LBP conducted at 20 nursing homes located in the capital region of Denmark. Of 941 eldercare workers invited to the Danish Observational Study of Elder Care work and musculoskeletal disorderS (DOSES), 469 eldercare workers volunteered to participate. Exposure was determined as resident handlings per shift for each eldercare worker by combining information from work schedules with observations of every resident’s need for physical assistance during care during morning and evening shifts. At baseline, 4716 observations of caring activities for more than 1200 residents were conducted. Subsequently, LBP was assessed monthly by text message on mobile phone during one year. The association between total number of resident handleings per shift at baseline and percent of days with LBP per month during 1 year follow-up (%LBP) was examined with a general linear model with adjustment for potential confounders. We also examined the association of specific characteristics of resident handling (i.e. use of assistive device, resident self-reliance and/or colleague assistance) and %LBP.

Results: On average, the participants performed 7.1 (SD 5.1) resident handlings per shift. Regarding the most physically demanding resident handling tasks (without the use of assistive device, resident self-reliance, and colleague assistance), 68% of the participants performed less than 1 per shift. On average, the participants reported 24.7 (SD 25.3) %LBP. When adjusting for age, sex, workplace and shift, we found a statistically significant decrease in %LBP per total resident handling performed per shift (-0.48 (95% CI -0.95 to -0.01)) and resident handling performed without assistive device (-0.82 (95% CI -1.59 to -0.06)).
When we additionally adjusted for baseline LBP, the estimate was attenuated for both total resident handling performed per shift (-0.20 (95% CI -0.52 to 0.12)) and resident handling performed without assistive device (-0.33 (95% CI -0.86 to 0.20)). We found no statistical significant associations between other specific characteristics of resident handling and %LBP.

Conclusion: No positive associations between observed resident handling and risk of LBP over one year were found. In contrast we found tendency towards a decrease in %LBP per resident handling performed per shift. There are several potential causes to these finding which will be investigated in future studies.
How to develop a HMI for an agricultural tractor focusing on the handling of various implements

Type: Abstract Oral Presentation
Category: Agriculture

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OBJECT

Agricultural tractors are used universally for a multitude of work scenarios. The large number of possible work scenarios and appropriate implements lead to different operating scenarios. However, the user interface of a tractor is mainly static and therefore represents a compromise solution for all possible operating scenarios. Thus, it is challenging for drivers to understand the operating logic, the operating procedures, and the assignment of control elements to functions. This leads to operating errors and reduces efficiency.

In this project, called aisa - adaptive interfaces systems in agricultural tractors - a user interface for agricultural tractors is developed which adapts to operating scenarios - it behaves adaptively. By this, it is possible to improve the intuition and usability of a user interface in different operating scenarios. The adaptivity is enabled with the features form, color, graphic, position, and operating force of control elements.

In this contribution, a concept for an adaptive HMI in tractors based on the analysis and developed method is shown.

METHOD

In almost 500 working hours the use of 13 different implements has been tracked in field tests. By the use of a CAN-BUS tracking system and a camera surveillance each operating step made during the time of the field tests is recorded. Out of this a characterization of each operating procedure is derived. By a workflow-based analysis a method is developed to generate significant requirements for an adaptive HMI. Various parameters have an influence on the results of the applied method. These different parameters include ergonomic factors and factors concerning the machine. Parameters are viewing areas, gripping areas, different kinds of compatibilities, cognitive clarity, behavior of the user and the machine and the interface system by itself. The analysis leads to different requirements for the adaptivity and the HMI. Based on that, defined concepts are developed. An evaluation of these concepts extracts the final concept what is meant to be finalized by designing it.

RESULTS
The results of the analysis are that especially hydraulic functions offer several degrees of freedom when being coupled to the tractor. Moreover the way of the installation of the implement and the use leads to ambiguities in the static HMI. Thus various cognitive difficulties take place while operating. In addition, there are a lot of control elements in a tractor that are not used permanently although they are placed in a very prominent position, which can be proven in heatmaps of the operating frequency. The concepts for the adaptive HMI are about to solve this problem. Both the usability and the gripping areas can be improved by an adaptive HMI. The methodical strategy which leads to the concept for such an adaptive HMI is shown as well as the concept itself.
Development of a bow motion analysis system using Kinect

Overview

We developed a simple bow operation system using Kinect and examined its capability. In this system, Kinect made it possible to develop a simple bowing motion measurement system by recognizing the movement of the body and tracking the skeleton on a real-time basis without wearing markers etc. on the body. Motion can be visually and quantitatively measured by converting the displacement of the position coordinate of each part into data. In addition, based on the bowing data from the previous study, we verified the performance of Kinect and its practicality in general educational facilities by comparing it with the system using other motion capture.

Test subjects and method

For the measurement, we intended junior high school students as test subjects and used Microsoft's Kinect. In the measurement, we extracted the data of the subject's four points, that is head, neck, waist, and knees. The distance between the Kinect and the subject is set as 2 m, and the shooting angle to the main body is set as 45 degrees. Set the contact patch of the floor and the foot as 0 in the X, Y, Z coordinates. Since the photograph data record the values of X, Y, Z coordinates of each part, we analyzed data in CSV format with the developed application and calculated values on the following 6 points. Based on those values, we compared the data of infrared cameras using markers carried out in previous study and TEMA of advanced function motion analysis software.

1. Time from start to end of bowing.
2. Time and speed from start of bowing to the bottom.
3. Time and stopped holding position at bottom.
4. Time and speed from the bottom of the bowing to the starting position.
5. Change in neck angle during bowing motion.
6. Change in waist angle during bowing motion.

Result

Kinect has a very high person extraction capability, it can automatically measure each part on a real-time basis from start to end of the bow, and in the result, no significant difference between the infrared camera using the marker and Kinect was not measured. Infrared camera using markers have disadvantages such as wearing of markers, securing an appropriate measuring environment, and installing expensive models. On the other hand, since Kinect is commercially available as a device for home game machines, it is possible to be used as a high-performance motion capture even if it is an inexpensive device and does not require markers. By making it more inexpensive and simple system configuration
with Kinect's capability, we made it with more practicality. With this, learning that incorporates motion capture is easily realized in general educational facilities.
The impact of emotion regulation on mental health of Japanese university athletes

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Introduction: Athletes’ mental health has been of great concern for coaches, supporters, and researchers in the field of sports science. Various kinds of problems related to mental health, such as depression, burnout syndrome, and eating disorders have been reported. To prevent such problems among athletes, development of sufficient support systems to enhance their ability to cope with stress and maintain their mental health are extremely important. Especially, in Japan, this is one of urgent tasks since the Olympics Games will be held in 2020. In this context, emotion regulation strategies are emphasized as effective for coping with stress from these problems. “Emotion regulation” is defined as the regulation of thoughts or behaviors that influence the emotions. Previous studies suggested that emotion regulation has an impact on mental health in general populations, but this relationship in athletes has not been clarified. Emotions may influence not only mental health, but also performance in competitive sports. Therefore, we examined the impact of emotion regulation on mental health among Japanese university athletes.

Method: Data were collected from 936 Japanese university athletes (615 male and 321 female). We collected demographic data (gender, grade, competitive level, and role in team), emotion regulation (Emotion Regulation Questionnaire: ERQ), and mental health (Self-report Depression Scale: SDS, and General Health Questionnaire-30; GHQ-30). ERQ assesses two emotion regulation strategies: reappraisal and suppression. We checked the relationship between demographic variables and ERQ scores. Next, we conducted regression analysis by setting emotion regulation (reappraisal and suppression scores) as the independent variable, mental health (SDS and GHQ-30 scores) as the dependent variables, and gender as a covariate.

Results and Discussions: Significant gender difference was found in suppression scores in ERQ, suggesting that male athletes showed a higher score on suppression than female athletes did, but no difference was found on reappraisal. This implies that male athletes tend to suppress their emotion than female athletes do. Regression analysis showed that reappraisal had a significant negative effect on SDS ($\beta = -.44, p < .001$) and GHQ score ($\beta = -.20, p < .001$), but suppression did not affect either of them. This indicated that athletes using reappraisal as stress coping have a good mental health. This implies that emotion regulation may contribute to the maintenance of athletes’ mental health.
Conclusions: We thus concluded that emotion regulation have an impact on mental health among Japanese university athletes. Sports coaches and supporters of athletes should pay substantial attention to athletes’ emotion regulation strategies to maintain their mental health and enhance their performance.
Public organizations are facing various challenges in the present economic situation in Europe. One challenge is related to working life itself. Working life is in a continuous change process and jobs and work tasks are constantly examined for optimization purposes. The common goal for the municipal processes to provide well-being at different levels may become fuzzy. Simultaneously, due to budgetary reasons, recruitment is decreasing and the average age of the employees is increasing. These factors cause both physical and psychosocial load that can lower the work ability and the productivity of any employee. (Reiman et al. 2017)

In this article we are discussing both macro- and microergonomics development needs inside a municipal organization (Hendrick & Kleiner 2001). More closely, our focus is on workplaces where stakeholders from different subdivisions inside the municipal organization work together. In industry such workplaces can be called shared workplaces (Väyrynen et al. 2012). In our study, two kindergartens and four schools were considered as shared workplaces where different actors act together to provide services aiming at educating children and youngsters. Our especial interest was to find microergonomics occupational health and safety (OHS) challenges. Further, macroergonomics was emphasized, as cooperation processes and organizational practices inside the shared workplaces and inside the municipal organization were assessed.

Multiple data sources were utilized. Firstly, past situation at the target workplaces was analyzed through OHS statistics; including accident and health data, personnel surveys and workplace survey reports. Secondly, the present work environments and practices were observed at the target workplaces. The observations were performed by following cleaning and meal services at their daily routines across the workplaces. Furthermore, during the observations, personnel were interviewed. Researchers followed the premises of Lean –oriented 5*Why –methodology to identify the root causes for the existing OHS problems (Ohno 1988). Based on the past and present data, visualized descriptions of the root causes of the problems were formed.

In the third phase, participatory development sessions, including personnel from all personnel groups at the target workplaces were arranged (Spinuzzi 2005, van Eerd et al. 2010). The goal of the workshops was to engage all the relevant stakeholder groups present in each work site (e.g. the representatives of the employee groups, employers and OHS personnel) to the development of the work. Participatory development sessions resulted in concrete development ideas and sharing of good practices. The principles of continuous improvement were also present throughout the participatory process. As a result to contribute to organizational management processes, a simplified model for
identifying and managing OSH problems at shared workplaces in the public sector was formed.
How Does the Peak Torque Produced during Eccentric Contraction Change regarding Velocity?

Type: Abstract Oral Presentation

Category: Sports Entertainment and Leisure

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Background:

Eccentric contraction is needed to support the joint during various sports activities at various speeds. In kung-fu, kicking is done so frequently in which the eccentric contraction of hamstrings is needed for the protection of knee joint from damage. We aimed to assess the change in the magnitude of peak torque produced in eccentric contractions of hamstrings at low, medium, and high velocities.

Methods:

Twenty-two skilled kung-fu athletes were tested through isokinetic system in this cross sectional study. The peak torque created by the dominant leg of athletes during eccentric contraction of hamstrings at velocities of 60, 180, and 500 deg/sec was assessed. The athlete performed 5, 10, and 30 repetitions at 60, 180, and 500 d/s respectively. The subjects had a rest period of 30 seconds between different speeds.

Results:

The peak torque produced in eccentric contraction of hamstrings was 201.0, 197.0, and 111.0 N/m at velocities of 60, 180, and 500 d/s respectively.

Conclusion:

By increasing velocity, the peak torque that a skillful athlete can produce during an eccentric contraction decreases. It reveals that sportsmen may be at an increased risk of injury at higher velocities and there is a need for additional care, support and also ergonomists’ attention.
Work-related musculoskeletal disorders (WRMSDs) are the leading cause of occupational disease. They are a group of painful disorders that can affect upper, lower limbs, and spine; more specifically the joints, tendons, muscles and nerves. The risk factors that trigger WRMSDs are numerous; such as, physical, organizational, and environmental constraints (Phajan, et al. 2014; Henry, et al. 2015; Izadirad, et al. 2017).

WRMSDs can be diagnosed through physical and psychological symptoms. The physical symptoms include sickness, and generally deceased productivity levels. Psychological symptoms include stress, depression, and anxiety (Phajan, et al. 2014).

This study aims at identifying the prevalence of WRMSDs among the hospital staff members in various Governorates (Wilayas) of Algeria: such as, Setif, Constantine, Annaba, Batna, M'sila, Oum El Bouaghi, Ouargla, and Skikda. As well as deducing their prevention strategies.

The work will be based on a sample of 500 staff members representing different health services and different disciplines. Data collection will be done through a questionnaire. Results will be discussed in light of sample personal demographics, and WRMSDs theories and models.

Key words: Work-related Musculoskeletal Disorders, risk factors, health staff, University hospital centers.
Biomechanical methodology for evaluating seat comfort during long term driving according to the variation of seat back angle

Objective: The aim of this study is to suggest a biomechanical methodology for evaluating seat comfort during long term driving with an use of driving stimulator. Background: Recent modern car seat have become increasingly complexed and sophisticated with ongoing seat discomfort problems. Consumers’ demands for better seat comfort has been increased but they still choose car seats in the wrong way. This is because most automakers offer several established short term evaluations for car seat discomfort, which have not considered the effects of fatigue by long term sitting. Previous research has recommended to quantify overall car seat discomfort by using questionnaire, EMG, and FEM etc. However, successful objective evaluation methods are difficult to find in both the literature and practice. Method: Six males were recruited to participate in a laboratory study. Participants were aged between 22~30 and all held driving license at least 2 years. Also, they have never suffered from musculoskeletal disorders and any kinds of orthopedic surgery. All participants performed three trials which were distinguished from seat back angles (86, 96, 106) and each trial was performed on the other day. Each trial was consisted of 120 min of continuous driving on the driving simulator. The simulator was consisted of the following equipments including electric steering wheel system(T300 RS GT, Guillemot, France), 6-axis motion platform(Pagnian-V3, NLR, Australia), real-car seat(Avante MD, Hyundai, Korea), acoustic vibration system(BK-GR2, GTMM, USA) and driving software(Euro truck2, SCS, Czech) in order to simulate the real environment and driving situation. Participants were required to provide subjective discomfort ratings verbally every 30min via the use of questionnaire. Also participants were video(Kinect v2, MS, USA) recorded with a full body and measured pressure(LX100, Xsensor, Canada) at seat pan and back to allow the investigator to analyze their postures and biomechanical methodology throughout the experimental period for 3min at every 30min of the trial. The results for each seat condition were performed unpaired t-test to acquire statistical significance (P < 0.05). Results: As expected, the overall discomfort rating increased over time, especially for neck, low back. Also the overall discomfort rating according to seat back angle 87 and 107 were higher than 97. As time goes by, the values for moment was increased in all groups, also there were significance after 30min from experiment started. Also, as time goes by, the seat pressure was increased all case both seat back and seat pan. Conclusion: These results suggested that a new biomechanical method could be an alternative for evaluating car seat comfort for long-term driving. The results of the biomechanical methodology for evaluating driving seat comfort, might be expected to evaluate car seat comfort and it could be recommended to driver for adequate posture in real time driving.
Home Care Workers’ Risk of Occupational Injury is Increased by Client Unsteadiness and Cognitive Impairment

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Unregulated paraprofessional home care providers who assist clients with care activities provide the vast majority (70-80%) of paid home care in Canada. They also experience high rates of occupational injury related to client handling activities. The mental and physical demands on workers are strongly influenced by the clients’ abilities and behaviours. However, there has been no systematic study to date on the influence of clients’ abilities and behaviours on care workers’ risk of occupational injury.

Purpose: to assess the influence of clients’ abilities and behaviours on workers’ risk of occupational injury.

Methods: Analyses were performed on administrative data from April 2016 – May 2017 shared by a large home care agency in Ontario, Canada. The open cohort examined in this study included all personal support providers employed during the study period in selected administrative regions that included rural, small-town, urban and suburban settings.

Information was collected on worker age, gender, years employed by the agency, hours spent on client care per week, administrative region, and number and nature of reported injuries. Data for each care visit were the client’s age and sex, and the workers’ structured observations about the client’s condition, including signs of unsteadiness (scale of 1 [no] – 5 [fall] or Stayed in Bed); degree of physical assistance required (1 [none] – 5 [full]); and signs of dementia (yes/no) and/or delirium (yes/no).

Multivariate logistic regression models with generalized estimating equations were applied to explore the client characteristics most predictive of reported injury rates, adjusting for worker age, years employed, and administrative region. Adjusted odds ratios and corresponding 95% confidence intervals were calculated for each predictor.

Results: This sample included 867 workers who provided 821 479 care visits to 5 761 clients over the course of the year studied. Injury reports showed that 147 (17%) of workers reported at least one injury during the study period.

Adjusted findings suggest that the providers were more likely to be injured if they had a greater average number of visits with very unsteady clients per week (OR=1.09, 1.05 – 1.13) and if they had a greater average number of visits per week with clients showing signs of dementia and/or delirium (OR=1.05, 1.02-1.08). Degree of assistance was
excluded from the final model because of a very high correlation with the ‘unsteady clients’ variable.

**Discussion:** Caseloads that included more visits with clients exhibiting substantial unsteadiness or signs of cognitive impairment led to small but significant increases in workers’ reported occupational injuries. Based on these findings, it may be possible to mitigate care providers’ injury risk by limiting their exposure to highly unsteady clients and to those showing signs of dementia and/or delirium.
Consequences experienced by home care workers who do not report safety hazards

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Under-reporting of safety problems is common in many health care settings. It has been linked to many factors including: a culture of sacrificing oneself to focus on patient needs; social pressure from patients, colleagues or supervisors; and fear of losing employment and/or income.

Purpose: This study examines the reasons given by home care personal support providers’ for not reporting hazards that they encounter in clients’ homes, and the immediate effects of this non-reporting.

Methods: As part of a year-long cohort study, 230 personal support providers employed by a large Canadian home and community care agency responded to surveys about their experiences in the previous week. Among other questions, they were asked: whether or not necessary equipment and assistance were available, whether they experienced abuse at work (from clients, families, colleagues or supervisors), whether problems were reported, and the effects that these experiences had on them. Thematic analysis of participants’ responses was used to establish codes and sub-codes to build a “tree” of association with increasing specificity toward the branches.

Findings: Workers who did not report hazards made this choice because of: fear of losing a client relationship, hours of work, or their job; fear of losing status with their supervisor or scheduler; and skepticism about the potential for change. Some respondents explicitly linked their unwillingness to report hazards to precarious personal finances, choosing to face added safety risks rather than risking loss of income.

Workers who were unwilling to report hazards said that this resulted in: completing designated ‘two-person’ tasks by themselves if family members or other staff were unable or unwilling to assist; working with equipment that they were not trained to use; and feeling coerced by clients and/or families into performing extra care or housekeeping activities, beyond those listed in the care plan and in some cases beyond those offered by the care agency.

Discussion: Home care workers’ reasons for not reporting hazards encountered in clients’ homes echo the reasons previously reported in other health care settings. Choosing to manage the situation themselves rather than seeking external assistance led to workers assuming additional risk to complete care activities (due to unsafe techniques or equipment) or providing additional services for the client and their families – some of which
were merely time-consuming and others of which also carried additional risk for the worker. These types of choices echo the common 'less-than-optimal' decisions described by Wills and colleagues (2016) in their analysis of home healthcare personnel's management of home hazards, and draw a direct link between reluctance to seek external assistance and the adoption of risky approaches to responding to safety challenges.
Dynamic adjustment of interpersonal distance in cooperative task

Type: Abstract Oral Presentation
Category: Robotics

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Personal space concept provides important behavioral bases for the design of humane services and comfortable environments. However, few studies were concerned with dynamic processes of personal space under cooperative situations. Its importance has been increasing, especially in the domains of medical and nursing services and education. This paper discusses how collaborators dynamically adjust their interpersonal distances in cooperation. Implications to the design of spatial behavior of social assistive robots will also be discussed.

Experimental Study

There were three factors in the present study. The within-subject factors were “task” (2 levels: no particular task vs. cooperative task) and “orientation of the body” (2 levels: face-to-face vs. side-by-side). The between-subject factor was “gender combinations” (3 levels: male-male vs. female-female vs. heterogeneous).

Twenty four healthy, young adults (12 males, 12 females; Japanese; aged 18–23 years) recruited at a university in Tokyo, participated.

Method. The stop-distance method was employed to obtain interpersonal distances. The data collection was performed by twelve pairs of participants (A and B). They were not acquaintances. At first, one of the participants (A) was assigned as an evaluator, and the other (B) took a role of an approacher. In “no task” condition, B approached A slowly from a distance of 300 cm. The participant-A was asked to say stop when she/he felt uncomfortable about the closeness. The remaining distance between the centers of their bodies was measured. On the other hand, in “cooperative task” condition, an approacher was asked to approach and perform a jigsaw-puzzles with an evaluator using a 15 inch Macbook Pro. After four interpersonal distances under different conditions (2 tasks x 2 orientations) were obtained from each participant, then the participants exchanged their roles.

Results. Mean of observed distances was 68.49 cm (SD=24.41). Three factors ANOVA (analysis of variance), multiple comparisons (with Bonferroni adjustment) and correlation analyses were carried out with SPSS statistics 22. The analysis revealed that there were statistically significant simple main effects of the “task” (F=11.44, p < 0.01), the “orientation of the body” (F=62.38, p < 0.01), and the “gender combination” (F=6.63, p < 0.01). The
result indicated that interpersonal distances under the “cooperative task” condition was shorter than “no task”; “side-by-side” was shorter than “face-to-face”; “female-female” was shorter than “male-male”.

Furthermore, the result of correlation analysis interestingly revealed that the reduction of interpersonal distance between the condition of “no task” and “cooperative task” had a significant positive correlation with the difference of preferred interpersonal distances between participants of each dyad ($r=0.537$, $p<0.01$). It suggested that a larger divergence of preferred interpersonal distances among each dyad derived a larger reduction by initiating a cooperation. In this paper, we will discuss a dynamical process how collaborators compromise their heterogeneous preferred interpersonal distances.
After the mechanization, electrification and computerization of industry, the fourth industrial revolution is now making its way into the company under the slogan "Industry 4.0". Intralogistics is being penetrated ever deeper by information and communication technology as well as its networking into the Internet of Things (IoT), Services and Data. This development is not only another contribution to the automation and digital networking of industrial production, but a systematic change, which will also affect the work in companies. It can be assumed that this transition will fundamentally change the industrial working world. Industry 4.0 is not just about gradually adapting work systems to the introduction of a new technology, but rather bringing a multitude of new technologies and applications with different levels of technical maturity to the workplace. In order to meet these challenges, there must be significant changes in industrial production, organization and work: the working relationships between humans, machines and possibly products are reoriented. Employees need to solve more complex work contexts, and skill requirements and previously established job profiles will change.

All this plays a major role in intralogistics in general. The delivery can be made on a just-in-time basis by connecting transport systems and products with the Internet. As a result, waiting times, detours and storage times can be avoided. Also the “search and get” of products in the warehouses can be extensively automated. But it is still unclear which role the employee will play in this future work system. What the professional profile of employment in the field of intralogistics can look like in the future is discussed in this article.

A "worker journey" (as already known from the customer journey) was created here. In this journey the daily routine of intralogistics activities are presented under the influence of digitalisation technologies. The changes that took place and their plausibility were evaluated using a Delphi study. Respondents were experts from companies in German industry who are already actively involved in the topic of Industry 4.0, not only in the context of intralogistics.

Result of this reflection and evaluation is a clear picture of the work of this profession in the future. The results go even further and gives answers for organizationally interesting questions such as "How is the number of employed people changing?", "How likely is automation in this work field?", "What qualification measures are necessary?" and "What opportunities do unskilled employees have?".
Studies show a significant decline in occupational hearing loss. However, this does not take into account the noise effects of leisure activities. Here, the sound level and possible dangers to the hearing are often unknown and hearing protection is hardly an issue. Certainly, hunting can also be counted among these activities that are dangerous to hearing, something that is practiced by a steadily increasing number of people.

Hunters are particularly dependent on good hearing. They want to perceive exactly every clicking noise or rustling to know: where is the game. However, hunters expose their hearing – without suitable precautions – with each shot an extreme sound level. Especially these bangs – up to 160 dB close to the muzzle – are particularly harmful to the ears and can sooner or later cause permanent hearing loss. Therefore, it is essential to protect the hearing effectively. However, the ability to wear a hearing protection when firing a shot is perceived by many hunters as disturbing and therefore often encounters rejection.

Initially, a subjective survey was conducted, which was offered both online and in interview form. Thus, information about noise exposure of the hunters in everyday life, about their shooting behavior, the dangers of hunting, the level of knowledge of the hunters regarding possible hearing hazards and existing safety precautions could be obtained. The survey was attended by 74 active but non-professional hunters of different age and occupational groups. The evaluation of the survey revealed that the danger to hearing caused by the pop of a shot is largely known to the hunters. Nevertheless, the use of hearing protection on the hunt is largely neglected. Furthermore, the evaluation of the questionnaire showed a mostly positive attitude to the use of mufflers on hunting rifles. Mufflers are considered as a further possible noise protective measure, but from a legal point of view the use is currently not allowed everywhere in the world.

Additionally, audiometric investigations were carried out on hunters. From these results it can be seen that in the case of the 20 surveyed hunters, aged between 22 and 75 years, there were in some cases dramatic changes in the audiogram at 6000 Hz. This can be interpreted as an indication of an existing bang trauma. Furthermore, the evaluation of the measurement revealed that there is a clear differentiation concerning hearing loss between the ear which is facing the weapon and which is on the far side.

Conclusion: From a health point of view, the joint use of hearing protectors and the worldwide authorization of mufflers for hunting weapons are certainly recommended.
A Modified Weighted SERVQUAL Method and Its Application on Elder Care House in Taiwan

Type: Abstract Oral Presentation  
Category: Healthcare  
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SERVQUAL and its variants have been widely applied in a variety of industries and cross-cultural contexts in modern time. One of their identical criticisms is that they cannot point out the improvement priorities to guide the allocation of resources.

This study proposes a modified SERVQUAL method to overcome this major defect. In our modified method, users’ expectation score is not only for comparing with perception score to get gap scope, but also the resource to extract the importance judgments from users directly. With sufficient sample sizes, users’ expectation score on attributes will form a normal distribution. The relative importance between attributes could be inferred from the accumulation percentages of this standardized distribution. Besides to gap scores, the importance evaluation of each attribute is another critical consideration for the planning of improvement. The effectiveness of our modified method is demonstrated with an example of customer satisfaction research on elder care house in Taiwan.

By applying SERVQUAL method, “suitable temperature at elderly rooms” (gap=1.20) and “Meals served are clean and hygiene” (gap=100) are the first two gap score among all attributes. But lacking of relative importance evaluation, the improvement priorities are unclear. By applying our modified method, the improvement priorities should be “The employees solve the elderly’s problem sincerely” (gap=0.95; p(c)=0.88) and “Medical treatment and doctor visiting are well scheduled” (gap=0.76; p(c)=0.82).

Research on service quality instruments have significantly benefits not only in scientific-theoretical fields but also in practical fields. The recommendation derived from our method can grasp the customers’ real needs and desires and enables managers to develop the coping strategies directly and easily. Furthermore, it expresses meaningful statistical results than only base on the methodology of ranking.
Study on anisotropic haptic texture of buttons for user interfaces

Type: Abstract Oral Presentation

Category: Others

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Recent years, we access more smart devices which are both functional and aesthetically pleasing such as smart speakers. These aesthetically attractive devices have some buttons having similar haptic textures as their user interfaces and the users intend to find the buttons with letters or symbols attached to them as visual cues to indicate their functions. Thus, haptic cues, in addition to visual cues, could help the user understand the buttons' functions of personal electronics.

In this regard, several studies proposed methods to determine haptic textures conforming to the user's image of button functions created by touching. In our attempts to define the haptic texture that conforms to button functions, we found that haptic texture is influenced by the user's knowledge, experience, context, etc. rather than the image created by touching. Therefore, we assumed the approach to define the haptic texture based on the user's image could be difficult way.

According to ISO 1503:2008, the operating direction of controls and the moving directions or changing states of target objects should be compatible and consistent with the series of paired concepts in Group A or B. For instance, ISO 1503 includes the following compatible terms in Group A: "below," "to the left," "dark," and "to switch off." Based on this concept, we used shark skin with different orientations for covering the buttons to indicate a kind of direction to the user. Thus, users can understand the intended purpose of each button by touching them if they know the paired buttons' functions. However, the characteristics of the anisotropic haptic textures of shark skin could infer the opposite direction depending on users in our previous study. Therefore, we do further research to figure out the directional images created by touching the anisotropic material and aimed to propose a guideline for designing paired buttons covered with the anisotropic haptic texture.

In the experiment, over 60 participants in their 20s to 70s were tried to perceive the anisotropic haptic textures of shark skin using their forefinger of the dominant hand without seeing them, and then reported the direction in which they felt the strongest frictional force and the directional image created by touching. From the result, 30 out of 37 elderly participants could perceive the direction in which the material presented the roughest surface; however, two opposite directional images by touching were reported regardless of age. Hence, based on the result, we determined the direction by touching the anisotropic haptic texture and suggest the direction to all participants. To reveal the effectiveness of the suggestion about the directional image, the verification experiment was conducted. As the result, we confirmed that almost of the participants could touch the invisible button correctly by touching.
Introduction

Nowadays, the average walking speed (AWS) is measured even during daily living by using wearable accelerometers. However, it is still not known how much the sensor location affect the accuracy of AWS estimation if the models were made in uniform manner. The purpose of this study was, therefore, to compare the accuracy of AWS estimation among following three body landmarks: wrist (Styliion Radiale), pelvis (ASIS) and ankle (Lateral Malleolus). In this study, actual AWS during walking has defined as the average speed of body center of mass (COM) during one gait cycle. Therefore, we hypothesized that the acceleration signals that obtained from pelvis could estimate the AWS most accurately because pelvis is most close landmark to the body COM.

Methods

Ten time-normalized acceleration signals during one gait cycle while walking barefoot at a comfortable, self-selected speed were obtained from 247 healthy adults aged 20 to 77. Linear multiple regression analyses with leave-one-participant-out cross validation technique were used to build the algorithms. Dependent variable was AWS of each trial. Independent variables were acceleration signals obtained from each of above mentioned landmarks. Stepwise technique was used to select independent variables to build the model. Following two errors were computed to compare the accuracy among the landmarks: absolute value of errors on each trial (AE_trial), and absolute value of mean errors on each participant (AME_participant).

One-way analyses of variance (ANOVA) were used to compare above mentioned two errors among the landmarks. Bonferroni's multiple comparison was used for post-hoc analysis if significant main effect was observed. Because of the large number of data, the differences in the means were considered statistically significant only if the $p < 0.05$, the $\eta^2 > 0.06$, and the $r > 0.40$, which indicating a medium effect size.

Results and discussion
Between-participant means (standard deviations) of AE_trial and AME_participant on each landmark were as follows: AE_trial: wrist 0.090 (0.070) m/s, pelvis 0.059 (0.046) m/s, and ankle 0.051 (0.041) m/s; AME_participant wrist 0.080 (0.061) m/s, pelvis 0.051 (0.040) m/s, and ankle 0.042 (0.035) m/s. Statistical analyses revealed significant differences between wrist and ankle for AE_trial; and between wrist and ankle, and wrist and pelvis for AME_participant. These results did not fully support our initial hypothesis. However, we found that AWS can be estimated from the acceleration signal of pelvis or ankle with almost same accuracy (approximately 0.05 m/s of average error).
Some aspects of visual attention data is already validated to be strongly correlated to estimated task related mental workload. In this study, N-back tasks with four difficulty levels were designed to induce mental workload for a sample of 21 university students at NTNU Gjøvik. Seventeen eye parameters (visual attention data) were measured using SMI RED250mobile Eye Tracker at a sampling rate of 250 Hz. Amongst the seventeen eye parameters that were measured we carried out a correlation study between the parameters. This correlation study was followed by applying Principal Component Analysis (PCA) on the entire data set. The main purpose of the PCA is to reflect the visual attention data in terms of a much smaller set of metrics than seventeen parameters. The relation between this smaller set of metrics and the estimated mental workload will be assessed. This would allow us to explore the possibility that we can estimate mental workload with a smaller set of metrics that does not necessarily discard all of the effects captured through variables other than peak fixation duration.
Theoretical considerations and development of a questionnaire to measure trust in automation

Type: Abstract Oral Presentation
Category: Others

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The increasing number of interactions with automated systems has sparked the interest of researchers in trust in automation because it predicts not only whether but also how an operator interacts with an automation. In this work, a theoretical model of trust in automation is established and the development and evaluation of a corresponding questionnaire (Trust in Automation, TiA) are described.

Building on the model of organizational trust by Mayer, Davis, and Schoorman (1995) and the theoretical account by Lee and See (2004), a model for trust in automation containing six underlying dimensions was established. Following a deductive approach, an initial set of 57 items was generated. In a first online study, these items were analyzed and based on the criteria item difficulty, standard deviation, item-total correlation, internal consistency, overlap with other items in content, and response quote, 40 items were eliminated and two scales were merged, leaving five scales (Reliability/Competence, Understandability/Predictability, Propensity to Trust, Intention of Developers and Familiarity) containing 17 items.

The internal structure of the resulting questionnaire was analyzed in a subsequent second online study by means of an exploratory factor analysis. The results show sufficient preliminary evidence for the proposed factor structure and demonstrate that further pursuit of the model is reasonable but certain revisions may be necessary. The calculated omega coefficients indicated good to excellent reliability for all scales. The results also provide evidence for the questionnaire’s criterion validity: Consistent with the expectations, an unreliable automated driving system received lower trust ratings as a reliably functioning system. In a subsequent empirical driving simulator study, trust ratings could predict reliance on an automated driving system and monitoring in form of gaze behavior. Possible steps for revisions are discussed and recommendations for the application of the questionnaire are given.
Prolonged occupational sitting is associated with a favorable time course of low back pain.

Type: Abstract Oral Presentation

Category: Others

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Background

Occupational sitting has been suggested as a risk factor for low back pain (LBP). However, the association between total and temporal patterns of occupational sitting and the prospective repeated measures of time course of LBP has not been investigated previously. Therefore, we aimed to investigate this association.

Methods

A prospective analysis was performed in the DPacto cohort, including workers from cleaning, manufacturing and transport sectors. Background information was collected by questionnaire.

Sitting time was measured by accelerometry by two ActiGraph GT3X+, directly mounted on the skin at the right thigh and at the upper back, at baseline for 1-5 days, and was processed using the Acti4 software providing information about posture. Occupational sitting was expressed in percentage of total duration per day, calculated by summing up the time spent in all periods of sitting and averaging across measurement days. Temporal patterns were quantified by the exposure variation analysis ie. % of occupational time spent in short (≤5 minutes), moderate (>5 – ≤20 minutes) and prolonged sitting periods (>20 minutes).

Time course data of LBP intensity were collected by text messages sent every fourth week, across one year (ie. 14 sent text messages). The sample text message was “On a scale of 0–10, grade the worst pain you have experienced in your lower back within the past month?” (0 = no pain, 10 = worst possible pain).

Workers were included in the analysis if they answered at least one of the text messages and had valid accelerometer measurements for ≥ 4 hours/day or ≥ 75% of average wear time during work.
Linear mixed models were applied to investigate the association of occupational sitting and LBP across one year, adjusting for diagnosis with herniated disc, peak intensity of LBP during the past three months collected at baseline, occupational lifting and accelerometer measured sitting during leisure time.

**Results**

665 participants were included in the analysis. Due to the non-normal distribution of the exposure variables, a square root transformation was applied to retrieve the normality.

Significant negative associations for total duration and short, moderate and prolonged periods of occupational sitting, with time course of LBP were found. The estimates for 10% decrease in occupational sitting were: total sitting (B -0.05, 95% CI -0.07 to -0.04), short (B -0.12, 95%CI -0.15 to -0.08), moderate (B -0.12, 95% CI -0.15 to -0.08) and prolonged periods (B -0.12, 95%CI -0.16 to -0.09).

**Conclusion**

Longer total durations of occupational sitting, irrespectively of temporal pattern, were significantly associated with a decreased time course of LBP. This study indicates that occupational sitting does not seem to be a risk factor for LBP among blue-collar workers.
Technology and IT solutions need to be compatible with the knowledge about human capabilities, if they are to serve and help people. In the era of raising productivity and digitization, human needs and psycho-physiological limitations are often not taken into consideration. Knowledge about Ergonomics is one of the motors for innovative activities and should be popularized by including it in teaching programs, starting from elementary schools, through next stages of education. In Poland, the obligation to teach about Occupational Safety and Ergonomics is realized mainly through universities.

The preparation process that results in a student becoming ergonomic designer and end-user, appreciating the usability and comfort of ergonomic solutions, requires proper education, which would trigger changes in his or hers value system, knowledge, skills and habits in seeking information as well as preferences and attitudes. Knowledge about psycho-physiological and social capabilities used in designing of products and systems allows people to use efficient products and comfortable working environment.

The goal of this article is to present current state and perspectives for ergonomic education in Polish universities. Article will focus on the results of research performed in selected universities in Poland between 2006 – 2017. Research was aimed at three issues:

1. Analysis of the share of Ergonomics and Occupational Safety related subjects in mandatory and complementary teaching programs as well as the current state of active faculties and specializations from this area.

2. Evolution of teaching content in the area of Occupational Safety and Ergonomics


Research results will allow to form a diagnosis on current teaching condition and prepare system solutions for popularization of Occupational Safety and Ergonomics at universities.
Technology and IT solutions need to be compatible with the knowledge about human capabilities, if they are to serve and help people. In the era of raising productivity and digitization, human needs and psycho-physiological limitations are often not taken into consideration. Knowledge about Ergonomics is one of the motors for innovative activities and should be popularized by including it in teaching programs, starting from elementary schools, through next stages of education. In Poland, the obligation to teach about Occupational Safety and Ergonomics is realized mainly through universities.

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Research results will allow to form a diagnosis on current teaching condition and prepare system solutions for popularization of Occupational Safety and Ergonomics at universities.
Redesign of squared-profile wood sanding machine for Work-position and Productivity Improvement.  (Case study on Abu Production, Pleret, Bantul, Yogyakarta)

Type: Abstract Oral Presentation
Category: Others

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Abu craft Production Industry is a small and medium enterprise (SME) that produces various types of handicraft products, such as tissue boxes, lamp cups, ashtrays, fruit baskets, flowerpots, flower vases, plaques, trays, souvenirs, and other types of wooden craft product. One of production processes is sanding process which is performed by the operator while in sitting position on a small bench for long time. It causes the worker works with the back in bent position, head bowed, elbows and both legs include knees folded. Standardised Nordic Questionnaires (SNQ) revealed that the worker suffers from pain in the neck, shoulder, elbow, wrist, back, buttok, and knee. So, it can affect on the work productivity.

The objective of this research is to redesign of squared-profile wood sanding machine for Work-position and Productivity Improvement. The concept of ergonomics is applied for work facilities designing. The discomfort level, completion time, and productivity level will be measured for comparing between pre and post redesigning conditions on this research. The anthropometric data is taken as reference for the dimension of sanding machine design which match to the body dimension of the worker. SolidWorks software is used in this research for sanding machine designing. The statistic computation is conducted by using SPSS software. The result shows a decrease on the level of discomfort of 70% into 10%. Regarding to the average standard time, the result shows 17.36 minutes/unit and 7.35 minutes/unit for initial and final condition, respectively. It indicates a decrease of 56.6% in term of completion time. Related to the standard output, it shows 3.46 units/minute for initial condition and 8.00 units/minute for final condition. It indicates that there is an increase 129.59% in term of productivity when compared to the initial condition.

Keywords : Ergonomics in design, Anthropometry, Productivity, Completion time, Discomfort level
[2799] On what conditions do people take "resilient" actions for safety?: Experimental Study for Safety-2

Type: Abstract Oral Presentation
Category: Others

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On what conditions do people take "resilient" actions for safety?: Experimental Study for Safety-2

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Human Factors and Ergonomics Domains:
Safety & Health

Productive sectors and services:
Others

Introductions:
In the perspective of Safety-1, people are supposed to follow manuals in order to reduce failure. On the other hand, Safety-2 - which is proposed in recent years - suggests, people sometime take resilient actions depending on the condition to generate better results. In order to effectively combine these two safety strategies, we need to take advantages of each of these two modes skillfully, in which people follow manuals under normal conditions and respond flexibly under
unusual conditions for having positive outcomes. Hence, this study is designed to find guidelines on how to use the two safety strategies for achieving higher safety by focusing on how people switch these modes subconsciously. The purpose of this study is to clarify how surrounding circumstances differentiate standard and resilient behaviors through simulation experiment of firefighting work.

Methods:

The experiment participants operated simulations of firefighting work on the desktop screen. They are required to take three actions in order to minimize the damage of buildings: to fire-fight by fire trucks, to build a barrier to prevent spreading fire, and to destroy the building.

The experiment participants are asked to comply with prepared manuals in the normal conditions, and respond the condition flexibly without following the manuals when they think that it would be necessary to minimize damage. For this task, we prepared six different scenarios (no fire truck, less fire trucks, less resources to build walls and destroy buildings, the construction of walls and destruction of buildings takes longer than usual, sudden reverse of the wind direction, normal) and prepare 18 conditions in total by combining these scenarios with the three wind speeds (average wind speed 3m/s, 7m/s, 12m/s) Each experiment participant tried each of the conditions once. We recorded their operation logs and hemodynamics with fNIRS.

Results:

Resilient behavior was defined as acting beyond the manual as necessary, and the behaviors of the participants observed in the tasks were divided into manual action and resilient behavior.

Then, in order to investigate factors influencing the choice from these two actions, we applied mathematical quantification theory class II to analyze it.

The objective variable was whether a standard action or a resilient action, the explanatory variables were a wind speed and a scenario. Based on the results, the following was clarified.

1) Experiment participants tended to take resilient actions, especially in the cases where the scenarios (no fire truck, reversed wind direction suddenly, and so on) changed more intensely than a certain level.

2) Experiment participants tended to take resilient actions at wind speed 7m/s rather than at 3m/s but when it got stronger than 11m/s, it became too difficult to deal with, and so they tended stuck with the manual.

Reference:

Today, enabling productive and ergonomic work processes, work methods and work systems play a significant role and in the future it is going to gain even more significance. The “Ergonomic Assessment Worksheet” (EAWS) is a screening tool to evaluate the physical workload on the human body in different workplaces. It was developed for ongoing production and for production planning in the automotive industry and similar industries. With EAWS physical stress can be easily evaluated and the results are very detailed. Aspects of successive stress superposition can be greatly simplified for short-cycle tasks. The results of the evaluation are the basis for the communication between management and workers councils. The new process building block systems Human Work Design (MTM-HWD®) describes motions of people in conjunction with an ergonomic assessment procedure in this case EAWS) in one step. Thus allows a direct correlation in designing productive and ergonomic work. This contribution presents principles, practical application cases and the standardized education concept of EAWS and MTM-HWD® in the light of their international application.

For both methodologies capturing or tracking of motions is essential in order to collect information about body postures of human beings, forces and loads for manual material handling as well as information of the frequency of the repetitiveness of the upper limbs. An automatic collection of these kind of data by a motion capturing suit (AXS) and the connected gloves as well as the evaluation of the collected data by an EAWS and MTM-HWD® analysis will also be presented in this contribution from a theoretical and practical (business case) perspective (see figure).
Learning objectives:

- How Human Work Design is applied to describe and evaluate human work.
- How Ergonomic Assessment Worksheet (EAWS) is applied to assess biomechanical risk and to quantify physical workload.
- How these methodologies are taught on an international base and are applied in the field to enable ergonomic and productive work.
- How motion data are collected automatically and are evaluated by an EAWS and MTM-HWD® analysis.

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India is the Second Largest producer of clay fired bricks, accounting for more than 10 percent of global production. Workplace related stresses are known to be linked to absenteeism and decreased productivity. Physiological, Postural, Psychological and Environmental stresses are mainly four major types of stresses that affect productivity/human performance. A good numbers of research paper suggests that “design intervention” is required as soon as possible in the Indian brick-making industry.

In Indian scenario, automation or high degree of mechanisation is not possible due to many reasons such as High initial Investment, limited or no access to grid electricity and low-profit margins. But partial mechanisation may be possible. Therefore in the brick-making industry, prioritization on direction for design intervention is essential. Keeping in mind, the necessity of prioritization between Physiological, Postural, Psychological and Environmental stress, the present study was focused to develop guidelines for design intervention.

The above mentioned four types of individual stress level were measured by existing methods. Overall stress was also measured by using proper protocol. A simple linear regression model was applied to know the weightage factor of four types of stresses, Physiological, Postural, Psychological and Environmental stress (PPPE) on the overall stress. A PPPE Scale was derived from the proportion/weightage values. From the above weightage factor, the dominant stress type was determined from PPPE Scale pointer which can be used for an intervention of work-related activities based on dominant stress factors.

To validate the above scale, three activities (Mud Making, Brick Moulding and Brick firing/Jalai) were selected from the brick making process. Heart Rate, OEC, PSS and CET were measured to know the Physiological, Postural, Psychological and Environmental stress levels for above three activities. It was found that Physiological stress is higher for Mud making activity, Postural stress is higher for brick moulding activity, and Environmental stress (Heat Stress) is higher for Jalai (baking) activity. This result gives a clear design direction for redesigning the task. For Mud Making with high Physiological Stress, partial mechanization is recommended, as the job demands high cardiac cost and high energy expenditure. To reduce the postural stress in the brick moulding operation, tools redesign is recommended as design intervention which would also focus on improvisation of work postures adopted in conjunction with the tool design. Lastly, the Jalai activity demands constant exposure to very high thermal stress mainly due to high radiant heat. To reduce the heat stress, protective gear and thermo-resistant uniform were the suggested.

In conclusion, it is suggested that when the dominant stress experienced by the workers in unorganized sector is identified and prioritised, the direction for design intervention is easier for the designer.
The brick industry in India is highly labour-intensive employing about 15 million workers and is characterized by the use of manual labour, primitive and age-old technology. Mud transfer is a sub-activity among the brick moulding activity. After the mud preparation, the prepared mud has to be transferred to moulding site by using a cart. The weight of mud transfer trolley was 50 (±5) Kg and they carried 300 (±25) kg mud on every trip and as such 20 trips every day. As a result, they handled 7000 kg (350 kg * 20 trips) load every day beside their main brick moulding activity. During the unloading the mud, they put both the hands above shoulder level and same time they need to pull the trolley to back and make an aisle of mud. This unloading method accumulates high-level postural stress on the shoulder and arms. This awkward posture creates musculoskeletal disorders in associated muscle & pain in different body joints. This sustained posture hour after hour and for days after days is biomechanically very detrimental to health & needs to be eliminated immediately. Assessment of Work posture adopted during job (REBA, RULA, and OWAS method) was done. A user-centred approach to moulders behaviour and understanding the issues were made through personal interview & observation method. The aim of the study is to change the work posture (unloading mud) ergonomically. One conceptual model of the mud transfer trolley was made by using SolidWorks CAD software based on anthropometric data of brick kiln workers. Workers comfort was also taken into consideration while designing the mud transfer trolley and special care taken to match the trolley with existing brick making sub activity. The CAD drawing was then converted to a full-scale prototype for the simulation study. The newly developed concepts were applied in the actual field which increases the productivity by delaying the physiological fatigue. Workers accepted the newly designed mud transfer trolley.

Keywords: Brick Kiln, Mud Transfer Trolley, Design Intervention, Musculoskeletal Disorder, Ergonomics
Abstract

Introduction

Underground workspaces have recently received renewed interest (Bobylev, 2009; Lee, et al., 2017; Lee et al., 2016; Roberts et al., 2016; Sterling et al., 2012). There is hence a need to understand how underground workers interpret and experience such spaces. We present a case study of a single underground complex in a state in the Midwestern United States. The objective of this study was to gain a thorough understanding of various social determinants along with architectural aspects that could affect performance in underground spaces. The site chosen is one of the largest underground workplaces and has been operational for decades. It also provided a good range of interviewees in terms of demographics, industry, company work policies, and job type.

Method

The study will present analyses of in-depth interviews of close to 80 full-time employees from various tenant companies. The research team focused on both repeated patterns in the data, as well as the aspects that were specific to each sample cluster.

Main Results

We identified a series of emerging themes that seems to be critical for workers in underground spaces. The size of the entrance to the underground complex was underlined as a key architectural point, especially among new employees or visitors; for some, it evoked a sense of awe and adventure, for others, especially those who were claustrophobic, a small entrance acted as a deterrent. Communication was another key factor. The site did not have uniform mobile connectivity. It was observed that the employees who could interact with the outside world and do so with ease felt more positively about the environment as opposed to those who could not. Similarly, employees who could leave the facility occasionally didn't mind the lack of mobile connectivity in their underground offices and viewed it positively as “me-time” and lesser distraction, whereas those who couldn’t leave the facility till their shift ended viewed the place less positively. Factors such as privacy, fresh air, sunshine, a
change of scenery etc. were repeatedly mentioned as reasons why employees wished to occasionally step out of the workplace. On the positive side, protection from the weather was an aspect that was repeatedly stated not only with respect to thermal comfort but also in terms of clothing, protection for the vehicle etc. The conclusions also include factors such as pollution, signage and orientation, and safety factors.

Conclusion

The study can assist organizations, architects, facilities managers and other stakeholders of companies and governments to understand how to ensure that workers in underground spaces are satisfied and productive. In particular, the analysis has relevance for issues such as attraction and retention of employees, offering insights on ways to improve the work environment and enhance their wellbeing.
Introduction: Labour force participation of elderly workers is expected to increase. Workers with physically demanding occupations, such as construction workers and electricians, have a high prevalence of musculoskeletal disorders and pain. Consequently, elderly manual workers may not be able to keep up with the trend in prolonged labour market participation. Previous research has suggested that reduced motor variability may increase the risk of developing musculoskeletal disorders. Moreover, low signal complexity has been related to musculoskeletal discomfort and pain. The present study seeks to investigate the association between handgrip force variability and musculoskeletal pain in elderly manual workers.

Methods: This study is part of a cross-sectional examination of physical performance in 100 elderly (age 50-70 years) manual workers. Data collection has commenced and is expected to be completed by March 2018. Force variability will be measured using a digital hand dynamometer during an endurance trial where the subjects exert 30% of their maximal isometric contraction (MVC) force until task failure. The test will be terminated when the force drops below 28% MVC for more than 5 sec. Both absolute variability (standard deviation) and relative variability (coefficient of variation) will be calculated from the endurance trials. Moreover, to assess the complexity of the force signal, nonlinear metrics such as sample entropy will be computed. Musculoskeletal pain will be assessed using a version of the Standardized Nordic Questionnaire. It includes questions about pain or discomfort within the last 12 months in the neck/shoulder, arm (elbow, wrist and hand), lower back, hip, and knee. In addition, the degree of pain in these areas within the last seven days is assessed.

Discussion: Although healthy elderly may be able to continue working until normal retirement age, those with musculoskeletal discomfort or pain may be forced to withdraw from the labour market prematurely. This is especially problematic for manual workers, which are dependent of their strength and endurance capacity to adequately perform their work. Knowledge about the association between force variability and musculoskeletal pain will lead to a better understanding of the elderly workforce. Furthermore, it may enable us to determine possibilities for prevention such as physical exercise programs or ergonomic interventions.
Barriers and Facilitators for Implementing a Moving and Handling People Programme: An Exploratory Study

Type: Abstract Oral Presentation
Category: Healthcare

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Aims

In order to reduce musculoskeletal disorders due to moving and handling people, national healthcare sector organisations worldwide have developed intervention programmes (Hignett 2003, Dawson et al. 2007, Verbeek et al. 2012). However, the efforts to reduce the incidence have been largely unsuccessful (Nelson et al. 2006). This study aims to identify barriers and facilitators for implementing the New Zealand Accident Compensation Corporation Moving and Handling People Guidelines (MHPG) (2012) in NZ healthcare organisations. The study also aims to identify possible solutions to overcome identified barriers.

Methods

The study has two phases: 1) focus groups with attendees at the Moving and Handling Association of New Zealand 2017 annual meeting and 2) semi-structured interviews with ten individuals in health care organisations that have used the MHPG and are classified as ‘high uptake’ users of the MHPG based on a questionnaire replies from 654 New Zealand healthcare workers.

The focus groups discussed how to overcome barriers to implementing the MHPG. Each of the identified barriers was considered by small groups of two to three attendees, who were asked to identify possible solutions to overcome the barrier. For the semi-structured interviews, ten key individuals were selected according to their work role and work place and their level of MHPG uptake. The interview comprised of questions about the use and implementation of the MHPG, specific questions about the 14 sections of the MHPG and individual questions specific to each interviewee based on their questionnaire answers. Data collected from the focus group and the interviews was thematically analyzed.

Results

From the preliminary analysis, the most prominent environmental barriers seem to be ‘costs of the MHPG implementation for the organisation’ and ‘MHPG incompatibility with organisation practises’. From the individual barriers, the ‘disagreement between the staff and trainers’ was most often mentioned in the interviews. From the environmental facilitators, ‘support and evidence from the MHPG’ seems to be the most prominent, whereas ‘trainer’s activity and persistence in implementing the MHPG’ the most important individual facilitator. In terms of ‘costs of the MHPG implementation for the organisation’, the barriers have been overcome by ‘referencing to the MHPG in terms of what is realistic
and safe. External contractors have also build training modules for organisations to choose from to maximise the efficiency of the training. In terms of ‘disagreement between the staff and trainers’ ‘referencing to the MHPG in terms of training’ has been used as a way to overcome the barrier. Environmental change has been recognised as a possible future solution for the mentioned barrier.

Conclusion

According to the preliminary findings, the barriers and facilitators for implementing the MHPG, consist largely from environmental factors. Further, organisations have also found some ways to overcome some of the identified barriers.
Oncologist’s consultation activity in a Tunisian day-hospital and challenges for quality of care, security of patient and wellbeing of physicians

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Abstract:

Context

Over 14 million new cases of cancer are diagnosis each year with increasing costs for health systems [1]. Female’s cancers are common as well, in low, middle and high income countries [2]. Oncologists are confronted to rapid and important evolution of knowledge in the field of cancerology and to therapy’s growing complexity [3]. At the same time, they have to face multiple reforms of health care systems with economic logics and management methods reducing human resource, targeting to avoid waste and to maximise performance[4].

Objectives

In this changing context, oncologist activity may be affected thus we investigate medical consultation and tried to help collective reconception of the activity. We searched to understand what define a "quality consultation" for practitioner, to identify its facilitators and strategies involved face to obstacles.

Methods

The study was conducted at oncology day-hospital of Maternity University Center of Monastir in Tunisia, devoted to the chemotherapy of female cancers. the diagnosis of cancer has already been confirmed For all patients, who have already in some cases, started their therapeutic project (surgical act or radiotherapy practiced...). While, for other patients, the treatment starts in the oncology’s unit. To understand the overall hospital functioning, physician activity and transvers collective
interactions, intervention was based on open observations and informal interviews. To better analyze this consultation activity, these data were completed with formal interviews with the physician team.

**Main results**

Physicians activity was characterized by the collision of three stages into one. Indeed, they provide both, the diagnosis announcement; the explanation of therapeutic project including potential adverse effects; and the clarification of administrative procedure for treatment recovery (which must be insured by the patient or one of her relatives from an another care establishment after the social reimbursement accord). "Added" consultation aspects (announcement and administrative clarifications) become central, impacting not only, the time devoted to the central information (therapeutic project, risks ...), but also the quality of information and patient capacity to assimilate it. In order to attend both quality and performance objectives, without sacrificing their wellbeing, oncologists adopt verbal and non verbal strategies of adaptation, try-in continus- to modulate and to adjust their patient representation. Coping strategies depend on the characteristics of the work situation, experience and perception of the physician. Physician communication with patient and her accommodating is adapted depending on parameters related to the pathology, the social, educational, cultural levels and the psychological situation of the patient.

**Discussion/perspectives**

Even if all physician shared the objective of "quality consultation", the judgment standard differs from one practitioner to other with shared caracteria of acceptability judgment. This quality is also strongly affected by the performance criteria. This quality is also strongly affected by the performance criteria imposed to the transverse collective of the unity as well as the exercise conditions[5-8].

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Activities developed in the field of workers' health extend beyond a narrow definition of health to include aspects of social security, justice, and work. Knowing how to analyze and lend visibility to the work processes of people involved at different points in the field of occupational health public policy and to consider the proposed intersectionality raised by the National Policy for Occupation Health and Safety (PNSST); Detect overlaps and gaps and develop advances to consolidate the intra- and intersectoral networks in order to activate an integrated, comprehensive system for attention to workers' health. This is a case study under the research-action rubric to be carried out in the city of São Paulo. Due to the number and diversity of the sectors and services involved, the design proposal is to organize them along two lines: 1) Analysis of public policy documentation, mapping the system of services that act at the interface of health and work, and interviews with key informants involved in developing policies and their respective implementation; 2) Study of the work process of those in each of the services involved, seeking explicit formulations for practices they implement and for aspects that interfere in intra and intersectorality. Along these lines, reflection groups with guidelines from the psychodynamics of work will be prioritized, and if not possible to carry out these, in-depth interviews will be done. At the end of the process, it is expected to be able to transform not just the work of those who participated in the study, but to promote change in the communications process and overall work system.
Inclusive human-centered design: Experiences and challenges to teaching design engineering students

Type: Abstract Oral Presentation
Category: Education and Training

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A considerable literature has grown up around the theme of inclusive design, but few studies have pointed the challenges to educate it. Recently, the inclusive design concept and philosophy have been included in the engineering design curricula as part of human factors and ergonomics module in a Mexican University. The expected value was to create empathy and awareness about physical and cognitive differences of the potential users among young students. The aim of this paper is to describe the teaching experiences and challenges of executing a design project using for the first time an inclusive design approach. Nine design proposals were developed during a five-month workshop by 20 undergraduate students and two teachers following methods from both human-centered and inclusive design. In collaboration with a non-profit organisation, each team designed a product to help children with either cerebral palsy or hemiparesis to carry out a daily life activity. Some issues were identified from the student’s viewpoint such as the complexity of reading scientific papers slow the design process, students felt overwhelmed with the responsibility to find a meaningful solution and they had problems to gain feedback from users. From the teacher’s perspective, the main challenges were the increase in the amount of time that students needed help and the lack of design research techniques to communicate with people with a speech disability. Another finding was that the use of a design logbook facilitated the process by allowing the student's metacognition after each activity. Overall, the evidence showed positive effects in students, increasing their level of engagement and motivation during the project and achieving a design that tried to satisfy the different user’s needs. Despite its exploratory nature, this study offers some insight into how could enhance the inclusive design training among young students.
Background: Interpreting alarms and alarm behavior of physiological monitors is not as straightforward as it should be, as a recent analysis of incident reports shows (Lange et al. 2017). Users frequently report missing alarms or other improper alarm behaviors as caused by device malfunctions, when both were actually examples of normal device functioning. This suggests a lack of awareness for the complex conditions that determine whether a monitor will issue an alarm. This is a problem, because alarms fulfill an important function in patient monitoring. If users have incorrect expectations as to when an alarm will sound, their trust in the alarms is likely to suffer.

Objective: Several factors may contribute to the lack of awareness and understanding of the device: device complexity, interface design, users' insufficient familiarity with the device, insufficient protocols, distraction, or attentional tunneling, to name but a few. We addressed a potential contribution of interface design by analyzing a monitor’s user interface.

Procedure: Based on our analysis of incident reports, we selected the following functions for further analysis: Deactivating individual alarms (SpO₂), changing alarm limits (arhythmia), muting alarm volume and disabling display of a particular parameter (blood pressure). We applied two different methods of assessing interface usability: an analytical approach supported by the formal-analytical method mAIXuse (Janß et al., 2016) and an empirical approach, i.e. observing whether expert users in a simulated care setting were aware of the various causes underlying alarm failures. The usability analysis was performed by three of the authors (SFM, AJ and MN). In the simulation study, seven experienced intensive care nurses took part. All nurses were familiar with the physiological monitor that was used during the testing.

Results: The mAIXuse analysis identified selected interface properties that may adversely affect perceptual and/or cognitive processing steps when interacting with the device, particular symbol size and contrast. The disabled blood pressure reading and the altered alarm limits were evaluated to be somewhat less easy to detect and understand than the deactivated SpO₂ alarm and the muting of the alarms. During the simulation, not a single user spotted the muted alarm and the altered alarm limits without being prompted. Four of the seven nurses never found the mis-set parameters, even when asked repeatedly. Three of seven nurses directly perceived that the SpO₂ alarm was deactivated and the blood pressure reading disabled. One and three nurses, respectively, never detected changes to these settings.
Discussion: The results of the formal-analytical analysis and the simulation study will be compared and conclusions regarding the contribution of the monitor display to users’ awareness of alarm settings will be discussed.
A Proposal of Model of Kawaii Feelings for Cosmetic Bottles

Type: Abstract Oral Presentation
Category: Fashion

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Affective values are important factors in manufacturing. Kawaii, which is a positive adjective that denotes such positive connotations as cute, lovable, and charming, becomes more important as one affective value. It plays an important role in the success of many products, such as Hello Kitty and Pokemon. Based on this success, we believe that kawaii will be a key factor for future product design.

In our previous research, we studied various aspects of kawaii feelings. It explored the idea of designing kawaii products by clarifying each of physical attributes that evoked kawaii feelings, such as shape, color, size, texture, and tactile sensation. In our next research, we collected the results of comparison of spoon designs based on kawaiiness. Then we extracted attributes of spoon designs based on shape and color. The comparison results and attributes were used to construct models of kawaii feelings for spoon designs. We used Support Vector Machine (SVM) algorithm to classify the data of spoon designs. As the result, we succeeded to construct the models. Moreover, we clarified important attributes in designing kawaii spoons.

In our current research, we studied a relationship between kawaii feelings and attributes of cosmetic bottles. Our aim is to propose a model of kawaii feelings for cosmetic bottles. In previous research we mentioned above, we extracted the attributes to construct the models. However, we did not need it in this research because we employed Convolutional Neural Network (CNN) algorithm which can perform classification by using images as input. We performed an experiment to evaluate the kawaiiness of cosmetic bottles by asking 15 participants to judge if each of the cosmetic bottles was kawaii or not. Then we constructed the model by using the experimental result of each participant. As the result, we succeeded to construct model with the accuracy more than 70%. Next, we constructed more general model for prediction of kawaiiness of cosmetic bottles. The detail will be written in the camera-ready.
Increased road and rail traffic in Australia results in actively protected crossings being closed for extended periods of time during peak hours. This results in road congestion. It is known that extended periods of warning/waiting times at level crossings have impacts on drivers’ decision making in regards to violating crossing rules. Excessive waiting times could lead to non-compliant behaviour by motorists, resulting in incidents, including injuries and fatalities. However, the correlation between waiting time and rule violation is not well documented, although it is known that a range of personal and environmental factors influence rule non-compliance. This leads to the question of whether longer waiting times affect motorists’ assessment of risk and how long motorists are prepared to wait at level crossings before undertaking risky behaviour.

A driving simulator study was used to obtain objective measures of RLX rule violations. Sixty participants completed six driving tasks each, with the tasks varying in terms of waiting times. Compliance with road rules at the level crossing during the simulated drives was examined.

Main results include that increased waiting times result in increased likelihood of risky driving behaviour, particularly for waiting times longer than three minutes. Risky driving behaviours included entering the activated crossing before boom gates are down; entering the crossing after the train passage but before signals are deactivated; and stopping/reversing on the crossing. The results suggest that, where possible, waiting times should be standardized at values lower than three minutes in order to reduce the likelihood of risky road user behaviour.
We interest on children’s creativity, especially in educational environments. We focus here on narrative activities, which are situated, finalized, mediated and creative activities. In our study, pupils are in situation of narrative production which increase the culture of creativity thanks to the freedom let to them. There have to invent a collective tale after a classroom trip in the Massif Central. The entirety of the class write the contents of the story, part by part, draw important scenes of the narrative and tape their voice to produce a multimedia tale with a several languages (Malaguzzi, 1987). We look this situation through the instrumental approach (Rabardel, 1995) in the aim to understand the means of activity with an anthropocentric point of vue on technology.

The concept of instrument, composed by schemes and artefact, is in the heart of this approach and it is really important for our study because this classroom has the specificity to be equipped by traditional artefacts, like paper and pen, but also by tactile tablets and a digital white board. We try to understand the structure of the instrument’s system, so we ask how these instruments are, first, produced by kids, and then, how their are used by them ? What are the effects of this instrument’s system on creativity ?

Complementary we use the Narrative Activity Model (Decortis, 2008) which is based on Vygotsky’s theories for who creativity is present in each person and throughout the life (Vygotsky, 1930/1983). According to him, creativity and reality are correlated and articulated into four relations : imagination is built from reality, in others words experience is the material to create (1), this experience is collective and feeds from social practice and exchanges with our pairs (2), emotions influence imagination and vice versa (3), and (4) there is a crystallisation of imagination in external and shared objects. To sum up, the mechanisms of imagination and creativity are based on the experience and the re-elaboration of experience through disassociation, association and mutation. This model helps us to apprehend globally a creative situation with systematicity because it integrates artefacts, individual or social dimensions, context, activity’s steps or pedagogical objectives. Following this model, we analyse the activity of children’s in four phases namely exploration, inspiration, production and sharing.

Finally, this analyse of pupil’s activity is realized in perspective of designing educational tools that support, even increase, the creative potential of children, where he is not just a « capable subject » (Rabardel, 2005) but a creative subject.

This study, fits on children centered ergonomics (Decortis, 2015), is a part of a big research trying to catch how children develop a creative cycle and on what creativity is based.
Activity analysis as a method to improve constructability in building projects

Type: Abstract Oral Presentation
Category: Building and Construction

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The need to make improvements in building and construction industry have been addressed in various researches. Due to problems relative to the incompatibility between design and construction, the term “constructability” derived as a proposal to facilitate operations and solve problems on construction sites. Constructability problems emerge from a design that does not adequately uses the competences of construction processes creating negative effects as schedule delay, budget loss, and low quality during the execution phase and occupational accidents risks. In this direction, ergonomics provides means to extract potential findings as a discipline focused directly on work. Essentially, the activity analysis focus on observing how workers actually perform their activities. Activity analysis uses observational and interactive methods that have the potential to capture workers competencies and knowledge during real work situation. This paper aims to propose an approach based on activity analysis to identify possible constructability improvements and guides its incorporation in future projects. To this end, we suggest an approach that uses observational and interactive methods to collect data. The data collection happens with various professional involved in a construction project execution. From the activity analysis of the workers involved in the building project execution, it is foreseen the validation process. The validation consists in collective meetings among different groups of specialists that works in the execution and the designers. In the occasion, they can confirm, avoid or suggest other solutions for the aspects identified in the data collection on real work situation. This information should be useful and incorporated into future building projects. Thus, in the discussion of constructability, ergonomic approach can be useful for the activity analysis elements, provides feedbacks to the designers and make positive contributions to design new work situations.
The design of spaces must take into consideration among other things, the physical characteristics of the variety of users. Regarding buildings of public use this diversity is even more, being useful to pay special attention to those users who are considered extremes in certain conditions. A segment among this variety are wheelchair users, who are particularly challenged by the built environment, making some daily activities a defiance. For example, going to the counter at the bank or using the sidewalk if there are no accessible ramps.

In the context of this study, it is possible to find some handbooks with guidelines for designing spaces for people using a wheelchair. However, it is not clear where the dimensions come from since there is not a specific reference nor a database with dimensions of people in such condition in that context.

The objective of this study was twofold: 1) to assess some design dimensions provided by three handbooks for designing spaces for people using wheelchair; and 2) to identify and understand the problems that users of wheelchair face in performing some of their daily life activities.

To reach this objectives, an anthropometric assessment of 15 wheelchair users was performed and then their dimensions were contrasted against dimensions presented by the handbooks. Along with the anthropometric study an interview about their daily life activities was made, to incorporate them in the formulation of the dimensional parameters for space design. The participants were asked to rate the difficulty level of some indoor and outdoor daily activities.

The comparison of the results through coefficient of variation showed that the data used in the accessibility standards manual correlates with the mean of some of the dimensions taken in this study, for example, maximum height point near the knee (6.7%), height to the rim handle (3.3%), elbow to elbow width (1%). However, the absence of information regarding the origin of the data and the indiscriminate use of the mean for the determination of scopes is considered an inadequate methodological error because it excludes the extremes of the population, furthermore, the data from the handbooks might not consider the anthropometric variations between different country populations.

Overall, the development of anthropometric data for special populations, in this case, wheelchair users contributes to the creation of a more inclusive society through the improvement of design guides, spaces and policies.
Faced with fluctuating production marked by high-demand periods, as well as worker retirement and worker migration to other industries, the mining sector is experiencing massive hiring needs at a time when there is a shortage of trained and experienced workers. At the request of the Joint Health and Safety Association, Mining Sector, a field study was conducted to document the conditions conducive to the safe and secure integration of new workers, the problems encountered, and possible avenues for improvement. This paper presents the formal integration programs implemented in the companies and the adaptations made during their application in the field.

The study was conducted in three underground mines and two open-pit mines. A total of 115 semi-structured, individual one-hour interviews were conducted with managers from the OHS, HR and Mining Operations departments, workers and their representatives (unionized or non-unionized). The researchers carried out the equivalent of 29 days of observation in the field, which gave them an understanding of the work activity and the buddying system used in entry-level jobs and specialized jobs.

The mining companies introduced new-worker integration programs involving a number of steps, with varying implementation processes depending on the mine: orientation, technical training, job training, evaluation and follow-up. The formal content and evaluation tended to be focused on compliance with safety procedures. These formal, structured programs were then adapted in light of the realities encountered in the field. For example, due to a lack of available internal trainers, some compulsory technical training courses were sometimes given late or by external trainers who knew little about the jobs or work. When the buddy assigned to job training was unavailable, or in mines where pairing was decided spontaneously at the start of the shift, workers with only a few months of experience showed the work to the new workers. In certain mines, performance pay and the absence of measures to compensate for the drop in production during training created time pressures that left less room for knowledge transmission. Training was sometimes interrupted when the buddy was called away to meet production demands. At times, it was also delayed, or given using poorly adapted means when the necessary equipment was unavailable.

The scope of these new-worker integration programs depends on the way in which they are actually implemented in the production context and with the resources available. The informal initiatives from experienced workers make it possible to go beyond the goals of complying with OHS procedures and to offer support over time when, among other things, new workers have completed their training and begun performing their jobs on their own. In search of a balance between procedure and practical expertise both formal process and informal contributions need to be considered.
Comparison of perceptions, use, and health effects of ceiling lifts and floor-based lifts in patient handling

Type: Abstract Oral Presentation
Category: Healthcare
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Background: Mechanical lifts have been identified as an effective measure to reduce the risk of injury from patient handling, but the use of lifts in practices has been far from optimal. Studies report biomechanical and biopsychological benefits of ceiling lifts compared to floor-based lifts in performing patient handling tasks. This study examined perceptions about lift use, frequency of lift use, and musculoskeletal symptoms by the type of available lifts (ceiling lifts vs. floor lifts only) among nurses in California.

Methods: This study analyzed data collected from a cross-sectional survey of 310 registered nurses with patient handling duties, who were randomly selected from a list of the California Board of Registered Nursing (response rate: 20%). Both postal (primary) and on-line (alternative response option) surveys were used to collect data from June 2016 to March 2017 on job information, perceptions about lift use, frequency of lift use, and musculoskeletal symptoms (back, neck, shoulders, hands/wrists) in the past 12 months. Symptoms with at least moderate intensity that occurred at least monthly or lasted at least one week were defined as major symptoms.

Results: Approximately 58% (n=181) of nurses reported having floor lifts only, 20% (n=62) had ceiling lifts, and 22% (n=67) had no lifts on their unit. Perceptions about lift use were significantly more positive among nurses with ceiling lifts than nurses with floor lifts only, in regard to safety for workers, safety and comfort for patients, and ease of use, access and storing (p<0.05); however, perception about time burden was not significantly different. Lift use was more frequent among nurses with ceiling lifts (use ≥50% of the time needed: 49% vs. 38%), and the prevalence of musculoskeletal symptoms was lower among nurses with ceiling lifts than nurses with only floor lifts; but the differences were not statistically significant. The prevalence of major symptoms in the low back was significantly less for those with ceiling lifts compared to those without lifts (ceiling 26.2% vs. floor 38.6% vs. none 49.2%, p=0.031). A similar direction of finding was observed for major symptoms of the hands/wrists (ceiling 7.1% vs. floor 17.0% vs. none 22.6%, p=0.071). For major neck pain prevalence, both ceiling lifts and floor lifts showed significant reductions compared to nurses without lifts (ceiling 19.3% vs. floor 29.1% vs. none 43.1%, p=0.015). For shoulder pain, there was no significant difference.

Conclusions: The study findings suggest that ceiling lifts are superior to floor-based lifts in multiple aspects, including better acceptance and use by nurses in patient handling, as well as being associated with reduced musculoskeletal symptoms of the low back, neck, and hand/wrist region. Healthcare facilities should make ceiling lifts available for more nurses in order to promote safe patient handling practices and prevent employee injuries.
[1122] Pushing induced sliding perturbation affects postural responses to maintain balance in standing

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction: Pushing is considered a manual handling activity in industry, but its functional role in our daily life, such as pushing a revolving door, moving strollers or grocery carts is underexamined. Most importantly, with the global aging population, older adults pushing a wheeled walker with a seat while walking is going to become more common. In such situations, older adults would have to deal with two perturbations simultaneously, specifically, pushing (voluntary movement) and pushing-induced slipping when walking on a low-friction surface (sliding perturbation). Hence, the aim of the current study is to investigate how postural adjustments control the risk of losing balance in response to voluntary movement along with a sliding perturbation. Methods: We used a movable board to simulate a low-friction surface, which could be locked for a stable surface, and unlocked to create a sliding perturbation. Thirteen participants were instructed to push a handle while standing on a locked or unlocked movable board, which was placed on a force plate. Three accelerometers were attached to the handle to detect the moment of the handle moving away (T\textsubscript{handle}), which denotes time zero, the pelvis to detect the moment of trunk movement, and the movable board to detect the moment of board movement. The center of pressure (COP) was recorded. The onset time, magnitude of COP at T\textsubscript{handle} and maximum pushing force were calculated. Results: The onsets of board movement, trunk movement, and COP were initiated prior to T\textsubscript{handle}. Pushing while standing on the unlocked sliding board significantly affected the onset of COP, but did not
affect onset of trunk movement. Onset times of 180 ms preceding $T_{\text{handle}}$ were observed for both board movement and COP. Additionally, the orientation of the accelerometer attached to the board indicated that the sliding perturbation was directed opposite to trunk movement. The magnitudes of the COP displacement and the pushing force were significantly smaller when standing on the unlocked board than the locked board.

**Discussions:** When standing on a movable surface, the delayed COP onset and the backward board movement induced by pushing movement were correlated with shank muscle activity and in the same direction of body thrust. In addition, the inertia of the trunk was used to assist in generation of the pushing force needed to suffice the pushing task supported a decreased magnitude of the pushing force in the unlocked condition. Meanwhile, body inertia allowed counteracting the destabilizing effect of force of gravity as smaller COP displacements were seen when the surface was movable. Studying the combined effects of varying movability of the support surface and pushing tasks may contribute to the development of new environment safety for workers and elderly.
A Dedicated Multimedia Toolbox to Support Standard Risk Assessment Method for Manual Handling of Low Loads at High Frequency

Type: Abstract Oral Presentation

Category: Others

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OCRA index is a standard ergonomic risk assessment method addressing workplaces and tasks requiring manual handling of low loads at high frequency. This method requires the operator to perform a video analysis of movements made by workers. This turns out to be often a difficult and time-consuming operation, and a qualitative measurement because of the 2D nature of data. For instance, the evaluation becomes very operator-dependent and measurement shows low repeatability and high variability. No specific and dedicated tools that can support the operators in collecting and organizing data are currently available.

The main goal of this work was to design a toolbox that can help the operator to collect, organize and analyze the information for OCRA analysis in a more reliable and time-effective way.

The workflow analysis led to the implementation of a toolbox prototype (Matlab The Mathworks Inc.) that includes:

Main GUI for the selection of the type of analysis to be carried out: the operator can identify the type of analysis to perform;

Module supporting Technical Actions (TAs) count. The operator can load a specific video, define limb side and - through fine control of playback – manually increment the number of actions and automatically extract corresponding frequency. Furthermore, he/she can establish the percentage of time related to static posture. All the information can be exported in common spreadsheet format (i.e. *.csv) and organized in folders tree.

Module for manual posture analysis. The operator can load a specific video, take notes about the tasks, define limb side and - through fine control of playback – manually identify temporal bookmarks corresponding to awkward posture for shoulder, elbow and wrist and the type of grasp/pinch; then, the software module automatically computes the corresponding durations of each single task and the related percentage time with respect to the entire action.

“Smart Posture” module for automatic posture analysis starting from joint kinematics acquisition. Initially, the operator can import the joint kinematics data (acquired through different technologies) and, if necessary, the corresponding synchronized video. Then, the module automatically performs posture analysis considering real 3D data, and according to algorithms and thresholds defined in ISO 11228-3. All data and plots can be exported and managed.
This toolbox was tested by a small population of lay users and skilled operators. Preliminary findings reported unquestionable advantage in the structured organization of the large available multimedia information. Furthermore, by using “Smart Posture” module with IMU-based kinematics, intra- and inter-operator variability is significantly reduced, thus making the analysis more objective and reliable.

Further steps will include a structured assessment of the toolbox including several operators, collecting information about the usability, the GUI design and the assessment of the overall performance (operation time and results accuracy).
In Sweden, authorities and other public organizations are required by law to recurrently prepare for crises, disasters and emergencies. This includes performing risk and vulnerability analyses regarding the organizations' societal tasks and operations, writing and implementing plans and conducting crisis preparedness exercises. The activities entail many challenges, as performed in large and complex public organizations, and requiring coordination and cooperation of large numbers of people. In the organizations, the preparedness planner is responsible for the crisis preparedness process. The preparedness planner, as well as managers and professional groups and stakeholders in the public organization, has to understand, articulate, advocate and handle the preparedness process activities as part of their work. For success, this requires negotiated social construction activities regarding sensemaking and sensegiving between actors and levels in the organization. In practice, challenges exist when implementing crisis preparedness decisions and plans. Successful implementation presumes that managers and co-workers actively participate in the implementation work. Values, attitudes, knowledge and comprehension among the individuals about the crisis preparedness implementation may have consequences for the actual implementation. Additionally, the prioritization and allocation of resources for crisis preparedness can have consequences for the implementation. The aims of an ongoing research project are to identify pre-requisites for efficient crisis preparedness work on local and regional levels in Sweden and to increase knowledge about managers' and preparedness planners' ways and means, incentives and motivational factors for implementing decisions concerning crisis preparedness. Focus is on organizational members need to understand their roles, assignments, and authorities in the crisis planning process via processes of sensemaking, sensegiving, communication, and collaboration between managers and planners on different levels. In a qualitative pilot study, 10 semi-structured interviews were conducted with local and regional crisis preparedness planners in the Scania County Council in southern Sweden. Interview items focused on areas such as: how planners on various organizational levels work with crisis preparedness, safety, and environment and how individual understandings and values about the work are expressed; tactics and strategies taken to implement crisis preparedness decisions and plans despite an existing general low priority of the issue in the organization; why issues about crisis preparedness are diminished in the organization although existing requirements and issued implementations says otherwise. The content analysis of interview data focused on finding focus areas, enablers and barriers when implementing crisis preparedness issues. Preliminary results highlights the following focus areas: assuming the role as a preparedness planner; to gain power to enable implementation; communicating requirements and benefits in the organization to enable implementation; and to manage work tasks and deliver results. In this conference paper preliminary results from the study will be presented and discussed.
Suggestions concerning enablers for implementing crisis preparedness on local and regional levels will be forwarded.
This paper presents an embarking and disembarking process for hyperloop, a developing high-speed transportation of passengers in tubes. The new form of transportation gives an opportunity to design from the passenger perspective with minimal constraints from the technological and business aspects. One of the main features of hyperloop is the high travel speed directly from origin to destination. While travel time is minimized, time efficiency is essential for the embarking and disembarking process.

Concepts of the (dis)embarking process are generated based on the future context of global public travel in 2027. After comparing them based on rational considerations, one that appears to stand out among others has been tested with experiments. Figure 1 explains the concept. The passenger compartments and luggage space are separated. Multiple doors on both sides of the vehicle allow passengers to embark and drop the hold luggage on one side, and disembark and pick up the luggage on the other side.
An experiment was performed to compare the new concept to one that is more similar to the embarking setup of conventional trains on the aspects of efficiency and experience. Participants were asked to (dis)embark in mock-ups that simulate the new concept and the conventional situation with luggage. Evaluation of the video recordings shows that the new passenger flow saves 40% of the time for vehicles to stay on the platform and 50% of the embarking and disembarking time for each passenger. Follow-up questionnaires and interviews with the participants show that the proposed passenger flow gives a better experience in terms of efficiency, seamlessness and friendliness.

Since they reduce the manufacturing complexity and weight of the vehicle, narrow doors are preferred in the hyperloop system. Therefore, subsequently, another experiment has been carried out to find out the influence of door width on (dis)embarking efficiency and passenger experience following the similar method of the previous experiment. Two setups with the exit width of 80 cm and 40 cm were compared. Regarding efficiency, it turns out that narrowing the door width does not noticeably influence the embarking time. However, the disembarking time increases due to the proposed luggage collection process. To overcome this, an improvement of the luggage collecting location is suggested which has the potential to achieve the same efficiency with narrow doors as with wide doors. As for passenger experience, interviews show that passengers do not sense a negative experience with narrower doors. For Persons with Reduced Mobility, a separate wider entrance is provided.

Based on these two experiments, a feasible (dis)embarking process is proposed for the future hyperloop system which aims to find an optimum balance between time efficiency of (dis)embarking and passenger experience.
The global revenue of the mobile games was $300 billion USD in 2015. Mobile games with
role-playing features are currently one of the most popular types of mobile games. A
player typically gets involved in these games, perceives a self-image through these
games, and then feels a sense of enjoyment from these games. From the viewpoint of
game development, it is crucial to encourage players to continue playing these games.
The relationship of a player with his/her game character/avatar is an importan
t factor for
game design. Some studies pointed out that character identification could enhance the
intention to play games. However, few studies have explored the effects of game character
design on character/avatar identification in mobile games.

The purposes of this study were to explore the character identification of game characters
for mobile game players. This study used an interface experimental to explore the effects
of character design factors on character identification. The three experiment variables of
color design included character face-setting, character clothing-setting and game
scene setting. The research flow was as follows: (1) An experiment was designed. (2)
Three experts were invited to perform the pretest. (3) The formal experiment
was performed, each participant had to test three experiment interfaces and fill in experiment
questionnaires. (4) The experiment results were analyzed, discussed and suggestions
were provided.

The data of 93 subjects were collected. The participants were 20–27 years old; there were
45 male participants and 48 female participants. This study performed a reliability analysis
of the character identification scale (CIS). The results showed that the Cronbach’s α
values for the CIS for face setting, ‘CIS for clothing setting,’ and ‘CIS for scene setting,’
were all higher than 0.9, indicating that the scales had high reliabilities. Then, we
performed the factor analysis. Regarding the ‘CIS for face setting,’ ‘CIS for clothing
setting,’ and ‘CIS for scene setting,’ were all reached the validity standards. Thereafter,
within-subject ANOVA analysis was performed for the three character identification scales
to explore the effect of character design on the three factors of character identification.

The study results were as following: the three character design factors were discussed in
isolation, players indicated that these variables significantly helped them achieve a sense
of embodied presence and realization of their aspirational selves. However, when these
variables were considered together with the entire game interface and sound effects, the
character identification changed, and players considered all the variables to be relevant to
character identification. Game developers can use these results as references for
designing and developing mobile games. If we choose to increase our self-identification as
a starting point, gameplay may be a way of assisting developers to design relevant
systems or products.
A study on posture analysis of assembly line workers in a manufacturing industry

Type: Abstract Oral Presentation
Category: Healthcare

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Objective: In order to reveal and analyze the feature of surface electromyography (sEMG) signal and assembler's posture of repetitive work, assembler's posture and electrical manifestations of localized muscles was collected by using the inertial motion capture technology and sEMG during the work.

Methods: Six male workers were chosen in laser lettering workshop of a medical equipment manufacturing industry. They performed repetitive pull-and-push operation, meanwhile, sEMG and posture signal in 10 minutes period was collected at the beginning and end of work.

Results: The MFs of LST, LBB and LFCR were significantly lower at the beginning than at the end of work, while the RMSs of LST, LBB and LFCR were significantly higher at the beginning than at the end of work. And the differences of LST between the beginning and the end of work was most distinct. Keeping fixed joint angle for a long time had a greater effect on muscle fatigue, and the result was statistically significant (P < 0.05).

Conclusions: The fatigue strength of muscle increased significantly with repetitive push-and-pull operation of workers for a long time, especially of the shoulder; And fatigue was easily caused by keeping fixed joint angle for a long time.

Keywords: inertia motion capture; repetitive work; sEMG; fatigue

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Multiple Factors Mental Load Evaluation on Smartphone User Interface

Type: Abstract Oral Presentation

Category: ICT

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Smartphone is now the most prevalent computer system being used and a lot effort from either academic areas or industries have been put to improve the quality of usage. Currently usability is a well-accepted standard for evaluating the usage quality for desktop computer system. However, on one hand, smartphone has more complex interaction mode and usage scenarios than personal computer and laptop, thus it is difficult to assess the quality of using smartphone via conventional usability evaluation. On the other hand, mental load serves as a crucial index of effort that operators have put in the human-machine interaction, especially under highly-demanding context. Mental load is a set of measurements, which assesses the efforts of accomplishing tasks in a particular environment and operating conditions with multiple dimension factors. Thus, it is a suitable method for evaluating complex mental work, and may indicate the usage quality of a product.

The purpose of this paper is applying a multi-dimensional method of mental load in a user testing, and find out which measurement(s) would be sensitive to reflect the efforts for using a smartphone. During the research, the efforts on conducting tasks with various level of complexity were assessed via the measurements in three dimensions, which are performance measurement (e.g. principal task and secondary task), subjective measurement (NASA-TLX questionnaire) and physiological measurement (electrodermal activity, EDA in short). They were compared across novice users, average users and skilled users. The results show that; in performance measurements, operation time and usability error number can accurately reflect the changes of mental load in smart phone tasks; in subjective measurements, Mental Demand, Effort and Frustration in NASA-TLX are highly related with mental load, and Temporal Demand is only suitable for novice users. The results of secondary task and EDA can be used as references for qualitative analysis.
The business process outsourcing industry is growing fast worldwide, particularly the contact center sector in the Philippines. In fact, Filipino contact centers had approximately 390,000 employees in 2016, and is projected to continue growing.

Several studies acknowledge that most contact center employees have experienced work-related injuries, leading to decreased productivity and performance. The increased risk of injuries and illnesses is due to poor workstation design, including disorders resulting from indecent noise level and duration exposure experienced by call center agents daily, and the equipment type used. Improving workstation design and working conditions of the agents have been found to improve productivity, absenteeism, and employee turnover.

The primary role of call center agents is to receive and make calls, which entail extended periods seated at a computer using a telephone or headset. However, most studies focused only on measuring and mitigating risks associated with musculoskeletal disorders; few attention has been given on another risk for call center agents: their regular exposure to noise. Some illnesses associated with prolonged exposure to unfavorable acoustic environment are headaches, increased anxiety levels, tinnitus, and noise-induced hearing loss. The objective of this study is to propose a tool to mathematically assess relative auditory risks among call center agents and propose possible interventions to address the risks.

Mathematical modelling is rarely applied to optimizing systems based on ergonomic concerns. These cases consider ergonomic risks that cause musculoskeletal disorders and only in other industries. Hence, it is important to consider the auditory ergonomic risks faced by call center agents mathematically.

Data Envelopment Analysis (DEA), which is a benchmarking tool traditionally used to evaluate relative efficiencies in service units, can potentially be applied in ergonomics. It considers several input and output variables, which becomes the basis of the computed efficiency scores. This allows the model to account for different sources and outcomes of potentially hazardous conditions. Furthermore, a limitation of traditional DEA is it only allows for precise data, however, this type of data rarely exists in reality. Thus, the model is modified to account for negative outcomes to measure risk efficiencies, and allow for uncertainties and probabilistic conditions. This study proposes Fuzzy Data Envelopment Risk Analysis (FDERA), a DEA-based risk analysis tool that considers the presence of imprecise data represented by fuzzy numbers.

The validity of the proposed model is demonstrated using a case example. The results of the proposed tool are relative risk efficiency scores for each call center agent. The agent
with the highest score will then become the basis to improve the least risk efficient agents. Guidelines for interventions are also presented using a matrix, which will provide possible preventive and corrective measures to address risks based on current impact and desired level of improvement.
Effect of Slopes and Walking Surfaces on the Gait of Older Adults

Type: Abstract Oral Presentation
Category: Others
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Falls due to icy winter conditions are a serious problem, especially for older adults. With an aging population in many countries, the number of injured older adults due to slips and falls is likely to increase. There are different factors that prompt the slip-and-fall incidents, such as individual gait. This study investigated how different slopes and walking surfaces affect the gait of older adults. Twelve healthy older adults walked on four different surfaces, which include dry concrete, dry tile, tactile tiles, dry ice, and wet ice. For each surface, the participants walked on seven different slopes, which were -7.1°, -4.8°, -2.9°, 0°, 2.9°, 4.8°, and 7.1°. The recorded kinematic signals were used to derive various gait parameters. Participants walked slower, took smaller step length, and had smaller foot contact angle in wet ice and dry ice compared to dry concrete and tactile tiles. The average step lengths and foot contact angles for wet ice and dry ice condition were 36 ± 2 cm, 6.2 ± 0.9°, 39 ± 2 cm, and 7.8 ± 0.9° respectively, in contrast to 51 ± 2 cm, 12.4 ± 0.9°, 48 ± 2 cm, and 11.0 ± 0.9° for dry concrete and tactile tiles. For wet ice condition, step length decreased significantly more (9cm ± 2 cm) when walking downhill compared to that in walking uphill at the slope of 7.1°. Foot contact angle decreased as uphill slope increased and remained relatively constant for different downhill slopes. In addition, there were no significant differences in the anterior-posterior margin of stability (MoS AP) between surfaces. The MoS AP decreased as uphill slope increased and increased as downhill slope increased. It supports Hak’s finding that the decrease in step length was a strategy to increase MoS AP, and thus to increase stability [1]. These changes in gait parameters reflected different gait adaptations to different conditions. Wet ice and walking downhill are much more prone to slips and falls.

Reference:
Slipping on ice surfaces is one of the main risks for outdoor activities in Nordic countries. The SATRA STM 603 whole shoe tester, used to evaluate the coefficient of friction (COF) of footwear on dry and contaminated indoor surfaces according to standard test methods, can be fitted to a refrigerated ice tray enabling different types of ice surfaces to be built in the laboratory. The SATRA TM144:2011 is the only mechanical test method that provides rough guidelines to test footwear on frosted and smooth ice surfaces. However, scarce information is published about this test method and the repeatability and reproducibility of such tests on ice surfaces have not been assessed. The aim of this study is to evaluate the repeatability and reproducibility of the results obtained with footwear tested on ice surfaces at two different laboratories at the two institutes (IRSST and TRI-UHN). This work is part of a project that compares two tests methods for evaluation of slip performance of footwear on icy surfaces: the SATRA test method and a human-centered test method using TRI-UHN’s WinterLab (Hsu et al 2015).

Ice was prepared in a STM 603 ice tray at various temperature set points in both labs. The ice surface temperature was monitored using thermistors installed on top of the ice surface. Ice tray’s ice temperatures were configured to match WinterLab’s ice temperatures and an ice tray preparation protocol was developed. Ten types of occupational footwear were tested in both labs on melting and cold ice surfaces at different sliding modes (heel forward, flat forward and forepart backward, ASTM 2913-17).

The ice surface temperature fluctuates as a function of the cooling cycle of the ice tray. This fluctuation showed slightly different patterns between the two labs. A specific temperature set point and a restricted temperature range for testing have been determined for each lab to ensure the ice temperatures measured by the thermistors were as similar as possible in both labs. The results obtained in both labs for boots tested on melting ice were equivalent, both in COF values and footwear ranking. For cold ice, although the footprint ranking was equivalent between the two labs, the COF values obtained at the IRSST were systematically higher than those obtained at TRI.

The significant impact of ice surface temperature on COF measurement makes reproducibility between laboratories challenging. The proposed test method on cold and melting ice surfaces were able to discriminate between some boots. However, the SATRA test method might give different rankings compared to a human-centered test method and may need improvement to be reliable on ice surfaces.
Introduction

Research consistently identifies healthcare workers among the top-ranked occupational groups for musculoskeletal disorders – often a result of moving and handling people (MHP). Therefore guidance materials are commonly provided by government agencies with the intention of reducing the likelihood of injuries. The New Zealand Accident Compensation Corporation (ACC) developed the ‘Moving and Handling People Guidelines (MHPG)’ for that purpose. However, no one knows, to what extent, for what purpose, or by whom the guidelines have been used or if the use has led to any changes since their launch in 2012. This study evaluated their uptake, purpose for use and changes influenced by use.

Methods

A questionnaire was developed on the basis of the identified target groups and industry sectors for the MHPG and how the guidelines should be used and lead to change; the MHPG’s programme theory (Pawson, 2013). The intended users included: Senior managers and directors; Health and Safety managers; Moving and handling people trainers and coordinators; Nurses and carers; Equipment suppliers; and Facility designers. The MHPG emphasised that a MHP programme should consist of: a combination of practical elements: Risk assessment; MHP training; implementation and use of MHP equipment; and design of facilities that facilitate safe MHP, and organisational systems: MHP policy; Workplace culture and monitoring; and evaluation and audit of the programme. The MHPG particularly emphasised that only implementing MHP training would not lead to an effective MHP programme or reduce the risk of injuries caused by MHP. An internet-based questionnaire was distributed via third parties to the intended users. The questionnaire asked about the awareness, familiarity, and use of the entire MHPG and specific sections. It further asked about for what purpose the sections had been used, and if they had led to any changes in the organisations. The responses were analysed in relation to the different target groups and industry sectors.

Results

The questionnaire was sent to 3,052 intended MHPG users. There were 654 responses giving an overall response rate of 21%. For the main MHPG target groups, the response rate was 61-58%.

Average awareness of the MHPG was 58% but the percentages were much higher for the main target groups, e.g. MHP coordinators and H&S representatives (93-84%). The
familiarity was higher with the majority of the practical elements compared to the organisational systems.

The purpose for using the MHPG varied between target groups dependent on the content of the section. The main purposes were: training and education; to argue for MHP programmes; and development of policies and programmes.

Changes influenced by the use of the MHPG were more frequent after use practical elements compared to the organisational systems. Change mainly related to: training in MHP; MHP policies and procedures; and workplace culture.
What facilitates or hinders the implementation and impact of a national health guideline - learnings from case studies in the healthcare sector

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction

Worldwide numerous national or state level organisations have developed moving and handling people (MHP) guidelines to help healthcare organisations implement MHP programmes. However, the majority of the MHP guidelines have never been evaluated. Hence it is unknown whether they are effective or not, as well as why.

Implementation of evidence-based guidelines in an organisational setting is a complex process because the implementation is influenced by contextual factors and other interventions at a national, industry, organisational, group, and individual level.

When evaluating the implementation of evidence-based guidelines, there should be a focus on identifying how the guidelines work, for whom, why and in which circumstances, as well as why the guidelines work in some situation, but not in others. This study aimed to identify factors facilitating or hindering the implementation of MHP guidelines in the healthcare sector.

Methods

Case studies of three healthcare organisations in New Zealand were conducted. They involved i) in-depth semi-structured interviews with key stakeholders in the organisations, including MHP advisor, H&S manager and senior managers, ii) document analysis, (procedures, organisational charts etc.), and iii) chronicle workshops with 8-10 stakeholders with different perspectives on MHP from the organisation.

The data was thematically analysed to identify: 1) external and internal contextual factors that influenced implementation of MHP initiatives; 2) mechanisms that motivated and influenced reasoning for the implementation; 3) stakeholders that facilitated the implementation and their strategies; 4) the outcomes of the implementation.

Results

The case studies indicated that the implementation of a MHP guideline was affected by contextual factors both internal and external to the organisation. External contexts were: heavier clients; media focus on occupational health and safety; new occupational health and safety legislation with focus on employer and senior management liability and worker involvement. Internal contexts were: heavy workload and resource constrictions, insufficient equipment and facilities; organisational structure supporting MHP; management attitude; work culture and willingness/resistance to change. Mechanisms
influencing the reasoning for implementation were: improving staff safety and reducing injuries related to MHP within resource constraints; complying with legislation; being more efficient. Implementation resulted in the following outcomes: increased awareness of MHP risks; more people involved in health and safety; better monitoring of injury trends.
THE ROLE OF PROTOTYPING IN ERGONOMIC PRACTICE AND RESEARCH TO ANTICIPATE NEW PRODUCTS AND SERVICES

Type: Abstract Oral Presentation
Category: Education and Training

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"Design Ergonomics" rely on numerous data collection methods from a wide variety of disciplines to investigate how human behaviour and needs may determine the development and improvement of products and services. Many of these collection methods are either analytical or predictive, but still lacks the interactive attributes to integrate research with practice to anticipate future needs and trends. As such, there is a need for Ergonomics to capitalise on the exploratory and synthesis characteristics of the design profession, for example “prototyping”

This article aims to propose a conceptual framework for prototyping in Design Ergonomics by integrating research and practice in acquiring new knowledge through a design thinking lens.

Results indicate that prototyping is a useful tool to facilitate abductive thinking in research and practice within “Ergonomics” and “Design”. However, prototyping for the two purposes is not the same, and so to make this activity serve as a bridge, it will be necessary to adjust slightly both their processes and outcomes (Liem et al, 2017).

Firstly, it should be clarified that prototyping has become increasingly important in other forms of design that are not only physical. They include communication, interaction, service, experience, and so on. Furthermore, they have been used in a broad range of disciplines, and not traditionally thought of as design, such as chemistry, biology, computer science, math, drama, education, and so on. Secondly, a prototype is often a learning and information gathering tool for the practitioner to help him or her to reduce uncertainty and narrow the conceptual space until a commodity is produced. Thirdly, For the researcher, prototyping is also a learning tool, but aims at knowledge acquisition, rather than the commodity at the end.

The role of prototypes in design ergonomics should address both, aiming for innovative commodities, as well as acquiring new knowledge. This requires designers and ergonomists to focus on designing experiences; perceived as an initiative to enlarge the design space, as well as a development of design discourse ‘beyond the object’.

As a response to the shortcomings of existing models of how usage and users are considered in the design process, this article concludes that:

- Prototyping is a kind of intervention for experiential learning and collaborative exploration (Bogers and Horst, 2013; Kolb & Kolb, 2017).
- A structured way of introducing prototyping complements the overarching system of interacting and collaborating entities, which is necessary to facilitate research and practice to develop new knowledge, as well as anticipate future products and services.
• When enlarging the design space, prototype resolution need not to be aligned with the progression of design activities.
• The pedagogical intent of prototyping lies in exposing students to larger issues around creating and testing operational models of knowledge.
The problems generated by the lack of adequacy of the built environment affect both psychological and physiological health for those who are carrying out the activity, consequently the productivity and the expected results are not achieved. It is possible to define ergonomics the area of study that aims at the methodical organization of work in function of the proposed end and of the relations between the man and the machine (RODRIGUES, 2000). This article aims to identify the problems of adequacy of a container to be used as a classroom, and propose solutions and guidelines for the adequacy of the problems encountered. In this sense, a container has been chosen for analysis that is being used as a classroom for three courses, among them Architecture and Urbanism at the Campus of the Federal University of Sergipe, located in the city of Laranjeiras. When analyzing a classroom, it is expected to find comfortable furniture, corridors with room for a person’s movement, satisfactory lighting, adequate temperature (natural, through openings, or artificial, with the aid of equipment), and the precise noise level to be as little as possible so as not to interfere with the activity. For this study, measurements were taken on the spot, in the morning and afternoon, with equipment to measure artificial lighting, noise and temperature in order to verify if these aspects are in compliance with the Brazilian standards and to verify if the container has been adapted for this function properly. In addition, the furniture in the classroom has been observed for its layout and dimensions, to make sure they provide the necessary comfort for the users, and finally, the dimensions of the windows were checked and how they were placed to control the natural illumination. After the measurements were carried out, NBR 5382 and NBR 5413 were used as parameters to verify the required levels of illumination, NBR 10152, to verify permitted noise levels and bibliographic references as the basis for other observations. In this way, the results have proved some irregularities in the environment that compromise the quality of the activity being carried out, being emphasized by the interviews with the students and teachers who make use of the container. In view of the results found, the suggestions for immediate solutions involve the insertion of sun protection at the openings and furniture change. In addition, other more comprehensive solutions are exemplified in a model design for container rooms. After evaluation of the container, it can be said that there was negligence of the authorities when delivering an environment unsuitable to be used as a classroom, being available for students and teachers of the Architecture and Urbanism course, who study ways to create comfortable spaces.
Education in ergonomics in Brazil - some experiences from the Universities of São Paulo, Rio de Janeiro and Minas Gerais

Type: Abstract Oral Presentation
Category: Education and Training

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The subject of this paper is a discussion about the learning process in ergonomics based on different experiences carried on in the universities of São Paulo, Rio de Janeiro and Minas Gerais related to specialization. The main questions are related to the difficulties students face to learn how to construct and conduct an Ergonomic Work Analysis, as well as learning concepts in ergonomics, especially when the focus is related to workers activities performed in actual situations. Some relevant factors related to previous training and the influence of distinct epistemological currents can be considered as one of the keys related to transform student’s points of view, specially concerning what we can consider as work and how different workers are engaged on. Work is never only “to perform a task”; actually it’s a challenge to each one and to teams in order to build competences, habililities and social relations. For students, understand what actually happens is one of the main pedagogic issues and this experience is built during the fieldwork. The purpose for them is to learn how to deal with uncertainty, a characteristic of this complex approach.

Other challenge for ergonomists and, specially, for the students is to understand also how to deal with one of the major problems in ergonomic interventions. Understand the organizational structure of companies and institutions and how to think in different perspectives, in short and long run, for example and to facilitate the adoption of changes by different actors is considered as one of the results of improvement actions. In many situations the interventions remain partial and limited. One challenge is the need to introduce a more long-term monitoring and alignment of corporate strategies towards actual transformation of work in order to build scenarios that favor health and professional development. The work situations improvement is normally delegated to the heads of each department without having a clear policy issues and project management work. As part of our experience in Brazil it seems very significant to introduce in educational programs in ergonomics this first order question, especially when there is a large spread of reductionist practices that provide diagnostic based on checklists and keeping a profound ignorance in relation to work activities.
In the participatory design an intermediary object is a hybrid object, they are at the same time a modeling of our future desire and an instrument to mediate the design process between all the work teams involved in the conception process. This article discusses and takes as the object of analysis the design process and the use of conceptual principles as an intermediary object, based on the participation of the authors in the development of a new Sulphur Recovery Unit. Ergonomics identifies the necessity to promote a social intervention, considering the project experts and operators as actors of a unique social construction. One important point to be considerate as determinants of functional mismatches in large industrial projects is the growing gap between operation teams and project teams, even when there is an expressed willingness to promote the participation of operators in the project and the return of the accumulated experience in the new projects. The consequences of this are predominantly organizational; creating obstacles that must be overcome to make more effective integration of operators into the project process, where the centrality of the project seems out of place and keeping the focus on the management of it and not on the goal the use of these units. This article discusses and takes as the object of analysis the design process itself, acting since the beginning of the basic and conceptual project. The ergonomic design comes prematurely, identifying the necessity to promote a social intervention concomitantly with the technical construction (Daniellou). This postulation, however, still requires more systematic studies on the actual design process in an organizational perspective, considering the experts project not as receivers of information but as other actors of a unique social construction, whose activities should also be analyzed to make possible the integration from the point of view of the design activity. One of the ways, that can I use to resolve that’s distortions of design is the construction of one or more intermediary objects to be shared between all actors of project. These conceptual orientations, is the place where the solutions for each design conflicts could be discussed and solved. Therefore, to construct these objects of collective work we must analyze the most important Typical Action Situations – TAS and after that built stronger conceptual points to be used for everyone as a project centered on the concept – PCC. This old proposition of AET (Guérin et al.), reset in this wider fresco activity analysis of the designing process, appears now as the general principle for the effective design of work.

Key-words: ergonomics design; participatory design; intermediary object; design concept
Juvenile workers in the retail sector - a new ‘pocket money precariat’ or an opportunity to educate the future workforce?

In the Danish retail sector, juvenile workers below 18 are employed in large scale. In general, they are employed for 10 – 15 hours a week, they mainly work outside of normal working hours including weekends due to regulation. Today an average of 50% of the employees in retail stores are below 18, though all part-time.

This presentation is based on a development project organized in co-operation with one of the major retail organizations. The overall aim of the project was to implement and evaluate an intervention where health and safety committees for juvenile workers were established in supermarkets to improve the juvenile workers’ influence on and awareness of their work environment (see additional abstract on this project). In order to improve knowledge of the target group, this part of the study explores how juvenile workers are constituted as a group and constitute themselves as workers within the sector.

Data are from baseline surveys among the juvenile workers and managers and from interviews conducted before and during the intervention.

Results from the projects showed:

1. The juvenile workers perform their tasks in stores, including maintaining counters, handling money and customers, and closing the shop at closing hours. They also face the same risks as their older colleagues: cuts from paper cutters, heavy lifting and harassment, robberies and bullying behavior from customers.
2. They do not see themselves as traditional employees. They have limited interest in seeking knowledge of their work rights or the work of their local Safety Committee.
3. They seem to see themselves as belonging to the group of juveniles, rather than the staff, which constitutes them as a temporary and disposable workforce, without authority to critique or suggest improvements and changes.
4. The management and senior workers had limited knowledge of how the juveniles experienced their work, what challenges they met and how they could contribute to improvements.
5. Juvenile workers are not part of the formal channels of influence and participation (i.e. Safety Committee, Works Council).

Conclusion: The juveniles below 18 in retail stores are constituted and constitute themselves as a group of employees that are distinct from the ‘normal employee’, although are half of the work force, performing the same tasks and experience the same working conditions as the adult work force. Due to their precarious employment, neither the
workplace nor the juvenile workers consider themselves equal in terms of influence and rights. In side-stepping the juvenile workers, the stores risk missing out the input of a resourceful group that could add value to the store's work environment and sales. And as a society we risk missing out on an option for introducing our youth to the work market in a safe and including manner and thus cultivate a knowledgeable workforce.

Health and safety committees for juvenile workers in Danish supermarkets - Process evaluation from a participatory intervention study

Background: In the Danish retail industry, juvenile workers employed in temporary positions for few hours a week constitute the primary workforce. For the main part of the juvenile workers this employment is their first meeting with the labor market, hence they lack engagement in their work environment, and are seldom involved in decisions regarding their work. We argue that it is beneficial for performance as well as safety to increase their engagement in their work environment.

The aim of the study was to evaluate an intervention process aimed at improving juvenile workers involvement in their work environment in Danish supermarkets.

Method: The intervention was implemented in two clusters between April 2016 and June 2017. Six supermarkets were allocated to the first round and five new supermarkets participated in the second round. Each intervention-cluster lasted 8 weeks. First a workplace-based health and safety committee for juvenile workers was established. Each committee consisted of two juvenile workers, and at least one adult (safety representative or manager) and a researcher. Next, the committee performed a workplace risk assessment centered on the juvenile workers' work situations. The juvenile delegates were encouraged to suggest solutions and improvements to the work environment, and the suggestions were then analyzed and rated according to feasibility. Finally, the committee implemented the selected initiatives and updated their peers, e.g. on local social media. The juvenile workers were supported in the process by the safety representatives and researchers.

Results from the process showed:

1. The committees chose to focus on issues affecting the juvenile workers daily working life.
2. The juvenile delegates experienced increased decision and action competence concerning their own work situation.
3. It was hard for the juvenile committee members to engage their peers.
4. It was a challenge to maintain manager commitment throughout the intervention process.
5. In post-intervention interviews managers found that the intervention had high impact for low effort.
6. Many of the supermarkets decided to continue

Conclusion: A scale-up of the intervention of health and safety committees for juvenile workers within the retail industry has the potential to increase the juvenile workers' engagement in their work environment while also adding value for the supermarkets. However, the implementation requires continuous support and commitment from the management and safety representatives, which is a challenge for a sector characterized by high turnover, short term orientation and shifting agendas.
With the promotion of the technology, the state-of-the-art TVs have already possessed the functions of 3D. The previous studies indicated some advantages brought by a 3D display, like decreasing reaction time and increasing accuracy as well as depth perception (Barfield and Rosenberg, 1995); its binocular cue provides information about 1.4 times more than the monocular one (Campbell and Green, 1965); it heightens people’s contrast sensitivity and cognitive ability (Yeh and Silverstein, 1992); it can simultaneously process multi-characteristic visual search (Nakayam and Silverman, 1986); and it performs better than 2D displays in searching performance (Ntuen et al., 2009).

Since 3D TVs have been the popular products in the market, theirs image quality assessment in related literatures are critical issues for users and manufacturers. Kooi and Toet (2004) indicated that vertical disparity, crosstalk, and blur are important factors that have an effect on the visual fatigue of stereoscopic display. Wang et al. (2010) also pointed out in their study that the interaction of luminance contrast between the shadow and the main background has an impact on depth. So and Chan (2013) set five viewing angles to discuss the impact of text reading. Cai and Li (2014) explored the impact of 15 display angles on readability. Based on above studies, disparity, crosstalk, contrast and viewing angle were the four critical factors to be investigated in this study.

In this study, Taguchi Method was used and L9 orthogonal array with large is better quality characteristic was applied in our experimental design. Thirty subjects were recruited in this study and we ask them to fill out the overall image quality questionnaire and IPQ (Igroup Presence Questionnaire) after the experiment. Through the calculation of MINITAB, the average value and S/N ratio of overall image quality and IPQ were found, then we can get significant factors and contribution ratios and then the optimal parameters were obtained. Finally, confirmation experiments were conducted to verify whether the data was within 95% confidence intervals.

Experimental results of SN ratio indicate that disparity (-0.08°), crosstalk (2.02%), contrast (0.287), viewing angle (45°) is the optimal parameter for overall image quality. Disparity (-0.08°), crosstalk (0%), contrast (0.287), viewing angle (0°) is the optimal parameter for the general feeling, spatial presence, and experienced realism of IPQ. Disparity (-0.08°), crosstalk (0.02%), contrast (0.287), viewing angle (0°) is the optimal parameter for the involvement of IPQ. The result of cross-analysis indicates the disparity (0°), crosstalk (2.02%), contrast (0.287), viewing angle (0°) is the optimal parameter in overall combination. The result of this study can be a reference for future product design in order to enhance customers' intention for buying a 3DTV.
When employee driven innovation becomes an organizational recipe – implications for what it means to be an innovative employee

Type: Abstract Oral Presentation
Category: Others

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Background and purpose: The creativity and solution-seeking activities of employees have at all times been crucial for the progress and output in any work place, and also a vital source for employee well-being. However, it is mainly within the last two decades that research on employee driven innovation (EDI) as a phenomenon has emerged in the innovation literature. Much of the research on EDI has revolved around defining the phenomenon and identifying what kind of work-conditions that foster and constrain EDI. In the Scandinavian countries, EDI is increasingly recognized as a valuable tool for a renewed public sector. Consequently, the strategic efforts to “implement” EDI as a form of organizational “recipe” or implementation guide, are spreading throughout the public sector. The aim of this paper is to explore how EDI as an organizational recipe for public sector relates to EDI as a practice of employees. Further, it addresses how potential mismatches in the interpretations of EDI possibly can lead to discouragement and alienation to employee driven innovation.

Study design: The paper is based on the empirical material from a longitudinal study of implementation of EDI as a strategic way to enhance service-innovation in four Norwegian municipalities. 113 qualitative interviews, observations on various events, and a survey repeated twice to all municipal leaders and employees, were conducted. The theme for this paper has emerged through abductive analysis, where the empirical material indicated needs for other analytical categories than first planned.

Results: We found that in the municipalities, EDI as an organizational recipe was implemented through structured top-down processes where selected innovation projects were supported by resource-allocation and methods (Lean and NST (Need, Solution, Testing)). Although the structures for fostering EDI in many ways contributed to the employees’ ability to prioritize and realize wanted improvements and changes, the structures also induced a strong pressure for every municipal unit to make use of the support activities. Projects, whiteboard-meetings, and support activities, were counted as measures of how the innovation work was implemented, while the degree of innovativeness or output in efficiency was harder to measure. An emerging, unintended consequence of the strong focus on support activities, was that the autonomous EDI initiatives, the so-called bottom-up initiatives that emerged independently of these supportive structures, were not “counted”. Consequently, employees initiating and accomplishing these autonomous initiatives, could feel that their innovation efforts were not valued enough, and that the way innovations were pursued, were more important than the output of the initiatives.
Discussion, conclusion and implications: EDI as a top-down implemented strategy to improve output and employee wellbeing in public sector, often takes a form that contradicts the conditions that are considered conducive to fostering EDI. However, EDI as a more informal work-practice, fosters these enabling conditions to a larger extent. Hence, trying to structure EDI through formalization, might not only be less effective, but could also potentially discourage EDI as an informal activity. EDI might be a form of innovation work that in its nature contradicts the bureaucratic way of organizing work to secure its quality and legitimacy. A relational and processual exploration of how EDI is fostered in public sector, opens possibilities for deeper understanding of how employees and leaders relate to EDI initiatives, and how expectations to what they could and should do, influence their understanding of what it means to be a good employee in public sector. There is considerable research on how organizations can increase innovative ability. Less research addresses how these organizational recipes influence employees’ understandings of what initiatives there is room for within these recipes. Hence, more research is needed in this field.
Building a dialogical interface among different logics: a contribution of Ergonomic Work Analysis to the design process

Type: Abstract Oral Presentation
Category: Others

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This paper discusses that, through the analysis of the work (GUÉRIN et al., 2004), it is possible to reveal the different logics of the actors involved in the design of the work systems and which are present in work-related situations, thus showing how the conflicts of their heterogeneous viewpoints, in the design of production systems, generate the negative effects both on the task and on the operator.

The vision of activity-centered design here is construed as an ongoing and multi-logical process (BÉGUIN, 2010), in which workers continue the design in their workplaces, revealing aspects of their own activity that help change the initially designed concepts.

This abstract discusses that the work activity, when revealed by an ergonomic intervention, can make a supporting interface function to the dialog among the different standpoints of the design [heterogeneous interests, goals, necessities etc.]. This dialogical interface construction, based on the analysis of the activity, seeks to support the collective work during the design process in terms of support for an interactive design dialog, thus enabling the design team to consider aspects of the activity that would not be considered or would be dealt with from partial representations. The involvement and the collaboration of workers in this dialog are essential in terms of the possible revelations of their activities and variables of the real work situations.

The results of the ergonomics intervention in the university restaurant (UR), based on the analysis of the serving staff’s activity at the serving counter, have evinced several inconsistencies in the UR project, such as the profile of the average student, which does not match the variable profile of the UR customers and the conflict between fixed offer and variable demand.

The observation and the interviews [self-confrontation] allowed the researcher to have the verbalizations aimed at understanding why the kitchen maids do what they do and why they created such strategies, how they use their operative modes and how they use their skills. This description is the representation of this interface, which is nothing more than the representation of the activity, a fundamental step for the Ergonomic Work Analysis. This dialogical interface development in the project meetings allowed for all the participants involved to build the transformations of the project’s initial concepts.

The serving staff took the results of their meetings to the serving counter, attempting to test the new vision of portioning, which became more flexible (within a defined limit, according to the local context of the serving counter). The performance of the UR project work system was improved by reducing the waste of raw materials and by improving the quality of the service, thus getting the students more satisfied in terms of having their individual requests fulfilled.
A straightforward and valid instrument to measure cognitive workload would be heavily appreciated in many research areas, such as human-machine-interaction, driver behavior (e.g. automation and fatigue), usability and UI design (e.g. adaptive displays), training and education, or other areas, that are interested in the assessment of the cognitive state of a person. The Index of Cognitive Activity (ICA) is a promising but also controversial instrument that could be of high relevance if it keeps its promises.

The Index of Cognitive Activity is based on pupillometry, which makes use of multiple replicated findings that the pupil widens when workload is rising (Beatty, 1982; Kahneman, 1973). The problem of the dilatation effect is that it is influenced by many parameters, e.g. anxiety, fatigue, intelligence, sympathy, or reward (Loose, 2004). Additionally, it is highly incipient for changing light conditions. The advantage of using the pupil size to measure workload is its accurate temporal resolution: The pupil reacts on the elevation of mental workload with a latency of 100ms (Hampson et al. 2010) and it reaches its peak of dilatation approximately 1200ms after stimulus onset (Janisse, 1977). Even if the interpretation of the composition of mental workload is still an urgent research topic, a parameter that is sensible to workload differences would be very useful to examine, e.g., peaks of workload.

The Index of Cognitive Activity is a patent from the year 2000, which claims to be an effective, light-independent recording method of mental workload (Marshall 2002). Its validity is controversially discussed: Neither the definition of the neuronal basics (Schwalm, 2009) nor the adequate measurement of mental workload succeeded in over 40 years of research. On the basis of an elaborated literature research, we carried out an experiment to evaluate the Index of Cognitive Activity in a lab setting with varying light conditions to test its independence from light adaptations.

The participants were equipped with an Eyetracking device and were seated in front of a huge screen in a dark laboratory without any other light incidence. In three different conditions the light of the screen was varied: A grey screen, a slow and a fast changing screen randomly showing a black, grey, or white screen. On a laptop in front of the screen, the participants worked on a mental rotation task and a Stroop task, each of the two varied in terms of their degree of difficulty. The NASA-TLX was to be answered after each test condition to evaluate the subjective workload of the participants in each condition. If the ICA is truly light-independent, the ICA should show the same mental workload for each light condition. The experiments are currently carried out, therefore results are pending.
How to help older adults learn smartphone apps? A case study of instructional design for video training

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With the fast development of open online courses and video-sharing websites, video training is widely used in daily life. Particularly, it is a promising alternative for older adults to learn smartphone applications, when no one around them teach them. However, most instructional videos do not target older adults, and thus they usually find it difficult to follow instructions and simultaneously watch the changes in the recorded screen of smartphones.

To solve this problem, this study proposed two methods. First, adding three kinds of visual cues in instructional videos to grab older adults’ attention: prompt box, cartoon fingers, and real fingers. Second, dissociating selection and validation phases of the pointing gesture of smartphone applications to give older adults enough time to get and understand information about operations. However, it is unknown which visual cues and pointing methods are more suitable for older adults in video training. So exploring this question is meaningful.

Among three kinds of visual cues, cartoon fingers have better directivity than red rectangle (Bobeth et al., 2012). Besides, cartoon fingers give the video picture a smaller blocking and a clearer picture than real fingers. For pointing methods, dissociating selection and validation phases gives older adults the choice and time to choose between information or validation phase (Chêne, Pillot, & Chaumon, 2016). Therefore, when older adults learn smartphone applications through videos, two hypotheses were developed: first, cartoon finger contributed to better performance, higher acceptance and satisfaction compared with red rectangle and real finger. Second, the pointing with separate validation contributed to better performance, higher acceptance and satisfaction than the pointing without separate validation.

An experiment was designed to check hypotheses. In the experiment, independent variables are visual cues and pointing methods, which are within-subject variables. As to visual cues, it had three levels: red rectangle, cartoon finger, and real finger. As to pointing methods, it had two levels: the pointing without separate validation and the pointing with separate validation.
Dependent variables are performance, acceptance, and satisfaction. There are four quantitative measures of performance: practice time, task completion time, task effectiveness, and the number of errors, which are recorded by the screen recording software (DC Recorder). Furthermore, acceptance is measured through one item of intention to use (Davis, 1986) and two items of ease of learning (Renaud & Van Biljon, 2008). Satisfaction is measured three items from Lewis’ study (1995). Expectedly, twenty-four older adults participate in the experiment.

Results may give design guidelines for older adults’ instructional videos and provide a reference for the development of smartphones.
Self-driving is one of the most significant technical advances in the transportation industry, gaining an increasing worldwide public attention. The major motivation for developing self-driving vehicles is to improve road safety. Previous studies have demonstrated that anthropomorphism design (i.e., making a nonhuman agent as a humanlike agent through adding anthropomorphic features such as gender and voice) can increase people's willingness to trust and use this technology. This study will explore how simple anthropomorphism can change people's severity perception of accidents caused by self-driving vehicles. The simple anthropomorphism design is to add a male gender and photo to self-driving vehicles. Respondents' affect evoked by the accident scenario, trust, and perceived severity of the accident scenario were measured. Two surveys (one online and the other offline) showed that the simple anthropomorphism cannot change the perceived severity of the accident scenario caused by self-driving vehicles. Affect evoked and trust were significantly associated with perceived severity.
LED lamps have a lifespan and electrical efficiency which are several times greater than incandescent lamps, and are significantly more efficient than most fluorescent lamps. Thus, LED lighting system is the best way in parking lots for save energy. However, LED lamps may flicker and longer exposures to flickering light contribute to eye strain and vision problems. This study examined the effects of intelligent LED lighting system on driver’s vision at parking entrance tunnel. The intelligent LED lighting system were two settings depending on surrounding light. Setting 1 were brightness increases (30%, 40, 60%, 100%, day setting) and top lighting 70%, side lighting 30% (night setting). Setting 2 were brightness 100% (daytime setting) and brightness increases (30%, 40, 60%, 100%, night setting). The driver’s visual search and pupil variation were record by eye tracker (Talkeye Lite 2950, TKK, Japan). The effects of lighting settings and types of vehicles (sedan, sport utility vehicle, SUV) on dependents variables were examined by ANOVA (SPSS 21.0). The results of ANOVA showed that mean pupil diameter during daytime was significantly less than that at night (30.3 versus 35.5 dots). For tunnel lighting settings, mean pupil diameters of setting 2 was significantly smaller than the setting 1 (31.87 versus 33.88 dots). On the other hand, the mean variances of pupil diameter at setting 2 were higher than setting 1. For types of vehicle, driving SUV has wider vision fields and drivers’ pupil variation are higher. LED lighting has the efficient of energy saving and carbon reduction. However, light brightness and light uniformity are important to consider in arranging the lighting environment. Ergonomic specialist must consider the lighting design both energy saving and user-centered design.
The achievement of interface design has made great progress in many areas, but it has not been extended and applied to interface design of the railway traffic dispatching. There are still some problems of the railway dispatching interface, such as function icons, the station chart and so on. To find the defects of the current dispatching interface and provide support for the improvement of interface, the eye movement experiment to the dispatching interface was conducted. Six railway dispatchers who have worked more than five years in this position participated in the experiment. The railway dispatch information was simulated with two displays and two patterns. One pattern was that the dispatching information was presented on two 32-inch displays placed side by side. This pattern was called the large display combination. Another pattern was that all information was presented on two 22-inch displays and was called the small display combination. The subjects were asked to do 10 kinds of typical railway dispatching tasks and the eye movement data was recorded. When the subjects completed the experiment, they were asked to make a subjective questionnaire that mainly related to the layout, color density and size of a variety of graphics, buttons, character and line and light flicker frequency on displays. The result of the task completion time showed that there is no significant difference with two patterns of display. There was no significant difference in the eye movement index of the fixation numbers, the average fixation time and the average scanning amplitude. Only the index of the average pupil size reached significant differences. The subjective data showed that the color of the interface element was the most seriously. Most of the subjects said that the color of the line of station chart is too bright and dazzling, the color of the graphic symbol is also some glare, and the color of the character of alarm information window is not easy to see. Based on above result, the conclusion can be made that within a certain range (for example, the common display size from 22 to 32 inches), the larger size display shows the better information; the color of the station chart need to be adjusted to 1.7 ~ 5.1 cd / m² referred to the national standard; the red color of the word is not easy to read, it should be changed to the color of obvious contrast to the background, such as black text with white background, white text with black background, yellow character with black background and so on.
People with speech disorder cannot communicate well with others, therefore they might get psychological symptoms those affect their daily life. Speech and language therapy is a highly personalized and time-aps task. To achieve the expect effects, intensive and repeated practice is essential for these individuals, however, the number of speech and language therapists (SLTs) is not enough to face a large number of treatment needs. Because of job burnout resulting from work overload, SLTs might cope with the excess load of treatment requirements by reducing the treatment duration or frequency, which may lead to reduce of rehabilitation effects. Nowadays smart mobile devices such as the iPad and tablet PC have changed the way to interact with the therapy, from social connections to work and entertainment. Most of speech therapy mobile application software regards augmentative and alternative communication (AAC) field which are developed to enhance, replace, or supplement an individual's communication capabilities. Few of them focus on the motor speech disorder therapy.

This study using user-centered design process to build an innovative treatment model and develop a useful assistive tool. In the Analyze stage, we use Delphi expert assessment interviewing the SLTs (average length of service to see 7 years) to realize how they work about motor speech disorder and re-examines the clinical pre-, current-, and post- therapy situation (Figure 1). In the Define stage, the SLTs are invited to define the weighting of defects using the analytic hierarchy process (AHP). The most two important defects are the therapist: have to repeat the demonstration of oral practice techniques to allow the individual to imitate; and cannot exam the rehabilitation results systemically. In the Design stage, we transferred the above defects into design criteria and develop the functional prototype. It provides volume, pronunciation, Diadochokinetic, syllable, and eight-step continuum practices (Figure 2). SLTs can select and demonstrate correct video to the individuals instead of exercising their oral muscles. In addition, STLs can track long-term practice data to check the rehabilitation effects. Finally, in the Assessment stage, the therapists participate the usability evaluation to validate this developed tool (Figure 3). All therapists suggest this is a useful tool, which can not only as an assistive manner of speech therapy, but also reduce the workload of them. It concludes that the developed motor speech disorder therapy assistive tool focus on the motor speech disorder and get positive feedback. In the future, the research team will extend the results and develop home-use practice one, expecting to enhance the rehabilitation motivation and effectiveness of individuals.

Keywords: User-centered design, Motor speech disorder, Speech therapy
Introduction: Carpal tunnel syndrome is a symptomatic compression neuropathy of the median nerve at the level of the wrist with increased pressure within the carpal tunnel and decreased function of the nerve at that level. Carpal tunnel syndrome is one of the most common reported work-related musculoskeletal disorder. Computer users are expose to a high risk of upper musculoskeletal symptoms and work-related musculoskeletal disorders since the amount of time spent on the computer is associated with a high incidence of musculoskeletal disorders.

Objective: To investigated the impacts of typing at two keyboard slopes (0° and +20°) on the median nerve deformation ratio.

Method: Fifteen healthy young men (24.8 ± 2.3 years) were recruited. Participants were randomized to perform computer typing with both 0° and +20° keyboards. The participants required to perform four blocks of 30 minutes’ computer typing for each 0° and +20° keyboard conditions. The median nerve at left wrist was examined after each 30 minutes’ typing block by ultrasound machine (LOGIQ e). Subsequently, the median nerve cross-sectional area (MNCSA, mm²) was quantified by ImageJ by tracing method. Two-way repeated analysis of variance (4 × 2 factorial design) was performed with four time blocks, and two keyboard slope conditions (0° and +20° keyboards) as factors to examine differences in the deformation ratio of MNCSA. Post-hoc pairwise Bonferroni-corrected comparison was performed to examine the significant effects.

Results: Continuous typing activity causes an increase of MNCSA deformation ratio. The main effect of typing block is significant on the MNCSA deformation ratio (p < 0.05). Although the main effect of keyboard slopes is not significant, but the deformation ratio of typing with +20° keyboard (approximately 20%) is larger than typing with 0° keyboard (approximately 14%).

Discussion: Ultrasonography examination to the median nerve after computer typing with absolute measurement and deformation ratio provide a better understanding of the impact of computer typing task on the median nerve.
Interdisciplinary Adaption and Extension of the Evaluation Method of the User Experience Questionnaire

Type: Abstract Oral Presentation
Category: Education and Training

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A digital transformed or perpetual disruptive working environment will change working processes just as on-the-job trainings at work. Using video sequences in diverse scenarios is actually growing like for instruction, training on the job and information brokage in case of fault reporting. The utilisation of mobile devices with their highly intuitive software make it possible. To ensure a user centered employment of such video sequences adaption of the method for evaluation is necessary. The evaluation method User Experience Questionnaire (UEQ DIN ISO 9241-210) as an approach to explore the perceived quality of a product means its appeal and usability in form of its objective and subjective effects. An adaption of the method UEQ is necessary for video sequences because of additional items like music, cuts and flashes. The adaption and extension process of UEQ includes the disciplines of media psychology and analyses of film realised in a mixed method approach. An analyses of central documents of those disciplines leads to a first extension of the UEQ with central items mentioned above. Afterwards an interdisciplinary focus group of lecturers formulates criteria independently according to pragmatic and hedonic quality. Based on a qualitative analyses of this focus group a second extension of the UEQ followed. Finally this version was tested interdisciplinary again with tutorials about technics for ideation processes by students of product- and processmanagement, ergonomics and wood design.
BUSINESS CASE STUDY

Control rooms are used in a variety of industries including transport, mining, security, healthcare, utilities and entertainment. Digital displays are often prominent as wallboards (overviews) and as multiple desktop displays. If the displays are not optimally configured for the work tasks and lines of sight, then individuals can develop visual and physical discomfort. It can also have an adverse effect on work flow. This business case study reports the process used by an architect-ergonomist team (called “the design team”) for providing very early schematic design advice for control rooms.

Methods: The process used by the design team engages end users in the design process by blending the requirements of ISO11064 for the conceptual design of control rooms with a modified participatory ergonomics approach. A key feature of the process is a workshop delivered to key stakeholders in the control room design project (called “the working group”) outlining general ergonomics and visual ergonomics principles. The educational component is integral to the design process because it provides an ergonomics framework for good design without placing constraints on how the control room should look. For example, instruction is given for the optimal location of visual tasks by the design team. Then, through a workshop led by the design team, the working group decides how the visual displays should be arranged at workstations and within the room so that the displays are visually comfortable and facilitate work efficiency.

Results: The design team has used this process for the schematic design of more than 10 control room projects. The principle observations are that the process engenders greater ownership of the design by the working group and pride in their new workplace when the control room is built. Most of the design suggestions are generated by the working group; the ergonomics education and the workshop guidance helps to focus the working group’s suggestions and resolve dilemmas between different design options. Less-than-optimal designs have occurred when key decision makers were not actively involved in the schematic design process.

Conclusion: Control rooms are a complex working environment with high visual demands. Engaging end users in the schematic design process provides an opportunity for developing creative solutions to visual ergonomics design problems.
Toward a better assessment of occupational exposure to nanoparticles taking into account work activities

Type: Abstract Oral Presentation
Category: Manufacturing

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Numerous industrial sectors and processes may cause worker exposures to ultrafine or manufactured nanoparticles (NP). In this context of uncertainty regarding health effects, exposure assessment in occupational setting is a challenge. Existing approaches to assess exposure to NP are complex to follow because of the expertise needed and of their heterogeneity, resulting from a lack of knowledge regarding determinants of toxicity. Today, the exposure data available are insufficient and need to be strengthened to develop prevention or epidemiological studies. Safety has to be integrated in the earliest stage of innovation.

We realized a systematic literature review of the recommendations proposed to assess occupational exposure to NP on the field. Then, a multidisciplinary study group gathering ergonomists, metrologists, epidemiologists and industrial hygienists has been built to propose an operational strategy to assess occupational exposure to NP integrating work activity analysis and measurements. Campaigns in workplaces (aeronautics, rubber, laboratory...) has been conducted following four mains steps: (1) pre-visit: prevention system analysis, process understanding, interviews; (2) NP sources identification: protective equipment and air flow analysis, preliminary measurement and work observations; (3) In-depth exposure assessment: video recording of work activity synchronized with real-time measurements and air sampling for physical-chemical characterization; (4) results analysis and presentation in companies.

Work activity analysis combined with NP measurements provides a better understanding of the NP exposure determinants, describing real-life exposure scenarios, and results in recommendations for tailored prevention. The implementation of this strategy reveals how workers and companies deal with risks resulting from NP presence on workplaces. We noticed different safety climates between aeronautics companies, rubber plant and research laboratory. High levels of NP exposure were recorded in rubber industry while laboratory and aeronautics companies wondered how to assess exposure generated by innovative processes to develop suitable prevention practices.

The tested exposure assessment method is operational and thus could be transferred and used by actors involved in ultrafine and manufactured NP risk mitigation. Results contribute to enrich reflection for standardization at both national and international levels. Relevant NP occupational exposure data could thus be produced, recording them in specific databases such as NECID-PEROSH or Evalutil. This will contribute to knowledge improvement of NP exposure levels and associated health effects by public health professionals such as epidemiologists. This method allows to answer the concerns of companies introducing new technologies that are leading to important work
transformations. The proposed approach takes into account limitations of the prevailing paradigm of risk prevention that hides some safety aspects. This work proposes a critical point of view on the work exposure situations and questions the functional approach of risk management. This method strengthens current consideration regarding innovative intervention in the field of occupational health, thus offering new perspectives to act on prevention.
Canary Designs Limited was established in April 2011 and the founder John Lovegrove would like to provide a summary of the ergonomics consultancy's year in 2017.

The consultancy had a wide range of work from the ergonomics of office design to large infrastructure projects like Hinkley Point C Nuclear Power Station. The consultancy undertook the following roles in 2017:-

- **Ergonomics Consultant**
  - Office design
  - Marine Biology Lab design
  - Nuclear Decommissioning facility design
  - Aerospace Manufacturing systems design

- **Human Factors Integration**
  - Nuclear
  - Healthcare (Innovate Mentor)
  - Aerospace manufacturing

- **Expert Witness**
  - Accident Investigation
  - Workplace Incident Investigation

- **CIEHF Regional Co-ordinator for North West England and North Wales**
  - Since Jan 2016, the event organiser responsible for the Talk n Tour series

- **Ergonomics training provider**
  - Airbus - Manufacturing Systems Engineering and Ergonomics

- **Research Support**
  - "Playstation to Workstation"

- **Ergonomics education development in my local community**
  - School visits
  - University talks
  - Exploration / Development of ergonomics courses

The learning outcomes for the talk are as follows:-

- An overview of 2 cost models used for running an ergonomics consultancy
  - The Contractor model
  - The Consultant model

- The principles used for practicing ergonomics, managing the expectations of different clients and delivering the work efficiently

- Tips for achieving a balance between work and home life

- The future direction / development of the consultancy in a rapidly changing technical world that is influencing the methods used to design systems, products and services
Approximately 20 minutes is required to deliver the talk and 10 minutes for questions.
Introduction

The purpose of this project was to develop and apply a framework for evaluating semi-structured case study reports of equipment intervention experiences in the Construction industry. The overall aim was to inform decisions regarding equipment intervention effectiveness on safety and health in the Construction industry. The state of Ohio (USA) has a state-based workers compensation insurance program. Since 1999 the Ohio Bureau of Workers Compensation (OBWC) has administered a Safety Intervention Grant (SIG) program in which matching funds from OBWC are granted to employers for the purchase of equipment to reduce workplace injury potential. Employers can receive up to $40,000 USD in matching funds. A requirement of the program is that a final “case study” report be submitted by the employer. The SIG program reporting elements contain information in addition to the quantitative workers’ compensation (WC) claims experience. However, the quality of that information is variable. The present review approach emphasized the content and quality of information, beyond the injury claims experience, employer grantees submitted to OBWC in the case study final reporting. This information included how, and to what magnitude, the evaluation demonstrated reductions in risk factors, descriptions of risk transference, employee acceptance/adopter of the intervention equipment, and impact of the intervention on productivity/quality.

Method

Approximately 368 grants were awarded to employers for purchase of equipment in Construction occupations during 2002-2016. Final report materials (case study reports) were available for 224 grants. After excluding grant experiences with equipment that was not used predominantly on construction sites the final review included 153 grant experiences. Grant applications and report review and data extraction was conducted by a research associate knowledgeable of Construction intervention evaluation. The analysis assessed the quality of evaluative aspects of employers’ experience with the intervention equipment in terms of: evidence of risk factor reduction, employee acceptance (e.g. usability), and employer return on investment (e.g. productivity, cost/benefit). The approach was applied to identify the intervention experiences with the strongest reporting of evaluative criteria - to inform Construction industry stakeholders on aggregate equipment experiences from this program. Reductions in a cumulative trauma disorder (CTD) risk score and safety hazard score were compared with evidence quality scores and
intervention cost per affected employee (in inflation-adjusted US dollars) to identify the most effective interventions.

Results

This paper will report results for aggregated employer experiences with interventions classified according to 24 types of Construction equipment. Preliminary aggregated results indicate that case studies for cable feeding/pulling systems used by electrical contractors showed high reduction in CTD risk factors and high rank in quality score relative to other types of equipment. These systems are also lower in cost.

NOTE: FOR INTERNATIONAL ERGONOMICS ASSOCIATION (IEA 2018) REVIEW PURPOSES ONLY. NOT FOR PUBLIC DISSEMINATION.
Due to several medical accidents breaking out, patient safety is getting more emphasis. People have raised attention to ergonomics approach to improve patient safety. This study is to evaluate the situation of ergonomics intervening medication for patient safety improvement cases and provide the advanced human factors knowledge to medication in hospitals and to reduce the risk of human error in hospitals. The cases are collected from Taiwan Joint Commission on Hospital Accreditation (TJCHA). The cases have been reorganized by the domains view of ergonomics (physical ergonomics, cognitive ergonomics and organizational Ergonomics); graded by the level how they approach of ergonomics and quantified to do statistical analysis. The results shows that percentage distribution of ergonomics knowledge using for medication safety promotional, ensuring infection control and improving operations Safety, such as the results shows that percentage distribution of ergonomics knowledge using for medication safety promotional are physical ergonomics (5.41%), cognitive ergonomics (21.62%) and organizational Ergonomics (72.97%). Some recommendations for increasing medication safety have been presented to all levels of medical institutions for reference study.
Keywords

Ergonomics, patient safety improvement, hospitals
Motor learning differs among novices during a repeated repetitive screwing task

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Background: Throughout our lives we acquire skills, adapt to new situations, and make decisions, three concepts embraced in the term motor learning [1]. Since motor learning is always present, it may also influence the interpretation of laboratory and field studies that include repeated measures.

Objective: This study aimed to detect whether novices showed decreased muscle activity levels and modified acceleration profiles across days when performing a repetitive screwing task.

Methods: 57 subjects (30 F; 4 left-handed) participated in the study (mean age 34 years; mean height 174 cm; mean weight 73 kg), performing a one-hour screwing task on three days. Acceleration of the forearm and electromyography (EMG) of four dominant arm muscles was bipolar recorded (PS11, THUMEDI GmbH & Co) using ECG Electrodes (KendallTM, Covidien). We calculated the mean of the following parameters: electrical activity (EA) as the root mean square of the EMG power spectrum amplitude normalized to the predetermined force level during a reference voluntary contraction [N]; median frequency (MF) of the EMG power spectrum [Hz]; forearm acceleration [mm/s²]; coefficient of variation (CV) of all aforementioned parameters reflecting motor variability. We used repeated-measures ANOVA to test day as within-subject factor.

Results: In the lower arm, the EA and MF of the flexor carpi radialis did not change across days. MF of the extensor digitorium significantly increased from day 1 (96 Hz) to day 3 (99 Hz) and its EA decreased from day 1 (28 N) to days 2 (27 N) and 3 (25 N). In the upper arm, the triceps brachii showed a significantly decreased EA from day 1 (14 N) to day 3 (11 N). MF of the biceps brachii increased from day 1 (55.6 Hz) to days 2 (56.2 Hz) and 3 (57.3 Hz). Cycle-to-cycle motor variability of the muscular parameters did not change across days. Forearm acceleration decreased across day 1 showing significantly higher values (237 mm/s²) than days 2 (219 mm/s²) and 3 (210 mm/s²). The acceleration's CV increased from day 1 to day 3 by ~6%.

Discussion: The behavior of the EA and MF of the four muscles is in line with our hypothesis and probably resulting from motor learning. Apparent is the different motor learning patterns across body parts; some showed a significant effect already after one day, whereas others needed longer. The unexpected increased motor variability of forearm acceleration might indicate that movement strategies develop in a different way than muscular activation strategies during the process of motor learning. In this respect, it could be interesting to observe the process of motor learning taking account for the baseline level of motor variability, which has been acknowledged as a functional factor in the motor learning and performance curve [2].
Every development process with consideration of the demands of future users must create not only new systems or devices, but should achieve a high(er) level of acceptance of these technical solutions. This goal is only obtainable, if the user’s requirements and wishes (which also should be accepted to be requirements) are well-known to the developers. To derive these requirements is the classical main task of user centered design and usability engineering. Though there are a lot of proposals for the structuration of development processes, including the field of usability engineering, user participation up to now is not strategically included into these processes (see [1]). And the earlier this participation is realized, the more probable is user acceptance of results.

In this paper we describe, how a new vibration based information interface using a concept presented by LUTHERDT [1] was developed. The core of this concept consists of a development process oriented at the V-model like the problem solving approach implemented in German technical guidelines VDI 2206/2221 [2, 3], with user participation from the very beginning and including additional feedback loops. This development concept called NuGASi (German acronym) was applied to define the development steps for the new interface. This led to multiple user tests during the development process as well as to recurring optimization cycles and associated user surveys.

The decision for the usage of vibrations as information modality was derived from analyses on human information processing. Our central nervous system, esp. the commonly used information modalities like vision and hearing, are nearly used to capacity by information in situations with intense information input (driving, piloting an aircraft, supervising of large factories/power stations). In situations of emergencies more or further information could disappear due to an overload of the information channel or the following centers of processing. In these cases, the use of haptic sense could be a promising alternative. We all know vibrational alerts from smartphones, but this could transfer only a slight amount of information. For a non-alert information interface, this amount has to be increased, but of course it is constricted by capacity of the haptic channel (1 bit/s, following [4]).

Result of our development process was an interface containing 15 vibration motors (ERM-type with cylindric shape), wearable at the lower arm near to the elbow joint. Just from the beginning, at a very early stage, recurring tests with users were performed to derive the best position, the kind and number of vibrational actuators and their output parameters, and the patterns of vibrations recognizable best. All tests were combined with user surveys. The results and conclusions for other development projects are described in the paper.
Waste collection and sorting are important stages for the municipal waste management. Since the 90’s in Brazil, collection, sorting and commercialization of recycled materials had been done for the most part by collectors either independently or organized in cooperatives. However, authors point that these organizations present a limited productivity, due to lack of technological infrastructure (facilities, equipment and adequate process) and also due to the poor working conditions. In this context, this paper aims to discuss technology and work, comparing the usage and appropriation of technologies in a recyclable waste collectors’ cooperative. The research was carried out qualitatively, as a case study, following the approach delineated by French-speaking ergonomics theories. Three situations were selected for data collection: usage of spaces and materials flow in the cooperative, the sorting conveyor in which operators separate the recyclable materials and the adapted containers used for materials' stocking and movement. Data collection comprised interviews with the cooperative president and two sorting operators, free and systematic observation of operators’ work and pictures taking. Results show that facilities, equipment and materials’ movers were mostly donated from other organizations to the cooperative. The cooperative did not participated in the decisions of facility location nor layout design. Regarding the spaces usage and materials 'flow, it became evident that lack of space and inadequacy of the waste reception and sorting areas present diverse constraints to workers and also limit system’s overall performance. Furthermore, the cooperative does not have specific containers for each type of separated and commercialized materials, thus having to adapt this containers from cardboard boxes, animal feed bags, buckets and so on as means for storing and handling in-process materials. Theses containers present a range of inadequacies to this end, causing discomfort to operators due to the lack of proper handles and resistance. Therefore, we see that the cooperative operates in a location where the facilities, equipment and machinery are not aligned with the type, amount and variability of the waste that the organization needs to sort to achieve its economic goals. To overcome this situation and actually fulfill its job, the cooperative develops different uses of spaces and technology, which sometimes happens at the cost of workers health, safety and well-being.
Characterization of the dynamics of sitting during a sustained and mentally demanding computer task

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Introduction:

Sedentary tasks are often suggested to be involved with developing work-related disorders including low back and neck-shoulder pain. The aim of this study was to characterize the dynamics of sitting during a sustained and mentally demanding computer task.

Methods:

Twenty asymptomatic young adults (nine females, 11 males being 23+/- 3 years of age) took part in the study. A computer task was designed to be mentally demanding. This task consisted of a sequence of cyclic computer operations including memorization, washout and replication. The task was performed for 40-min divided in 12 times 20 cycles separated by a 5-s. The intensity of mental fatigue before and after the task completion and the overall performance during the task (based on the number of correct and incorrect clicks) were assessed. A force and torque transducer mounted on an office chair was used to measure forces and movements. The displacement of the center of pressure (CoP) in anterior-posterior (AP) and medial-lateral (ML) directions was calculated. The average displacement (AVG), standard deviation (SD) and sample entropy (SaEn) values were extracted from the CoP signals in the AP and ML direction. Standard deviation and sample
entropy were respectively used to assess the size of variability and complexity of the sitting dynamics. \(P<0.05\) was considered as significant.

**Results:**

Mental fatigue ratings significantly increased from before to after the computer task \((P<0.001)\). The overall performance did not change significantly over the session. The direction of displacement of the CoP did not affect the AVG mean \((F=0.836, P=0.372)\) but resulted in larger SD and SaEn values in the AP compared with ML direction \((F=26.988, P<0.001\) and \(F=21.036, P<0.001\), respectively). Time did not play a significant role on any outcome measures. There was a tendency towards direction \(\times\) time for SD \((F=1.554, P=0.115)\).

**Conclusion:**

The present study showed that the designed computer task elicited mental fatigue among young asymptomatic adults. The overall performance level and the dynamics of sitting did not significantly change over time. On the contrary, the size of variability and the complexity of sitting dynamics depended on the direction of the CoP displacements. Larger size of variability and complexity of the CoP time series was found in the AP direction compared with the ML direction. This finding provides novel and important information for systems aiming at preventing discomfort due to long time sitting.
The OHSAS18001-standard is one of the most widely adopted management systems for occupational health and safety across the globe. First published in 1999 by British Standards, the standard is now adopted by a number of different types of organizations and workplaces globally. This paper researches how policymakers and stakeholders expect the standard to work within organizations. Furthermore we research what mechanisms are actually involved in successful implementation and management, and how the context of adopting organizations impinge on said mechanisms. In the paper we utilize a framework inspired by a realist methodology (Pawson & Tilley 1997; Wong et al. 2013) to review the international research on OHSAS18001 implementation, and synthesize the findings into useful knowledge for practitioners and fellow researchers alike. In this way, the paper presents an analysis that illuminates challenges and possibilities for organizations in the face of the new ISO45001 standard of occupational health and safety that is expected to be published in 2018, and that will supersede the OHSAS standard as the dominant international certificate (British Standard, 2017).

We start by analyzing the ‘program theories’ of the standard (Wong et al. 2013; Weissbrodt & Giauque 2017) that we identified in the standard and supplementary materials from key stakeholders. Thus we analyze how key stakeholders and policymakers expect the intervention or program to work when it is implemented in a real organizational setting.

Regarding the OHSAS18001-standard three distinct program theories can be discerned in the standard itself, as well as in accompanying materials and publications from key stakeholders. Each program theory has its own expected positive outcome for organizations. (1) An institutional program theory emphasizing increased legitimacy and thus an improved public image in the eyes of the public. (2) An ‘operational’ program theory that emphasizes operational gains to the safety management system of the organization, and finally (3) a ‘compliance’ program theory that emphasizes the standard as a way to streamline and comply with increasingly complex and, for organizations operating in multiple countries, diverging regulatory frameworks.

Furthermore, we compare these program theories to our review of studies of implementation (the actual mechanisms), and thereby the actual social mechanisms involved in making the standard work in various contexts. In doing so, our paper provides both in depth understanding and granularity in the literature on the use of certified management systems in occupational health and safety management.
Internet has evolved and changed the way any business operates, especially by changing the restaurant business process with online ordering and delivery application via mobile phone. Anyone can place an order simply through a mobile device, as opposed to call or to visit the restaurant. This has become an opportunity for any business restaurant to develop and improve their service, and eventually could sustain their position in today’s highly competitive environment.

McDonald’s is one of fast food restaurants in Indonesia that has its own online ordering application, named McDelivery which provides delivery services. The customers only need to tap the food of their choice, register their address, and choose the payment method from their smartphones. However in Indonesia, customer prefer to order the McDonald’s through “Go-Food” delivery service from “Gojek” application rather than McDelivery itself. The difference between both application is when customer orders from McDelivery, it will automatically connected to the nearest McDonald’s restaurant and the order will be processed by the company. While in Go-Food, a motorcycle driver will receive the customer’s orders, visit the chosen restaurant to place the order manually and deliver the foods to the customer’s place.

The purpose of this study is to examine and evaluate why Go-food has higher customer intention than the McDelivery, using the eye tracker through the Cognitive approach in terms of the interface of the application. This leads to the convenience of the use of the application, a main factor that affects the attitudes towards ordering food by internet from the previous study. The outputs from the eyetracker are the customer’s eyes intention by seeing the movement of the pupils and the heatmaps (customer’s eyesight area with the duration). This data can be processed as a base for user interface design preferences. Later on, the result from this paper can recommend the best design for every online ordering and delivery application to gain the maximum utility of the application.
Contemporary product and production development is typically carried out with support of computer tools where design of products and workstations are originated and evaluated within virtual environments. Ergonomics addresses factors important to consider in product and production development process to ensure a good fit between humans and items being designed, whether that is a product or a workstation. Digital human modelling (DHM) tools enable simulations and analyses of ergonomics in virtual environments which reduces the difficulties in achieving a proactive ergonomics assessment process. However, an improved process for how to utilise advanced DHM tools and methods needs to be identified.

The purpose of this paper is to study and evaluate possibilities and challenges for a more proactive ergonomics assessment process within train propulsion and control equipment manufacturing. The objective of the paper is to identify and describe product development activities where ergonomics issues could be considered and illustrate how that could be done through a number of different techniques and methods. The study was divided into two parts where an interview study was done to give an understanding of the specific product development process of the partner company. A goal was also to identify where in the product development process consideration of ergonomics issues are or could be done. The second part of the study included an observation and simulation study of current manufacturing operations to evaluate and compare different assessment techniques such as observational based ergonomics evaluation, usages of motion capture data and DHM simulation and evaluation.

The results shows that to reach proactive manufacturing ergonomics it is important to consider these issues in very early development phases where principal design decisions are made and when product data only exist in virtual formats. It is also important that the ergonomics assessment process is integrated in the overall product and production development process and that evaluations can be done both in simulation tools but also in the physical world with real subjects to verify and validate results from virtual simulations.

**Keywords:** Proactive, Ergonomics, Manufacturing, digital human modelling, Process
Advancing technologies and digital transformation continue to alter how work tasks and systems are designed, organized and operated. As the sophistication and feasibility of implementing highly automated and autonomous technologies increases, the way in which the human element interacts and contributes to achieve a system’s goals will continue to transform. Thus, the role of the human element, including their required training, competencies and work tasks, within complex socio-technical systems is constantly being redefined by technology. Maritime-related industries, such as shipping, offshore energy, commercial fishing, aquaculture and tourism operate in frequently harsh, isolated and dangerous environments. As such, they have developed as engineering and technology-rich domains, typically interested in applying new solutions that can enhance both the safety and efficiency of their operations. The aim of this research study is to explore the effects of highly automated and autonomous technologies in safety-critical domains, with a focus on maritime-related industries and applications. Ten Subject-Matter Experts consisting of academic researchers and industry professionals were interviewed to elicit their perspectives and predictions of autonomy and applications of autonomous systems. The academic researchers consisted of full professors (3), associate professor (1), and research scientist (1) from five post-secondary institutions in Europe and the United States with research interests in the areas of safety management, design, maritime technology and human factors. The industry professionals comprised of individuals working at simulator and professional training centers (2), a maritime equipment and technology manufacturer (1), a national transport agency (1), and a classification society (1). The industry participants represented five institutions, headquartered in four Northern European countries, with both domestic and global interests. Each participant was interviewed individually. The interviews followed a semi-structured question format which focused on three general areas: (i) the definition and concept of autonomy and autonomous systems, (ii) perceived challenges, and (iii) the role of humans in future training and work paradigms. The interviews were audio recorded and transcribed verbatim post-hoc. Three researchers independently reviewed the interview transcripts. Thematic Analysis was used to code and define common patterns and themes across the data. The results provide a comparison between academic and industry perspectives on autonomous systems and concepts of future work system organization. The increasing sophistication of highly automated and autonomous technologies applied in safety-critical domains demands research to better understand the potential applications and implications on current and future work organization of complex socio-technical systems. This study explores the potential effects of autonomous technologies on the future work organization and evolving roles of humans within maritime industries, contributing to the current body of knowledge from both theoretical and practical perspectives.
Emergencies involving people with special needs enforced the Italian National Fire fighters Corp to develop and modify the approach to the issue, adopting more inclusive operational procedures. For this reason specific training and standard operating procedures have been elaborated. In emergency scenarios in which fire fighters operate (e.g. fires, earthquakes, etc.), if on one hand it must be assured the protection of the people that have to be rescued, on the other hand, the rescuers should work in safe conditions to achieve that objective with greater reliability. The rescue of people with disabilities is held considering operating procedure that do not cause further damage to the person (e.g. excess of digital pressure or bedsores for peoples with mobility impairment on a wheelchair, etc.). With regard to the rescuer, unsuitable fireman's lift techniques could damage his musculoskeletal system. The contribution describes the operative procedures developed considering the ergonomics aspects used in the rescue.
Fire safety law in Italy was updated on August 2015 with the introduction of the Internal Ministry Decree 3/8/2015. The regulation provides mandatory recommendations and guidance to consider the requirements of people with disabilities since the stages of design and to heed the inclusion as a prerequisite of the edifice. Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Disability can be permanent or temporary.

The concepts of "Universal Design" and "Design for All" therefore can also be extended to fire protection design.

In the context of this new regulation, new and different means of access and egress consider the possibility to escape from a danger situation not only using stairs for egress, but also horizontal evacuation into another fire compartment at the same floor. These solutions are Known as “area of refuge” and "progressive horizontal evacuation".

Architectural solutions are synergically completed with other safety measures (e.g. fire alarm and detection systems, fire safety signs, escape lighting, etc.) to offer adequate performance to the needs of "all" the persons, including people with visual, mobility and cognitive impairments.

The contribution highlights some design solutions according to the Italian fire safety regulation, comparing them with the international ones, developed by each country using its own regulation.
Exploring packaging lid design preferences among Mexican university students

Type: Abstract Oral Presentation
Category: Manufacturing

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Product packaging and its ‘openability’ have been known for their troublesome relationship when it comes to user interaction. Lid designs and their production are being constantly driven by the market needs and the most profitable production methods, which can sometimes lead to poorly designed products since the priority relies on material reduction. Hence basic ergonomic principles are often sacrificed and sometimes this translates into the inability of twisting a lid.

Knowing the users’ preferences alongside adequate design methods, can lead to an optimal lid design that eases the task of twisting it while improving the users’ comfort and avoiding an overexertion. Therefore the aim of this research was the assessment of three redesigned lids among young Mexican university students. It must be highlighted that a user group that has not been profoundly studied.

To reach the objective, a test was performed with three 3D printed lids that were redesigned based on valuable features regarding the overall shape, texture and dimensions as found on previous studies. The lids’ most different characteristic amongst each other was the overall shape. Eighteen female university students participated in this test, which consisted of opening a bottle using the three redesigned lids while placing their hand according to the user’s most comfortable position. Four evaluation methods were used, the Borg CR-10 scale, two satisfaction questionnaires and an evaluators’ assessment through direct observation. These evaluations were used to measure the perceived exertion, the user’s satisfaction, the comfort and perceived effort, and the grip used in the test, respectively. The results from the evaluation were later analyzed and interpreted in terms of repetition of each test’s variables.

Among the most relevant results is the enhanced grip using hexagonal lids with rounded corners and clearly marked concave sides to place the fingers along the lid’s wall. Overall, the results in this study provide valuable ideas to designers in order to create lids that are able to satisfy the needs and preferences of people with characteristics similar to those of the participants in this research.
EVALUATION OF REPETITIVE LIFTING TASKS PERFORMED IN CONCRETE BLOCK AND BRICK FACTORIES IN PAKISTAN

Type: Abstract Oral Presentation
Category: Manufacturing
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Repetitive manual lifting and lowering tasks exposes workers to a high-risk musculoskeletal disorder. This paper aims at assessment of the postures of workers during the piling up process of a Bricks and Concrete Blocks (B&CB) at B&CB manufacturing factories in Pakistan and to study the effect of different risk factors such as contact force, stresses, and repetition of jobs that put muscles under redundant physical forces, which causes musculoskeletal disorders. The lifting indices were calculated for the piling of B&CB using the NOISH equation. For this purpose, the anthropometric data from 103 workers, working in 33 different factories, was collected. The postures were simulated and analysed, using a human modelling solution HumanCAD software, with an objective to minimize the risk of work-related injuries, and stresses on the different parts of body was calculated. The results showed that in current work environment, the risk of injuries especially in lower back are very high due to its exposure to high stresses followed by thorax pain and neck pain. Therefore, re-design the lifting methods of B&C factories are essential in order to reduce the work-related injuries.

Keywords: musculoskeletal disorders; lifting task; lower back pain; muscle stresses; digital human modelling
Negotiation is the most advanced co-ordination mechanism able to strengthen relationship between the parties involved and inhibit the rise of conflict. In particular, virtual negotiations are becoming increasingly important as most of current interactions take place online or via computer-mediated communication (CMC).

The present study aims to analyze the role of empathic and emotional skills in virtual bargaining. For this purpose, 320 people aged between 19 to 25 were involved in a simulated virtual negotiation through a specifically created software. Subjects who took part in the experiment were faced with a written description of a scenario. Each subject interacted with one scenario. Scenarios could be related to either a monetary or non-monetary bargaining negotiation and proposed a bid for the presented asset, framing it in a positive or negative state of mind. As a consequence to the offer made by the subject, the software provided a counter-offer based on the sum proposed by the subject but always unfavorable to the latter. People expressed their opinion on the response received concluding the negotiation.

Subjects were also given a Basic Empathy Scale (BES) questionnaire. The various factors involved were analyzed, in particular: a) the relationship between the level of empathy of the participants and the bid they proposed in the trading simulation; b) the relationship between their level of satisfaction with the response received from the software; c) the level on which they perceived the opponent as real.

The results show that empathic abilities have not had a significant influence on the context created by the experimental situation.

In general, subjects showed similar behavior in all scenarios. Unlike the literature, there was no difference between the behavior of male and female people. However, it has been noted that the participants have been more willing to accept the proposed sum when they were bargaining with a friend.

There was a different propensity to maximize earnings depending on whether it was required to minimize losses or maximize profit. This result confirms the principle of loss aversion exposed by Tversky and Kahneman: decision makers usually tend to avoid risk when they see a gain perspective, while they are more likely to accept the risk if prospects involve a loss.

It has been observed that the emotions experienced during the negotiation are in relation with this factor: those who experienced ‘happiness’ had the impression of bargaining with a real person, while those who experienced ‘disinterest’ were aware of having to do with a simple software. It is appropriate to further explore this aspect of the research to understand what elements may have affected the perception of the adversary's reality.
How and why a care coordinator is needed for care coordination: analysis of the French PAERPA initiative

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction.

Care Coordination (CC) is widely promoted as a mean of ensuring continuity of care, improving patient outcomes, reducing adverse drugs reactions, and achieving efficient management of resources (Iliffe et al, 2011). One major issue is to determine if this coordination should be assumed by a Human, or if a computerized system could efficiently support the interrelated needs of the actors involved in a CC.

The current research addressed this question in the context of the French national PAERPA initiative. The role of a care coordinator was analyzed within a GP-centered CC initiative implemented to support continuity of care for older patients after hospital discharge, with a special focus on drugs management. The purpose of the research was to study the conditions of sustainability of this initiative.

In this situation, CC was supported by cooperative activities that were distributed in terms of space, time, and actors. The actors were coordinated around a patient for a specific care pathway over a given period. Therefore, the “team” involved in CC was different for each patient, according to his/her needs and his/her dwelling place. This kind of cooperation requires two distinct processes (Falzon, 1994) to be efficient: (i) an operative synchronization leading to the coordination in the distributed environment, and (ii) a cognitive synchronization to integrate the different points of view and to share both general knowledge and specific knowledge about the current situation.

Methods.

A qualitative data set was collected including interviews with the care coordinator, healthcare professionals and social professionals, observations mainly focused on the care coordinator, and project documents. Unified Modeling Language was used to represent the CC process.
Results.

For each step of the CC process, the actors involved, their tasks, their interactions with the others, and the tools they used were identified. The gaps between the CC as initially planned in project documents and the actual CC process were highlighted. The care coordinator ensured the smooth running of the process through collection and transmission of information and the mobilization of the right persons at the right time. The results showed that the care coordinator was also essential to support motivation of healthcare professionals and was the only person of the PAERPA initiative that each actor meet in person, which was appreciated a lot.

Discussion/Conclusion.

This study shows that operative and cognitive synchronization is mandatory in CC and could be supplied in part by a computerized system. However, such system could never (i) facilitate the activities of each one according to the constraints of others, (ii) efficiently support motivation of the professionals, and (iii) personify the ephemeral collective set up around a given patient, highlighted as a key factor of success for the involvement of professionals.
Ergonomics and acoustics in music education


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Introduction

In music education, teachers and students often complain about acoustical discomfort. The facilities dedicated to study and musical training play an important role in risk assessment and have to respect standards on architectural acoustics. In particular, bad sound insulation of the classrooms, sound level emitted by musical and/or vocal instruments, high level of background noise and an unsuitable reverberation time, can compromise learning and performances and could cause pathologies (especially to auditory system and vocal apparatus) due to excessive noise levels and acoustical discomfort.

The present work aims to estimate the potential risk for music teachers and students in an Italian music school, identifying critical issues by collecting objective and subjective information.

Material and methods

Measurement campaigns (background noise analyzed according to psychoacoustic parameters and sound quality metrics), medical evaluations (voice analysis in relation to posture, audiological examination and audiometric evaluation), questionnaires (among the questions: lesson duration, average number of students, non-working factors, assessment of noise exposure, etc) have been performed to identify critical issues related to ergonomic discomfort.

Results

129 workers were examined and 81% were in a low acoustic risk class ($L_{EX,8h} \leq 80\, dB(A)$), 15% in a medium acoustic risk class ($80 < L_{EX,8h} \leq 85\, dB(A)$), 4% in a high acoustic risk class ($85 < L_{EX,8h} \leq 87\, dB(A)$). The measurement campaign has detected that insulation values and reverberation times were often not adequate for the purpose of the classrooms.
Moreover, from the questionnaires, a high discomfort was found both among teachers and students (respectively 60% and 33% of the interviewed people). The analysis of the singers' voices in relation to the posture has allowed to identify possible solutions to remedy the pathologies related to the relationship between vocal effort and posture.

Conclusion
The results show that effective prevention can be achieved through adequate training and information to teaching staff and students, with the aim of raising awareness of potential hearing problems, extra-auditory effects and vocal tract diseases. Proper posture and a targeted acoustic restructuring of classrooms could improve comfort and performance of musician. Only an integrated approach would bring significant benefits to users, as well as optimize the costs of acoustic interventions.
Co-conception spaces: new organizations to support participatory projects

Type: Abstract Oral Presentation
Category: Others

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In recent years we have seen the development of technologies to support the design process that has increasingly facilitated user collaboration on projects. Features such as additive manufacture, virtual reality immersion, three-dimensional scanning and electronic prototyping have enabled to represent (physically and virtually) different design aspects that facilitate interaction between designers and users. These new features have made it easier to bring users closer to the design process and understand the consequences technical choices for users’ lives. Something that has enriched different design review formats of information about reality. The interest in these new technological resources have lead to the creation of new organizations to support the project, such as Fablabs, living labs, space makers and other types called here as co-design spaces.

These resources begin to open new possibilities for thinking about the project organization itself. Rather than using these technologies as a means of validating design proposals, they can enable a better user integration since the beginning of the project. In this way, these technological resources for design materialization and virtual reality open possibilities for consecutive cycles of learning that would allow a continuous better understanding of design problems and its objectives. It is a resource that can help to break a linear and Taylorist orientation of how to act in a project, to a non-teleological model that values learning and its incorporation into solutions.

This work aims to launch a first look at whether these technological resources have transformed the design practice within these new organizations that aim to support the design process. For this, a multiple case study (Yin, 2005) is carried out to compare different projects carried out in these spaces to evaluate how these resources are used. The analyzers used in this research are (1) the different spaces of “dialogue with the situation” (Schon, 1983) created with these technologies; (2) the different intermediary objects (Vinck, 2009) mobilized and the different actors involved in the creation and use of these models; (3) while frontier objects (Star, 1989), the types of information shared and built with the support of these objects and incorporated into the design. This study allows a first look at how these technologies have transformed project design and project design practices, or if their use still limited to enable prototypes more quickly to validate models built by designers.
An exploratory study of the issues of a professionalization to the industrial safety in a large French railway company

Type: Abstract Oral Presentation
Category: Transport

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I. Context

This thesis, conducted in the framework of an industrial partnership (SNCF, FONCSI, Paris Descartes University, CNRS), is part of a global project to renew the safety culture in a French railway company. It has as its main topic the evaluation of formal and informal plans of professionalization to the safety culture (IAEA, 1991). It falls within a business trend that intends to develop an "integrated safety" culture (Johanson et al., 2016). The research question is: how do we assess the formal and informal safety professionalization plans and ensure that they contribute as a matter of fact to the support of this safety culture?

This communication stands as an account of the first exploratory study, which aims to identify the leverages and impediments of a professionalization to an integrated safety culture in the light of the current organization of work and training.

II. Method

The methodology consists in carrying out two types of analysis: a documentary analysis conducted on internal documents (safety repositories; benchmark jobs) aimed at: a) identifying the trades by essence of "safety culture" and others; b) identify the safety model(s) carried by these internal documents (Dekker, 2003; Amalberti, 2013).

A thematic analysis of twenty-four semi-structured interviews (Fylan, 2005) conducted with actors of professionalization in the enterprise (safety, training, or organizational and human factors) aimed at: a) educate the expectation of actors of professionalization within the three institutions of the enterprise (implicit aspects of work, differences-similarities, understand their determinants); b) identify, from the actors perspectives, situations of formal and informal professionalization to safety in occupational and training.

The data processed for these two analyses will be both qualitative and quantitative.

III. First results

The first results of the documentary analysis show that internal documents have a rule-based safety approach, and that 10 out of trades are considered "pure safety".
Dealing with the interviews, the first results reveal: 1) A will to change the evaluation method of training and its effects in work situations; 2) the lack between the training courses and the actual work; 3) the combination of formal and informal situations in very complex way in training (i.e. practical exercises) and in the work (i.e. ascent of the agents).

This part will be developed in the final version of the paper.

IV. Conclusion

These first results show that the actors encountered demonstrate a desire to change and the various situations of formal and informal professionalization. They highlight the paramount importance of evaluation as a matter of fact to the safety culture.
Vehicle manufacturers are racing to get highly automated vehicles to market, but the success of these vehicles is greatly dependent on user acceptance. Trust has been identified as a major factor increasing the likelihood of user acceptance (Extended TAM, Ghazizadeh et al. 2012). Furthermore, the driver’s trust in the vehicle can be affected by using anthropomorphism - human likeness – as an interface design strategy. Studies appear to agree on a positive correlation between anthropomorphism and trust (Waytz et al. 2014, Kraus et al. 2016), however, only based on simulator studies. As trust is likely to be affected by the driving context, further research is needed to understand the effects of anthropomorphism in a real-world context. Thus, the aim of this study was to investigate how trust in automated vehicles is influenced by anthropomorphist interface designs in a moving vehicle on road.

Three interface designs were developed; human, caricatured, and non-anthropomorphic (cf. Zhang et al. 2008). The anthropomorphised features were used to communicate the intentions and actions of the vehicle, and were complemented by a visualisation of the vehicle’s awareness of its surroundings. The interfaces were evaluated in an in-vehicle user test, using a Wizard-of-Oz set-up on a test track, with a 10 participant within-subject design. Data was collected through questionnaires for each condition and a summarising interview.

The results showed no significant difference in levels of trust related to the interface, even though when internally ranked, the caricatured interface was ranked the least trustworthy and the least liked. Interviews indicate that its toy-like appearance was deemed inappropriate in a car-context and its voice annoying, both indicating low quality.

While participants did perceive a difference in the level of anthropomorphism, they rated the concepts similarly in aspects such as perceived competence of vehicle, usability and level of control, as that depended on the content delivered through the interface rather than its embodiment. Instead, the way in which the car manoeuvred and handled obstacles was a major carrier of trust. The anthropomorphic features however affected the participants’ acceptance of the vehicle in other ways, through the perceived ease of use and perceived usefulness of the interfaces. The human face was for example seen to draw attention, which was positive as it gave a focal point, but negative as it distracted from other aspects and was perceived to stare unpleasantly. The interfaces suitability in different contexts and in-vehicle states was also frequently discussed.

The main implications are that interface designers must be cautious when using anthropomorphism as a design tool, potentially giving the vehicle an identity rather than features, as well as consider adaptability and customisability to diverse user needs associated with different contexts in which highly automated vehicles will be used.
Work-Related Musculoskeletal Disorders (WMSDs) are one of the most common work-related health problems affecting millions of European workers across all employment sectors with a cost of billions of Euros to European employers and society as a whole. In fact, forty-five percent of European workers report working in painful or tiring positions, thirty-three percent are required to handle heavy loads in their work. As for Italy, there was an increase of reports of these diseases of about 100% from 2012 to 2016 in the agriculture sector, and more than 600% in the period 2007-2011. The main risk factors for MSDs in dairy farming are the repetitiveness of the operations, loads weight during the attaching phase (e.g. milking cluster), awkward posture in order to perform specific subtasks and muscular effort during attaching and stripping phases. Collecting quantitative data about these risk factors is a very difficult task, due to the characteristics of the workstations, the environmental variables and the instability of the working conditions, therefore also implementing good solutions is not easy. Literature data suggest that demonstrated, among others, wrists represents one of the district more stressed by these risk factors. Nevertheless, since the complexity of scenario and the need of original quantitative data, an ergonomic study with more sophisticated and accurate tools are desirable.

The present study is part of a bigger study conducted by our research group, focused on the definition of risk profiles of biomechanics overload of upper limbs in cow milkers, specifically addressed at testing the suitability of the software “Captiv” (Captiv developed by INRS and TEA) for this purpose. The objective of this pilot study aims were: 1) to define the milking subtasks with higher exposure to MSDs’ risk factors through the use of the Captive; 2) define a proof of principle of Approach for the collection of quantitative data in the field. This study has been conducted on a sample of 3 workers from two different herringbone and a rotary milking parlors. The dominant hand (2 right hand and a left hand) of the workers were equipped by a goniometer during the first hours of the milking activity. Four subtasks were observed: pre dipping, wiping/stripping, attaching, post dipping. During the activity each worker was followed by a camera synchronized with Captiv Software. The results show that the milking operation that requires the workers to perform their job in awkward posture are stripping, wiping, and attaching phases. The software Captiv results to be a valuable ergonomic tool to be used in the field and it also allows getting accurate data to be used for risk assessment in order to implement preventive solutions.
Crane incidents occur in the ports of South Africa and around the world in the maritime industry. This is mostly due to the dangerous nature of the ship-to-shore operations which include the loading and offloading of shipping containers to and from vessels. Crane operators’ and crane supervisors’ accounts of such events are used in investigations. Therefore the parties are required to search for a causal explanation for why incidents happen. The aim of this research paper is to understand and compare crane operators’ and supervisors’ perceptions of why incidents happen. The accuracy of the findings from the incident investigation is important because they inform the remedial actions that must be taken to address the cause(s) of the incident. This may be an employee, the organisation, or a systemic issue. According to Heider’s (1958) theory of attribution, the two different types of explanations for an incident are an internal type which focuses on personal explanations and an external type that focuses on situational or contextual explanations for events. Attribution theory research has shown that the hierarchical level in the organisation has an effect on individuals’ attributions concerning workplace incidents. Supervisors have been inclined to use internal explanations that place the blame on the subordinate in question, therefore deferring their accountability (Gyekye, 2010).

A qualitative approach was used in this research study which included semi-structured interviews with eight crane operators and eight crane supervisors at a port in South Africa. Thematic content analysis was conducted on the interview data to identify the emerging themes between the two groups utilising a systems thinking approach (Wilson, 2012). The results were displayed on an Accimap.

The results support Gyekye (2010) with supervisors being more inclined to attribute crane incidents to internal factors of the crane operators while the crane operators are more inclined to attribute crane incidents to external, systemic factors. Both groups identified external factors such as mechanical and maintenance issues, weather conditions, communication, training and skills, and safety culture as factors contributing towards crane incidents. The supervisors identified personal factors relating to crane operators such as a lack of concentration, fatigue, skills and eye sight as causal factors of crane incidents. Conversely, crane operators mostly felt that these factors were insignificant in causing any incidents. The Accimap graphically illustrates the complexity and interactions of the causal factors of crane incidents. The perceptual differences between crane operators and crane supervisors may contribute to inaccurate reporting of the causes of crane incidents and the corrective measures taken to resolve the issues. A learning culture and a just culture needs to be established in the port to truly understand why incidents happen.
NURSING HOME MANAGER ROLE IN MANAGING AGING WORKERS: A QUALITATIVE RESEARCH IN NURSING HOMES

Type: Abstract Oral Presentation
Category: Healthcare

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Today in Italy, as in many other countries, nursing home manager (NHM) has a great challenge: managing an aging staff with respect of an increasing clinical complex blend of residents’ condition, ensuring higher level of quality assistance and enforcing health and safety regulations.

Aim of this research was to analyze NHM awareness of professional role in managing aging workers in order to think up solutions to improve working condition and quality of assistance.

On the basis of preliminary literature search, an ethnographic quality approach and a purposive sampling or a network sampling were applied. This study was based on a retrospective data collection. A registered nurse with experience in residential aged care facilities carried out semistructured interviews and collected administrative data.

Data extraction and synthesis of the findings were codified for each specific topic and knowledge aims. A comprehensive description was made and results were discussed with an expert occupational physician.

There are 8 nursing homes in Val Trompia area. These facilities provide care services and assisted living to 651 older people residing in it. There are 401 employees, mean age is 45 and mean length of employment in each facilities is 11 years; 27% of employees are fit to work with restrictions.

Key points emerging are: a) NHM were usually involved in individual job task description, but their awareness of responsibilities in health and safety management of nursing staff was not clear; b) NHM were not usually consulted by occupational physician (OP); c) work modifications indicated by OP were considered by NHM often generic and not contextualized (31%); d) organization consequences of work restrictions were not shared among OP, Chief of staff and NHM; e) where work restrictions were preceded by OP’s case discussion with relevant parties there was a better management of nursing staff (6%).

Data on aging nursing staff and their work restrictions in Val Trompia area are consistent with emerging data from literature; on the basis of our results, main suggestions to improve management will include: new approaches for nursing staff risk assessment, better definition of NHM role and duty, specific pathways of learning for NHM and for registered nurses, involvement of registered nurses in nursing assistants’ management,
OP case discussion with relevant parties, improving in scientific documentation for fitness to work process, implementation of procedure for work restriction management.
Exploring flicker perception in the far periphery for warnings and notifications

Type: Abstract Oral Presentation

Category: No productive sector applicable

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Visual perception is one of the most important means of absorbing information from the environment. In critical or dynamically changing situations, it is important not to obstruct a user’s central field of view. In this work we are exploiting the peripheral field of view to provide warnings and notifications without hindering the central vision. In particular we are exploring the option of attaching LED panels to the sides of safety glasses, so that they are in the far periphery in order to provide important visual notifications. Another option is to attach them to Augmented Reality (AR) glasses with a limited field of view thereby augmenting the display and adding more information.

The detection of movement and light works remarkably well in the human peripheral visual field. Especially under low lighting conditions, the periphery is more capable of detecting light variations than the central field of view. Therefore, flickering or moving light signals can be employed to indicate dangers in the environment. Additionally by presenting flickering light signals on the left or on the right side, the user can be given cues to redirect attention intuitively in the respective direction.

An experiment was conducted to determine the optimum angle in the far periphery or slightly outside the periphery where the LED panels should be mounted. The aim was also to find the farthest angle where there is still sufficient perception of flicker. The wider the angle with acceptable flicker perception, the better since the LED panels will be less obtrusive. In the experimental setup, LED matrices were presented to the participants at the edge of the visual field. We investigated four different angles (90°, 100°, 110°, 120°) measured from a fixed point right above the nose bridge. The flicker signal was offered in three different frequencies (10Hz, 30Hz, 50 Hz) alternating randomly between left, right and both sides. To direct the user’s focus to a task in the central field of view, the Letter Memory Task was administered throughout the experiment. Since the experiments are ongoing, the results are pending at this point.
Background. In ergonomics, a variety of observational methods are available for assessing postures, movements and external loads. The observer is required to make judgments under uncertainty in a cognitive process comprising three stages: encoding (apprehending what is to be evaluated in the observed situation), retention (maintaining information in memory), and response (delivering a judgment of the situation according to specified criteria). Cognitive demands differ widely between observational methods, and even depend on the context of the observation. Larger cognitive demands lead to larger uncertainty in judgment, and thus likely to larger variability in ratings between and within observers. This, in turn, reduces methodologic efficiency, since more data are then needed to reach a trustworthy result. The present paper presents a model for categorizing observational methods according to cognitive demands, as a basis for developing methods in ergonomics that optimize the use of human cognitive capacity.

Model. We propose a model with two axes: stimulus and response difficulty. Stimulus difficulty refer to factors influencing encoding, while response difficulty addresses retention and response. Stimulus difficulty is mainly determined by visibility, locus of attention, and certainty at target encoding. Visibility may be low if a worker is only partly visible in a dark compartment, and large as when observing a worker in full daylight. Locus of attention may be compromised if a posture to be observed on-site occurs only rarely in a busy environment, while it is facilitated by observing from a video snapshot off-line on the computer. Certainty at encoding can be low if an observed posture is close to a preset threshold value, such as when deciding whether an arm elevated to 58° is above 60°, and high if the arm is instead pointing at 15°.Response difficulty depends on judgment criterion, attention and memory demands, and access to support tools. A judgment criterion may be highly subjective, such as rating whether a task is “repetitive”; or almost objective, as when estimating an angle. Memory demands are higher when the observer is required to remember and summarize postures for several minutes of work than when rating a snapshot. In some methods, the observer gets no support in rating, while others offer visual aids, such as illustrations of awkward postures. Both stimulus and response difficulty is likely modified by the observer’s personal characteristics, including previous experience, working memory capacity, and visuo-spatial ability.

Conclusion. We hypothesize that observer variability increases with cognitive demands in a relationship modified by the capabilities of the observer. We therefore argue that a better understanding of the determinants of stimulus and response difficulty, and of the relationships between difficulty and observer variability would open for an informed development of efficient observation methods associated with minimized observer variability.
[277] Regulations performed by workers and insufficiency of prescribed rules and in real situations

Type: Abstract Oral Presentation
Category: Manufacturing

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Introduction
There are two logics present in quite distinct ways within any industrial organization: the normative approach – more concerned with the indicators of productivity – and the operational logic – that seeks to find ways of maintaining the productive process in works in the face of variabilities not predicted at work (Falzon, 2015). It is up to workers to develop strategies to deal with this uncertain routine. In this sense, the purpose of this article is to make visible the Mounting/Dismantling regulations adopted by workers in order to think about future improvements in working conditions. To illustrate this reflection, was studied a company of electrical and mechanical maintenance of motors, located in the city of Itabira (Brazil), with the aim of showing the regulations proposed by the workers, in the real work situation.

Methodology
In order to know and understand the regulations and strategies adopted by workers, an Ergonomic Work Analysis (Guérin et al., 2006) was carried out. It lasted four months, with weekly visits to the company, each of them lasting approximately 4 hours, was carried out a documentary analysis, interviews with workers and observations of the mechanics activity.

Results
We can classify the regulations found in three large groups:
Strategies aimed at the efficiency of the productive process, like ordination of engines (a mechanic, when organizing the day maintenance plan, places all the motors that will need to go through the bridge in sequence) or tools sharing (combination of mechanics to share the missing tools in the toolbox).
Strategy created for health preservation, like lifting of engines in pairs (the workers choose, whenever possible, to transport in pairs the equipment because it is more practical and fast) and position heavier motors on the nearest shelves (avoiding the loading of loads over long distances).
Strategy created for system safety, like placed heavier motors in the lower part of the shelves (to avoid ruptures and instability in the shelf structure) and division of tasks based on knowledge and experience (the more experienced perform more complex and skillful tasks, while beginners are left with tasks that require less specific knowledge; this is a way to make the system more secure).

Conclusion
The present study demonstrates that only norms and rules may not be able to cover all the situations that make up the daily life of the labor field, and this enabled the demonstration of the importance and necessity of the use of regulations as a way of filling the existing gaps. By regulating, operators seek not only to maintain production, but also to protect their health and the safety of the system.
The current communication is part of the results of the PhD thesis in Ergonomics related to the operators of a center of coordination and control of forest fires in Chile (Maureira, 2015). The particularity of this focus is that the management of forest fires constitutes a complex and risky dynamic environment, which paradoxically is handled by a temporary team, due to budgetary constraints. Thus, all the operators must leave their job at the end of the season. Consequently, the concrete problem for field work is the loss of the human capital, the experienced knowledge and the organizational know-how. This condition is identified as a clear weakness for the system and implies an important investment every year both in training and guiding the new heterogeneous team.

Based on the theories of situated action (Suchman, 1997), distributed cognition (Decortis & Pavard, 1994) and distributed social cognition (Hutchins, 1995) the researcher observed work for an extended period (six months) and collected data during the initial training process and throughout the peak season, in the operational setting. Data collection was supported by audio and video recordings in order to analyse both the actions and the content of the trainer’s interventions and the spontaneous verbal exchanges among members of the centre (5 experienced operators, 3 trainee operators). Systematic observations were supplemented with individual interviews with each member of the team.

As a result, according to the situational analysis of the activity in progress, several sociotechnical strategies were conducted and dynamically adapted by the manager during the formal training process at the beginning of the forest-fire season as well as during the season. As a result, it was observed an active participation of team members, self-organization, and mutual support not only in order to fulfill the task, but also in order to exploit opportunities for learning from experience. Those results aim to identify the role of management style that enhances both individual and collective learning engagement as well as the collective functional configuration, oriented to self-regulation, a key aspect mentioned by De la Garza & Weill-Fassina (2000). But also this leadership allows the construction of the working collective (team building) proposed by Caroly & Clot (2004). The dynamic leadership style identified from the beginning was: team member’s roles distribution and accurate contextualized operational collective rules emphasizing self-organization, surveillance and mutual assistance, active participation, self-analyses and mutual skill knowledge of the teammates. This leadership style confirms what Tyssen, Wald and Spieth (2013) have established, in the sense that for temporary work environments, is more effective a combination of leadership approaches. It also gives empirical evidence suitable for complex and dynamic risk environments, conducted by temporary team workers than need to learn under severe temporal pressure.
Phishing is a social engineering tactic where a malicious actor impersonates a trustworthy third party with the intention of tricking the computer user into divulging sensitive information. There are various strategies that can be employed to persuade a target to divulge this sensitive information. Cialdini identified six broad persuasion principles (Cialdini, 1987). Four of these are much more common among phishing emails than the other two (Zielinska et al., 2016); therefore, we will focus on these. These four principles and brief descriptions are provided below:

- Commitment/consistency: the concept of completing an action you previously initiated.
- Liking: trust due to a prior interaction or familiarity, such as for a largely recognizable brand.
- Authority: an authority figure mandating an action, with consequences for failing to comply
- Scarcity: a short and specific time frame to complete an action. (Cialdini, 1987).

Previous work has also demonstrated that the personality profile of the victim plays a role in the likelihood of being phished (Welk et al., 2015).

Method

This study was conducted to investigate whether there is an interaction between specific message content (i.e., what persuasion principle is used) and the personality characteristics of the user within the realm of email phishing. One hundred two participants completed a personality inventory and an email identification task where they had to make a judgement discriminating between phishing and legitimate messages.

Results

To assess the interaction of the various personality traits with the persuasion principle utilized, multiple linear regressions were conducted. The predictor variables entered into the model were impulse control, trust, neuroticism, extroversion, openness, agreeableness, and conscientiousness (i.e. all seven of the personality measures).

Inputting all of the listed predictor variables, a significant model was found for phishing accuracy $F(7,101)=3.37, p=.003, R^2=.20$. High extroversion was a significant predictor of decreased phishing accuracy ($b=-.33, p=.007$).

Next, a series of regressions were conducted with each of the nine individual persuasion principles (or combinations of principles) as the outcome variable, using the same predictor variables as above (i.e. all seven personality measures). Nine separate linear
regressions were thus conducted, one for each persuasion principle (or combination of principles) identified within phishing emails.

Extroversion was associated with decreased detection of phishing attacks utilizing: authority & commitment/consistency persuasion ($b = -.31$, $p = .015$), authority & liking persuasion ($b = -.29$, $p = .021$), commitment/consistency persuasion ($b = -.30$, $p = .017$), and liking persuasion ($b = -.28$, $p = .024$). Conscientiousness was found to be associated with increased detection of phishing attacks utilizing super persuasion ($b = -.24$, $p = .031$).

**Discussion**

In conclusion, this work confirms that there are interaction effects between the personality of the victim and the persuasion principle utilized in the context of phishing attacks.
Automation is becoming more common in daily life (Parasuraman & Riley, 1997), and naturally we find ourselves having to make decisions regarding input received from automation alongside other humans. One type of automation where trust and reliance are particularly intertwined is within the context of an automated decision support system (DSS): this automation type assists a human decision maker by organizing information and providing a recommendation on the best course of action (Sage, 1987).

One of the few recent dual adviser context studies was conducted by Lyons and Stokes (2012), where they investigated perceived risk and reliance between conflicting information of human and automated advisers. They found that higher risk decreased reliance on the human DSS, which was unrelated to trust. A partial replication by Pearson, et al. (2016) found different results. Both of these studies are limited by the uncontrolled third variable of pedigree, where the human was a high-ranking military official and the automated DSS was not distinguished in either direction.

METHOD

This study involved two differing decision aid sources (human adviser and automated adviser) and pedigrees (high and low perceived expertise) that give information in conflict with each other. Participants were tasked with choosing the safest route for a military convoy. Participants (N=200) were recruited via Amazon Mechanical Turk.

Participants interacted with a map that included past insurgent activity and past improvised explosive device locations. Four text-based profiles (automation-high pedigree, automation-low pedigree, human-high pedigree, and human-low pedigree) were used to prime the participants with the level of pedigree involved with each advisor, modeled after Madhavan and Wiegmann (2007).

RESULTS

A multiple regression analysis was conducted to discover if automation pedigree perceptions and human pedigree perceptions, along with an interaction term, predicted adviser trust preferences (see table 1). The model was found to be significant, $F(3,196) = 39.16, p < .001$. The three predictors explained 36% of the variance ($R^2 = .36$). It was found that higher automation pedigree perceptions predicted a trust preference in the automated adviser ($\beta = -.38, p = .004$) and higher human pedigree perceptions predicted a trust preference in the human adviser ($\beta = .53, p = .001$). The interaction term did not significantly predict adviser trust preferences ($\beta = -.09, p = .68$).
Table 1.

Multiple regression model with automated adviser and human adviser perceptions predicting trust preference

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated pedigree</td>
<td>-.45</td>
<td>.16</td>
<td>-.38*</td>
</tr>
<tr>
<td>perception</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human pedigree perception</td>
<td>.55</td>
<td>.16</td>
<td>.53*</td>
</tr>
<tr>
<td>Interaction term</td>
<td>-.02</td>
<td>.05</td>
<td>-.09</td>
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</tbody>
</table>

Note: * p < .001

**DISCUSSION**

Higher levels of automated adviser pedigree perception predicted trust preference towards the automated adviser. Higher levels of human adviser pedigree perception predicted trust preference towards the human adviser. Trust preference scores did not vary by the interaction of adviser source type and pedigree perception levels.
For those between the ages of 15 and 24, road accidents represent the leading cause of death worldwide (WHO, 2015); across all ages, it is the tenth leading cause (ibid.). Even across England and Wales, home to one of the safest road networks in the world, it is still the 12th leading cause of death (ONS, 2017). In 2016 the UK saw 181,384 road incidents involving injury reported to the police. Of these, 24,101 resulted in serious injury, and 1,794 in loss of life (DfT, 2017). Although accident rates are far lower today that they were thirty years ago, the UK has seen little change in fatality numbers since 2010 (DfT, 2017), leading to suggestions that road safety efforts have plateaued in their effectiveness. We propose that part of the reason for this plateauing is that too much focus is still being put on the driver and their immediate surroundings, and that not enough attention is being paid to organisational factors, and the relationships across actors within the road transport system.

We build on Parnell et al.’s (2017) extended version of Rasmussen’s (1997) Risk Management Framework, and the Accimap method (e.g. Svedung & Rasmussen, 2002), and provide a visual indication of the UK road transport system in its entirety, from the vegetation lining the roads, to the international organisations affecting high-level political decisions. The analysis effort began with an extensive document review, covering a variety of sources from charity to governmental organisations, through to academia and industry outputs. The resultant models were then supplemented and improved via engagement with a number of subject matter experts of varying backgrounds, including emergency medical response, public health, and road policing operations.

In the paper, we put forward a seven ‘E’s perspective of road safety, expanding the traditional three ‘E’s (i.e., education, engineering, and enforcement) with an additional four; economics, emergency response, enablement, and ergonomics. We use these perspectives to introduce colour-coding to the Actor Map, assigning each actor identified in the analysis to one or more of the road safety perspectives. This gives an indication of the sheer complexity of the system. A comprehensive, generic system Accimap was also developed that articulates over 240 functions associated with the system actors, each of which could be associated with a wide variety of potential errors or failures. Building on this, we reiterate the idea of responsibility for failures being shared across levels of, and actors within the system; only by having the concept of shared responsibility in mind can we work towards solutions that will truly address the road safety challenge facing the world today.
Financial Impact and Causes of Chronic MSD cases in Malaysia based on SOCSO claims record

Type: Abstract Oral Presentation
Category: No productive sector applicable

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The objectives of this study are to determine the total direct costs incurred as a result of cases of chronic musculoskeletal injuries that was approved by the Social Security Organization of Malaysia (SOCSO) from 2009-2014; to identify the total direct cost for the types of industry, causes of injury, types of injury and types of body part; to assess the levels of Knowledge, Attitudes and Practices about MSDs among the employer and to find the association of Knowledge, Attitude, Practices (KAP) with demographic profile and KAP variables. This study adopted top down approached from SOCSO database on permanent disability, paid cases and completed cases on the occupational disease for the period 2009 until 2014. The total direct cost on types of industries, types of injury, causes of accident and type of body parts is collected for the 416 claims. 270 questionnaires are distributed to the employer in order to know the KAP and 45 were responded. The data is analysed by using descriptive data and inferential statistic. Manufacturing industry, strenuous movement, sprain and strain and back are recorded as highest total direct cost with the cost of MYR 5,181,282.34, MYR 7,088,839.51, MYR 8,753,975.13, and MYR 5,526,590.69 respectively. The age group of 35-44 years old is recorded as the highest total average cost. The knowledge shows strong correlation with the experiences work in safety field and practices has the significant with level of education. While, only attitude shows the correlation with practices. MSDs cases are increasing hence thorough research is needed in order to understand the underlying of cost claims. For the KAP factors are crucial, therefore it is need to increase the number of the sample size. This study will provide the basis for future studies and intervention on MSD related injuries in working environment in Malaysia.
During the last two decades Quality of Work Life (QWL) has gained attention of the research community, for it is “becoming an imperative issue to achieve the goals of the organization in every sector” (Yadav & Khanna, 2014). As a research issue, QWL has been defined in a variety of ways (Ilgun et al., 2014), and the term QWL include quality of work and employment quality (Carayon et al., 1999). Walton (1973), one of the early researchers of QWL, asserted that the concept suggested comprehensiveness and was broader than the aims of the unionization movement, labour laws, or equal employment struggles”. While, Sirgy et al. (2008) define QWL “as employee satisfaction with a variety of needs through resources, activities, and outcomes stemming from participation in the workplace”.

There is a consensus in the research literature on the importance of QWL as it is a prerequisite to increase employees’ productivity and wellbeing. “As a result, high QWL organizations may enjoy better sustainable efficiency, productivity and profitability” (Mosadeghrad, 2013, p. 43).

Measuring the level of QWL was a challenge to many researchers as it embodies many dimensions (Tabassum, 2012, Yadav & Khanna, 2014, Marta et al., 2013) and it enhances cultural and organizational ingredients, in different sectors of occupational activity. QWL “is an umbrella term which includes many concepts. QWL means the sum total of values, both materials and non-materials, attained by the worker throughout his life” (Yadav & Khanna, 2014).

Many dimensions of QWL were thoroughly investigated, their effects on QWL were studied, while studies of the effect of demographic characteristics (gender, age, work experience and Socio-professional categories) on QWL have conflicting results (Yadav & Khanna, 2014, Ayesha et al., 2012, Sandhyanair, 2013, Indumathy et al., 2012).

In Algeria, the situation is more ambiguous, especially in the services (tertiary) sector of activity, which is economically considered as the most important sector.

According to the Algerian National Office of Statistics (ONS, 2014) the tertiary sector contributes nearly 48% of GDP and employs nearly 60% of the labor force. The share of services in GDP has increased recently, well ahead of agriculture (13% of GDP and employs 10.8% of the labor force) and industry (39% of GDP and employs almost a third of the workforce). The tertiary sector encompasses a large spectrum of activities, among which: transport, distribution, sale of goods and the provision of a service.
The aim of the present paper is to measure the level of quality of work life (QWL) and to study the relationship between QWL and some demographic characteristics (gender, age, work experience, and socio-professional category) among managerial staff in two public settings from tertiary sector based in Oran - Algeria.
Nowadays, the effective application of Ergonomics in the worksystem is seen as a facilitator within the reach of a balance between the characteristics of the workers and demands of the task, improving worker productivity, providing better security (physical and mental), and satisfaction with work. According to Azadeh & Sheikhalishahi (2014), several studies have demonstrated positive effects of applying the principles of Ergonomics in the workplace, including machines, workstations and structural projects.

The objective of this work is to present the Ergonomics management program of a multinational company based in the state of São Paulo (Brazil), and its positive results, which has generated an improvement in the working conditions and the quality of life of the operators who work there.

The program involves several actions (planned, controlled and documented) based on the Ergonomics of the Activity (whose main objective is to understand the work to transform it) and in the national legislation, covering the ergonomic workplace analyzes (which contemplate the three dimensions of ergonomics - physical, cognitive and organizational), execution and validation of projects of ergonomic improvements (conception and correction), investigation of work-related outpatient complaints, follow-up of return to work processes and inclusion of people with disabilities in workstations, trainings (both work-related and non-work related issues) and actions aimed at the well-being and quality of life of the employees, with relaxation, strengthening and postural alignment activities in a place inside the company equipped and with professionals specialized in Physical Education and Physiotherapy.

The ergonomics activities in this company have existed since 2009, however, from 2015 onwards that the management program was set up and the controls and records began to be made in a systematic way. With this, it is possible to monitor all program results, create indicators and check the PDCA (Plan, Do, Check, Act) management cycle, after all, management models need to facilitate the achievement of high levels of efficiency, effectiveness and effectiveness, three different and complementary indicators that can be used in the evaluation of a management model. Being efficient means performing tasks in a rational way, optimizing the ratio of resources spent with the results achieved and obeying the applicable rules and regulations. Efficacy is related to the achievement of the objectives adopted by the organization. Finally, effectiveness has its focus on the contribution to society (FERREIRA, 2009).

Therefore, with the combination of the Ergonomics concepts of the activity and the management model of the PDCA cycle, it is possible to propose steps for an Ergonomics program that seeks the continuous improvement of the work processes and the constant validation of the actions performed by it.
This qualitative research, with a phenomenological and observational approach, aimed to identify and present relevant aspects regarding the use of sleeper cabins in semi-heavy and heavy trucks in Brazil as temporary dwellings, based on user perception, on observation of the researcher and on experts’ evaluation. Its relevance lies on investigating the use of a product that, besides being a work station, also serves as a second home for a large and strategic professional category, since the road modal represents 52% of the Brazilian freight transport matrix. Data collection in the field was done by 25 semi-structured interviews with truck drivers and by direct observation and image record of their cabins in actual use. The sample was randomly selected in relation to truck brands and models, at roads and ports in the states of São Paulo and Pernambuco, and included vehicles from the Southeast, South, Northeast and Midwest regions. Interviews were also conducted with six experts from truck manufacturing companies and two professionals from cabin customization companies. The results suggest that trips with many overnight stays, typical of Brazilian use, generate needs not always met by the original designs of the sleeper cabins, so there are many adaptations made by users in order to sleep more comfortably, store objects, cook and eat, travel with their families, just to mention some. The high incidence of robberies generates demands for solutions to meet basic feeding and hygiene needs inside cabins, as well as anti-theft devices. It is concluded that Brazilian users desire higher cabins, larger beds, night air conditioning, onboard refrigerators, electrical installations suitable for the use of electrical and electronic appliances, solutions to accommodate and transport family members safely. Thus, there is potential for a greater offer of customization options for the interiors of sleeper cabins by the manufacturers themselves, in order to achieve better adaptation as to the use observed in Brazil.

Keywords: design, product design, trucks, sleeper cabins, ergonomics, user-centered design.
Workforce is aging in Italy too for demographic causes and for the increasing age of retirement due to economic obligations or choices.

Retired employees are only partially replaced by young workers. These facts cause more difficulties and problems in fitness and employability for several aged workers, with or without diseases, first of all but not only assigned to tasks with significant physical, mental or organizational loads.

The Italian Inter-associations Board for Prevention (CIIP) includes professional and scientific societies whose members are public and private occupational doctors, ergonomists or other specialists in the field of occupational and environmental health and safety. These societies, according to their different functions and peculiarities, deal with ergonomic approaches and topics like work organization, biomechanics, toxicology, epidemiology and interfaces among men or women, machines, environments and work organization. CIIP set up a working group about “work and aging” which gathers main international literature and experiences and proposes solutions for Italian situations.

We published online a free access “aging eBook”, in Italian with an English translation in progress, which includes a general part and a first specific part for the working sector of health services, promoting also national meetings and panels.

We tried to analyze the subject and to propose solutions according to the “multiple
approach” (individual, at a company level, social) defined by J.Illmarinen and Others, highlighting resources and critical aspects of Italian conditions, proposing physical, mental and organizational ergonomic actions inspired by the interesting French INRS checklist and by researches and expertises of Clinica del Lavoro of Milan and Others, building general and specific checklists directed to health services (employers, employees, advisors).

Our CIIP working group reiterates however that individual life styles and ergonomics are necessary but not sufficient for every aged employee and for every task; consequently, it’s necessary also to update an effective welfare support and a policy allowing gradual retirements.

http://www.ciip-consulta.it/
Effect of sleepiness on visual attention in nurses

As shown by Landrigan CP et al. (2004), sub optimal shift schedules contribute to serious medical errors. Visual attention is a central function in health care. For instance, scrub nurses are responsible to ensure that no foreign bodies are retained in the patient after surgery (Koh RYI et al. 2011). In order to design shift schedules and minimize medical errors, it important to understand the relation between attentional performance and sleepiness quantitatively.

In a previous work, we developed an ecologic valid method for recording visual attention, in which a visual target is presented in combination with a complex, dynamic varying background (Menozzi M et al. 2012). The method records attentional performance, as expressed by the sensitivity $d'$, in detecting a visual target in the central and in the peripheral visual field.

Using our ecological method, we recorded visual attention in a total of 39 (female) nurses. The participants took the test at the beginning, and at the end of their shift. After taking the second test, participants rated their sleepiness by means of the Karolinska sleepiness questionnaire (Akerstedt T at al., 1990). Demographic data, shift lengths, hours of wakefulness and other parameters were recorded by means of a separate questionnaire.

Among the 39 participants, only 31 completed the whole set of measurements. The median age of the participants ranged in the class of 30-39 y. Only two participants were over 60 y old. Sleepiness, as scored according to the Karolinska sleepiness questionnaire, ranged from 2 (“very alert”) to 7 (“sleepy - but not difficult to remain awake”), with an average of 4.8 (SD = 1.6). Attentional performance was found to be affected by location in the visual field (central vs. peripheral) and by sleepiness score. Effect of sleepiness on attentional performance (sensitivity $d'$) is compared to results our previous work, in which we investigate the effect of blood alcohol concentration on sensitivity $d'$. In an important number of measurements, the drop in sensitivity $d'$ at the end of the shift was similar to the drop caused by a dose of alcohol, leading to a blood alcohol concentration of about >0.2 %/o. The drop of attention was more pronounced in the peripheral visual field than in the center.

In agreement with the literature (Karhula K et al., 2013), findings suggest that nurses are exposed to a high strain work severely affecting performance in visual attention. In particular, we expect that risks associated with peripheral visual tasks will increase with duration of work, imposing to adapt work organization as a function of work duration. We suggest to record attentional performance before starting work shift and use attentional performance as an organizational means to improve quality of work and reduce risk at work.
The forestry sector is facing a number of challenges that have an impact on the sustainability of the workforce and productivity of the system. This study examines the relationship between working conditions in the forestry sector and the workers in the Chilean forestry sector and identifies causes of problems between these elements. In addition, it examines the strategies that the Chilean forestry companies are using to address these issues. Finally, two examples are used to identify the consequences of the sustainability issue of the workforce on productivity. The overall objective of the study was to investigate the impact of working conditions on the workforce in the Chilean forestry sector.

The study on which this paper is based involved data collection over a period of several months from 350 forestry workers from Chilean forest companies and Chilean contractors. The study included interviews with managers and contractors associated with these companies and experts in the area of forestry, ergonomics, working conditions and health and safety.

The findings indicate that even though working conditions in the Chilean forestry sector have been improved, they continue to have a negative impact on workers in terms of occupational health, which has reduced the market attractiveness of the sector. This aspect also influences the replacement of the working population, which is resulting in an ageing population in the Chilean forestry sector. This ageing population is associated with increasing OH issues and reductions in the productivity of the sector where the main activities are still based on human (non-mechanized) labour. The findings, also, discuss the strategies that forestry organisations have implemented to improve the sustainability of the workforce, and conclude that these strategies are not enough to assure sustainability in the Chilean forestry sector. The strategies were focused on the prevention of accidents rather than OH problems. This aspect is related to the lack of data about the reality of OH problems in the sector and the need to develop and prioritise effective interventions to improve the health of forestry workers. Apart from that, none of the strategies pays attention to the wellbeing of the workforce and the development of resources, aspects that the workers themselves demand. In addition, the relationship between main forestry companies and Contractors Company is not collaborative. Therefore, forestry organisations need to improve their strategies in this area. Finally, due to the problem mentioned above, a negative impact on the productivity of the systems, based on examples related to pruning and planting activities was studied.

Key words: Sustainability workforce, Forestry sector, working conditions
**Digitalization of the Ergonomic Assessment Worksheet – user needs and requirements for digital evaluation functions**

**Type:** Abstract Oral Presentation  
**Category:** Automotive

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**Background:** By using the Ergonomic Assessment Worksheet method (EAWS), biomechanical risks for the whole body and upper extremities can be assessed on the basis of an 8-hour working shift and ergonomic measures can be taken into account (Schaub et al., 2012). Here, a digitalization of the EAWS process can lead to more objective and reliable evaluation results and higher transparency (Wagner et al., 2013; Sarodnick & Brau, 2011). Different EAWS programs are available but are mostly limited to the presentation of EAWS points and the involved stress factors such as weights and postures (Bullinger-Hoffmann & Muhlstedt, 2016; Di Valentin et al., 2015; Finsterbusch & Kuhlang, 2015; Fritzsche et al., 2012; Spitzhirn 2017). That limits the employment of the EAWS method in practical use.

**Objective:** For the purpose of user oriented extension of digital EAWS evaluations, requirements and needs of users have to be determined for EAWS evaluation functions and design elements as well as the user context as part of a user-centered design process.

**Method:** For that purpose an online survey is conducted to obtain an overview of the use of the EAWS method and user requirements in practical experience. In addition, semi-standardized interviews with EAWS-experienced people are deployed to receive more detailed information about the usage and design requirements.

**Results:** In summary, 61 people participated in the online survey and 13 people in the interviews. The field of operation of participants covers work planning, industrial engineering, ergonomics, occupational health and safety. The EAWS method is mainly used in the automotive industry, mechanical engineering and aviation. The EAWS is not only applied for the evaluation of working processes, but it is also increasingly used for the deduction of measures and in other cases. The evaluation of the currently used EAWS evaluation systems indicates the need for improvement according to the effectiveness, efficiency and satisfaction. In general, a high importance for an EAWS digitalization can be stated. There is a particularly high need for evaluation functions such as ‘ergonomics map’, ‘sensitivity analysis’, ‘design analysis’ and ‘job rotation analysis’. Users deployed certain requirements for the design of these functions such as the presentation of the essential information or the use of colour coding.

**Conclusion:** The surveys demonstrate that the EAWS method is widely used in involved companies. Existing digitalizations of EAWS have to extend by further useful functions. For that purpose, the results of the two surveys can be used to develop more user-friendly EAWS evaluations according to the user-centered design process.
The products assembly service for residential use is an important step in the segment of industrial furniture to order and that demands specialized work. In the case of furniture for kitchens, this stage becomes particularly important: even though the designs for these spaces are based on standard modules, the layout of the modules results customized projects and designs, according to the dimensions of the architecture, the personalization of interior spaces and especially direct interference with the technical installations of these environments, such as hydraulics, electric, gas and complementary products, such as countertops and household appliances. For this reason, often to meet the deadlines established in the schedules of completion of architectural works, this assembly service happens in environments that are still under construction, without the appropriate structure for their use. Considering the above, that is, assembly work based on the interpretation of customized projects and transitory working environments, which are still often to be completed, this article presents the results of an exploratory research with furniture assemblers carried out in the metropolitan region of São Paulo, Brazil, between the years of 2015 and 2016 and whose main objective was to identify, from ergonomics standpoint, remarkable aspects regarding the furniture assembly activity, considering, mainly, the environmental conditions and the cognitive aspects related to the space and to the project, respectively. Based on the principles of human-centered design, as a methodological resource for data collection, three procedures were considered: analysis of the designs instructions used in the assemblies, interviews with the assemblers and non-participatory observation field research during assembling of the furniture for the kitchens. As general conclusions, regarding the environmental conditions, the reduced size of the spaces for assembly is emphasized, which makes difficult the proper use of the tools; in the same way, inadequate lighting, ambient temperature, bad smell coming mainly from unfinished drain installations and the difficult access to these places, commonly located in condominiums with many residential units and in noble regions, away from the assemblers residence, are the main criteria that interfere in the good quality and result of the work. As for the cognitive factors, the design representation often stands out as incompatible with the technical needs of the assemblers, resulting in misinterpretation and wrong decisions, generating rework, change of parts and dissatisfaction of the assemblers. Likewise, it was possible to identify other problems in this process, such as customers dissatisfaction on waiting for the replacement of these parts and costs with the disposal of materials, production of new parts to be replaced, logistics and transportation, for example, expanding the problem to other areas besides ergonomics.
Introduction Glaucoma is a progressive optic neuropathy characterized by slow degeneration of retinal ganglion cells resulting in irreversible loss of peripheral field of vision. This loss progressively reaches the centre of the visual field (VF). The most important issue for patients is whether they will be able to continue their daily tasks, particularly driving (1). Standard evaluation performed by ophthalmologists does not always allow to answer this question, because it consist in static and non-ecological batteries of tests. Thus, ophthalmologists cannot take into account the elaboration of strategies allowing to compensate for the disease. In this context, the driving simulator can be a very useful tool. It allows to immerse the patient in an ecological and standardized situation without any danger whatever the criticality of the events he may encounter on the road.

Method In order to assess the impact of the loss of the VF on driving, 4 scenarios were developed in a fixed-base driving simulator equipped with 3 screens (115° of visual angle in width and 25° in height). 3 scenarios measured the size of the VF in static and dynamic/ecological conditions. The static scenario used a grid of 104 white dots successively displayed on the 3 screens, coloured in grey. The driver had to continuously look straight ahead and to indicate whenever he saw a dot by means of an action on the left light switch. In the 2 dynamic scenarios, the driver’s gaze is free and the dots were successively displayed while he was driving in a rural environment. In one of these scenario, the dots’ positions vary with the gaze direction. These scenarios allowed to assess if the patients develop efficient strategies of visual exploration. The 4th scenario (rural environment) was used to assess the dynamic of the gaze in driving.

22 Women et 20 Men participated in the study. Half of them were suffering from glaucoma.

Results Whatever the considered population, a tunnel effect (reduction of the size of the VF) was observed in the dynamic conditions when compared to the static one. This effect is higher for the patients, indicating an increase of attentional cost for them. Moreover, this effect, as well as the driving performance, was not related to the size of the VF loss. The dynamic of the gaze was also analysed in order to draw a profile of the drivers as a function of their capacity to compensate for the disease. This will allow creating a reference database so that practitioners can improve their diagnostic concerning the driving ability.

Conclusion We showed that using a driving simulator to place the participants in a more ecological situation is an efficient way to assess the impact of visual deficit on driving.
Recent forecasts about the European population have highlighted the fact that the number of elderly people will grow rapidly in the upcoming years and that the economic impact of aging society will be relevant in all EU countries. In this perspective, a healthy, active, and independent aging, for as long as possible, is a goal that involves the whole community, as it can lead to an improvement in the quality of life and a great cost savings.

In this scenario, digital technology can put itself at the service of healthy ageing also by empowering available tools and devices, and allowing the development of new support paradigms, like seamless anywhere-anytime medical treatment and home assistance, with sustainable quality and costs.

The search for adequate solutions for the management of the home assistance of the elderly population is also the aim of the HABITAT project, which will last two years starting from April 2016, financed under the 2014-2020 POR-FESR Program of the Emilia Romagna Region, Italy. The expected result of HABITAT is the design and test of a platform based on the Internet of Things for the creation of assistive, flexible and adaptive environments for the care of the elderly at home.

Within the Habitat project, an eco-system of smart objects is under development, including some wearable devices to allow positioning of the user within the domestic spaces and to monitor the quantity and quality of her/his actions and movements with the ultimate goal of preventing from dangerous facts resulting from certain pathologies in advance, like chronic or senile dementia. In addition to this, a GUI tool will be designed to support and monitor some parameters of the user's behaviour and, at the same time, remind her/him of important tasks, like appointments, visits and medicines and give suggestions and hints for a more active and healthy lifestyle.

Smart objects, thanks to an Artificial Intelligence support system, are expected to be able to customize themselves to the needs of each person and adapt to lifestyles, habits and interests of the users.
Every single device must be first and foremost user-friendly, ergonomic and non-invasive; the interface of the different smart objects must be intuitive, easy to learn even for the elderly who do not master the technology.

Furthermore, such smart objects must have high levels of usability, reliability and accessibility, minimizing the need for trained and specialized technical personnel.

The article aims at analyzing the issues related to physical and cognitive ergonomics in the design of smart objects connected to the Internet of Things for elderly, self-sufficient and non-self-sufficient with their caregivers, based on the first results obtained by the Habitat project, proposing some design criteria.
Comparative Analysis of Subjective Workload in Laparoscopy and Open Surgery using NASA-TLX

ABSTRACT

Background: The mental resources required by laparoscopy is higher compared to open surgery. We tested the hypothesis that subjective total workload (STW) is higher in laparoscopic (LS) compared to open surgery (OS).

Methods: The National Aeronautics and Space Administration-Task Load Index (NASA-TLX) questionnaire was self-administered by trained physicians at the end of each procedure. STW was calculated using NASA-TLX software.

Results: Fourteen surgeons performed 66 LS and 48 OS procedures. The following results were observed in the OS group: a higher STW, significantly longer procedure duration, older surgeon age and a significantly greater number of years of activity. Sub-item analysis showed higher temporal demand and frustration values in the OS group. STW was not normally distributed; the high workload subgroup within the LS group exhibited a higher mental and physical demand.
Conclusions: NASA-TLX is a valuable tool for assessing STW in the surgical setting. Contrary to our initial hypothesis, higher STW was observed in the OS group, possibly related to a longer duration of procedures and greater experience of “open surgeons”. These results should be viewed with caution because of several potentially confounding variables. Larger studies will be required to identify STW determinants among different surgical groups.
To assist ergonomic design of a product using a digital hand model, possible natural postures to use the product should be estimated and assessed. When designing interface dispositions, a main concern might be about reachability, which is strongly related to the range of motion (ROM). From the viewpoint of using products continuously for some period of time, however, it is also important to avoid discomfort postures. The purpose of this paper is, therefore, to measure and analyze the degree of posture discomfort with respect to the coordinated ROM. We concentrated on the thumb because it plays an important part to form various grasps by opposition and it is often used to operate control interfaces.

To model ROM considering coordination among joints, hand postures during a given set of exercises was captured by an optical mocap system for four adults with healthy hand. The carpometacarpal (CM) joint of the thumb is a saddle joint that has two degrees-of-freedom but moves three-dimensionally and the direction of anatomical joint axes are known to be different from person to person largely. Therefore, a posture of the CM joint was expressed with spherical coordinates to integrate different subjects’ ROM easily. Boundary of the projected postures was calculated on each plane of two of the joint angle variables using alpha-shape algorithm as the authors’ proposed in [1]. ROM boundary of four subjects were derived and combined.

The posture discomfort data was then collected through the experiments for the same subjects in ROM measurement. To control variety of the postures, each subject was asked to reproduce about 45 displayed postures and to answer whether the subject felt discomfort or not in terms of keeping that posture for 10 seconds. The discomfort experiment results were combined into a discomfort possibility map with respect to joint postures. We demonstrated the use of this possibility map as reach envelope of the thumb tip with colored discomfort information.

Ergonomic Practices in Africa: Date Palm Agriculture in Algeria as an Example.

Type: Abstract Oral Presentation
Category: Education and Training

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For more than fifty years, early ergonomists such as Sen (1984), Wisner (1985), Abeysekera (1985), and Shahnavaz (1987) called for the application of ergonomics in developing countries to expand its application rather than its confinement to developed countries.

Indeed, ergonomists from developing countries applied ergonomics to many traditional workplaces, machines, and jobs in the field of what was called at that time, traditional ergonomics. Despite what has been done, the African share of ergonomic studies is modest when compared to the ergonomic work done in other continents.

African countries are predominantly agricultural countries (Cotula, et al. 2009). In addition, a large proportion of their population live and work in rural areas. Work in these areas is still traditional with a lot of static work, stretching and awkward postures. Various efforts have been made to develop agricultural work in Africa (Salami, et al. 2010; Obi, 2015). But most or all of them dealt with the subject from the economic angle. There is no doubt that these approaches help develop African countries. But, it is necessary to give an opportunity to ergonomics, which has contributed significantly to the development of the economies of industrialized countries.

Date palm (Phoenix dactylifera) farming is considered as one of the most important economic resources especially in hot and dry areas in Africa. In Algeria, according to Bouguedoura, et al. (2015), the number of date palms is in millions. The number of people who work in date palm industry is also very great. The majority of date palm work (climbing, dethorning, pollinating, thinning, pruning, bunch covering and date harvesting) is carried out after the farmer climbs the trunk to reach the crown. The worker climbs the palm tree, which may be about 21–23 meters in height, barefooted and in rare cases uses a harness or a rope for support. The work is insecure and associated with significantly higher rates of work related musculoskeletal disorders (WRMSDs) (Grivna, et al. 2015). The major source of insecurity is falling that could result in death or at best in disability. However, the major source of WRMSDs is that, date palm farmers have to do various tasks and operations on the palm crown (above the ground) with a large amount of static work, bending, and adopting awkward postures.

To address these problems, it is necessary to take advantage of the ergonomics interventions that make the workers work comfortably, safely and effectively, while at the same time lead to increased production. Therefore, this paper aims to answer the following questions:

- What attempts can be made to solve the problem of falling from the date palm crown?
• What attempts can be made to fight WRMSDs?

Keywords: Ergonomics, Africa, Date Palm Agriculture, Developing Countries, WRMSDs.
Estimating anthropometric measurements of Algerian students with Microsoft Kinect

Type: Abstract Oral Presentation
Category: Education and Training

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Ergonomics has been- since its appearance- aiming at fitting the job to the man. Anthropometry supports ergonomics to achieve this aim. The design or redesign of workplaces, machines, and tools can be done successfully through anthropometry. Therefore, the measurement of anthropometric dimensions is highly necessary for ergonomic practices.

Currently, the main concern of ergonomists is the search for tools that enable taking measurements reliably, efficiently and inexpensively. The use of traditional anthropometry has been criticized for being time consuming, expensive, and requires skilled personnel. Indeed, in recent years, ergonomists have found their place in 3D scanners. Despite the fact that with 3D scanners, anthropometric surveys are done faster with quicker results, greater accuracy and minimum errors, they are costly and many institutions (universities, research centers, etc.) in developing countries cannot afford to buy them. In addition, their maintenance is another burden on these institutions to obtain them.

It may be wise to seek a compromise between the two types of anthropometry. Motion capture interactive entertainment tools like Kinect show some promise in anthropometry.

The origin of the word Kinect is from the combination of two words “Kinetic” and “Connect”. It was originally designed by Microsoft in 2010, for gaming purposes. But the device now has multiple uses. Among them, it is used in ergonomics, especially in anthropometry. In comparison to other devices, it is affordable as it can be purchased for about 200 $. Further, it is light, easy to use, and can be interfaced with computer Microsoft Windows Operating Systems.

Study questions: This study aims to answer the following questions:

1. How both traditional and modern anthropometric data with Kinect are taken?
2. Are the results of both anthropomorphic data similar?
3. What is the effect of gender on anthropometric data?

Keywords:

Anthropometric measurements · Traditional anthropometry · Modern anthropometry · Microsoft Kinect
Artificial intelligence enables us to gain new insights in psychometrical data; this article in particular explores new relationships between attributes (categories) of Questionnaire Actual Availability (QAA) from AH-Model uncovered by implementation of decision trees classification algorithms. Clustering analysis was already employed in development of QAA – it identified composite attributes on which decision tree classification was deployed. Already imbedded clustering analysis thus enabled us to do efficient feature construction and selection and negated the need to employ tree pruning or any other noise reduction algorithm.

The QAA has been implemented on the sample of 2031 workers from financial sector. Estimations of actual availability parameters have been implemented for the average working day.

In regards to prediction of general actual availability the most important feature is psychical fatigue. First level of decision tree divides population in 4 intervals of different levels of psychical fatigue. Lowest interval of psychical fatigue is further divided according to levels of physical fatigue and age. Lower level of psychical fatigue is also highly correlates with lower levels of education and consequently higher percentage of manual workers. For workers experiencing lower levels of psychical fatigue, age and physical fatigue decide their level of availability. On the other extreme of the spectrum, workers who experience highest levels of physical fatigue, stress and motivation prove to be deciding factors in determining actual availability. Only workers who overcome their higher levels of psychical fatigue with high motivation and absence or lover levels of stress maintain their high availability.

Presented results upgrade the AH-Model with specific identification of attributes shaping workers performance and identify gripping points for intervention to keep sustainable level of workers performance.

Key words: Questionnaire Actual Availability, human performance, psychical fatigue, psychical fatigue, artificial intelligence, classification algorithms, AH-Model
The research refers to two different initial topics of interest. On the one hand the large-scale diffusion of tracking devices and the growing interest towards the movement for the personal quantification, led us to the hypothesis that devices could autonomously analyze not only physical field related data, but also those related to emotions. On the other hand, the development of an intangible and interface-free system that aims to shape the environment around us according to our needs, in theory doesn’t require our direct intervention. A so called zero user interface system. In this scenario, the presence of data related to our emotional state, generally referred as mood, could be useful to regulate a system otherwise based on a single automated collection of exogenous values.

The interest in collecting this kind of data has so far leaded in the development of mood trackers, mostly in the form of web based applications, mobile apps or even objects to manipulate. The input of these values is often left to the user, who manually attend in the creation and record of the data. The goal of our research is therefore the identification of the bases on which one (or more) device could provide equivalent values but also hidden, unconscious qualitative data in an autonomous and more accurate way. At last, but not least, tracking our emotional state with the aim of improving it, we’ll be able to improve our social skills and in a wider way to see, the social sustainability. For doing so, in the first instance, we examined the context related to emotions, differentiating endogenous and exogenous reactions. For exogenous reactions, we analyze the world of communication, dwelling on how this occurs, not only verbally but also through the body. For endogenous reactions, we take into consideration all those involuntary biological reactions triggered by the autonomic (sympathetic) nervous system. We also focused on the possibilities of people to recognize other people’s emotions, examining if and with which methodologies an automated system will be able to perform the same task.

Subsequently we examine technological solutions currently available with a critical design approach in order to evaluate how to capture data in the least intrusive, most transparent and reliable way. The purpose of this paper is primarily to highlight and define, from a design point of view, the development of scenarios made by tangible objects able to relate and regulate a system that has no interface by definition. Secondly, we propose a set of both technical and theoretical guidelines to test our research thesis through an experimentation that considers humans, data and technology as a complex system able to improve our social environment.
INTRODUCTION

The idea of the paper was centered on the Health Promotion concept proposed by World Health Organization, in 1986. According to WHO (1986), “health promotion is the process of enabling people to increase control over, and to improve, their health.” Health promotion consists of activities focusing behavior changing of individuals, considering lifestyle, their families and the cultural environment where the individual belongs.

Based on this concept, the team defined to research the health promotion to diabetic patients, once Diabetes is a disease with many side effects and is difficult to count deaths derived from all complications.

Based on this context, and understanding that this disease is a concern in most countries around the world, research was started in 2015 aiming to discuss and answer the following questions:

1) Considering the variety of patients profiles, which are the most vulnerable, considering the Health Promotion values, established by WHO?

2) How can a design approach, based on human factors/ergonomics principles help the prevention of this disease?

At this point, the research established as objective to provide some educational content for diabetic patients, considering literacy and information access, aiming to inform and to minimize the risks of this disease.

METHOD

The research began with a field survey with diabetic patients, to clarify which are the primary sources of information to deal with the disease. Once analyzing the data, considering the human factors/ergonomics aspects involved, quantitative and qualitative data were collected. After noticing that kid’s education and information about the disease is neglected, and the condition can lead to other fatal problems, children from three to eleven years, became the focus of the data analysis, once education resources for this group can improve the quality of life and save lives in the long term.

The team research considered here those in preschool that can’t read or write yet, but already need to follow an equilibrate diet to deal with the disease. All this data lead to creating a persona, and the configuration of a product, an app.
RESULTS: AN APP PROPOSAL

The core of the app was about the adequate foods to eat for diabetic children. The first proposition for the app consisted of a character – a basket named ‘Tina.’ The primary challenge is to convey the idea of a healthy diet.

Games end when the player selects five ‘prohibited’ food consecutively, in his/her basket.

Some initial tests were performed, and some solutions are proposed as next steps.

REFERENCE

Connection has become an essential component of work. It appears to be an essential resource for efficiency, rapidity as well as accessibility and transmission of information. However, it may have harmful effects on individuals, collectives or organizations because of its continuous nature (Bobillier-Chaumon, 2012, Jauréguiberry, 2014, Boudokhane-Lima & Felio, 2015). Communication Technologies use can provoke an intensification of work’s pace, have an impact on work-life balance and quality of life and work (60% of managers find connections have a negative impact on their life’s quality; APEC 2014). Some studies indicate that being connected can be used by individuals as a proof of their engagement to the firm (Felio 2013, Créno & Cahour 2016, Boswell & al.2016) and this may partially explain continuous connection.

Our study aims to characterize factors which may contribute to a positive or a negative experience of this connection at work and ways of making them acknowledged by the organization.

To analyze the difficulties linked to connections, we focused on a population of managers in a very large French company. Our aim is to help the organization to find solutions to improve the situation.

We built a questionnaire about practices, uses and feelings linked to connection and about potentials effects on health, and received 400 answers.

We have also conducted in-depth interviews with 15 individuals using elicitation method (Vermersch, 1994). The analyses focus on the individuals’ practices of connection and their feeling about them in specific situations. We also analyzed the existing regulations (individual, collective and institutional) of the connection process.

The analyses from the questionnaires indicate the proportion of managers facing difficulties with their connections, the nature of these troubles and their impacts on activities and life. We have learned for example that some managers have noticed negative consequences caused by a disconnection during non-working hours, as work overload or missed information. The most impacted sectors and professions are also described.

The interviews allow us to deepen contextual elements and their feelings about these practices. The connection experience depends on 3 elements:

- The ICT’s characteristics (free or constraint use, usability, articulation between different tools),
• Team dynamics concerning connection dimension (support, solidarity, informal regulation in the team,…),
• Psychological factors as the capacity of detachment.

Our analyses have shown, among others things, the importance of team solidarity and how the collective could regulate the connection overload when neither the individuals nor the institution can succeed. It could be interesting, in a next step, to work on the collective organization by providing a collective method (e.g. forum-theater) and, based on our previous analyses, to discuss and improve the individual experience of connection.
People tend to be emotionally upset when they are sick, and estrangement from the hospital environment can accentuate this process, just as a welcoming environment can soothe it. Thus, with regard to physical hospital environments, it has long been understood that they should favor the satisfaction of their users, constituting themselves in a therapeutic instrument.

Researches point out that the visual characteristics of the environments have an important impact on the human experience, being able to evoke strong emotions like pleasure or displeasure, to act as a stressor or restorative effect and to make inferences about places and people. They may also influence human behavior, such as the decision to frequent or avoid certain places (NASAR, 2000). Although evaluative responses alone cannot predict actual behavior, combined evaluation of evaluative responses and predicted behavior provide a good indication of actual behavior (NASAR, 1988).

In this way the evaluations of the physical environment that are realized through the processes of perception and cognition, allow the establishment of relations between the environment and the individual.

The present article aims at a theoretical framework based on the perceived visual quality concept to evaluate the visual preferences related to hospital reception environments. The field research was delineated (MARCONI; LAKATOS, 2003) and qualitative, and for the data collection the multiple classification system was used, because it is a technique that provides more sensitive procedures to diagnose the impressions of the users.

In order to structure the multiple classification system, a basic element of the Theory of Facets (COSTA FILHO; OLIVEIRA, 2014) was used for this study, two variables, the CONTRAST variable and the variable VARIETY, varying in the low, medium and high levels.
Each participant was asked to classify nine figures according to the quality (soothing / relaxing) of the environments, with answers arranged in a Likert scale of five points, corresponding to: 1 - "very unfavorable", 2 - "Unfavorable", 3 - "indifferent", 4 - "favorable", 5 - "very favorable".

The questionnaires were applied to a sample with 73 participants, 72.6% of the female gender and 27.4% of the male gender, aged between 18 and 55 years old, where 53.4% had a complete upper level and 39.2% incomplete upper level.

According to the results, the most relaxing hospital reception was the one that presented low contrast and high variety, assuming that the contrast variable is more considerable in the perception of these environments presenting consistency with NASAR (1988) affirms about the predilection of environments.

Thus, although the results cannot be generalized, given the sample size, they strengthen the theoretical bases and can be considered for future studies related to this subject.
Using OpenSim to Investigate the Effect of Active Muscles and Compliant Flooring on Head Injury Risk

Type: Abstract Oral Presentation
Category: Healthcare

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Using OpenSim to Investigate the Effect of Active Muscles and Compliant Flooring on Head Injury Risk

Introduction

Force and acceleration of the head has been experimentally shown to be significantly reduced on compliant flooring during impacts from falls [1]. Often, these events are often not feasible to investigate experimentally. The OpenSim platform allows investigation of muscle activations in head impacts during simulated falls using dynamic simulation [2]. The purpose of this study is to determine if simulations in OpenSim can provide a greater understanding of the effect of muscle activations during falls on compliant flooring to study the role of neck muscle strength on injury risk.

Methods

A recently developed OpenSim model of the head and neck was used to simulate falls onto surfaces with varying degrees of compliance and with various muscle activation levels. A backward fall was simulated by dropping the model from a fixed height of 62.5cm to represent a fall out of bed [1]. The model included muscle forces representative of a 50th percentile male. Muscle activations patterns tested included no activation and flexion-muscles activated to 10% and 50% of their capacity. OpenSim contact surfaces require a stiffness value calculated from material properties from each contact pair. Stiffness values were calculated for impacts between bone, concrete, and Sorbothane (compliant flooring material). A stiffness value halfway between Sorbothane and concrete was also used. Resultant linear acceleration and force during impact were compared to values identified in the literature.

Results

Linear acceleration was 163g for concrete impacts, 125g for halfway between concrete and Sorbothane impacts, and 42.5g for Sorbothane impacts (Fig 1). These values are comparable to values found in the literature for impacts of similar velocities [1]. The maximum force and the force profile for Sorbothane impacts also compared well to force profiles in the literature (Fig 1). Active flexion muscles reduced accelerations for all impacts. Muscles activating at 10% of their capacity reduced accelerations for concrete impacts by 15% which corresponds to a reduction in head injury criterion (HIC) of nearly 33% [3]. Muscles activating at 50% of their capacity prevented all head impacts.

Discussion
These results demonstrate that fall simulations in OpenSim produce head forces and accelerations during impact that compare well to values published in the literature. This suggests that OpenSim may also be used to explore other questions related to falls and compliant flooring that cannot be safely answered experimentally. The results indicate that any muscle activation aimed to prevent the head from contacting the floor appears protective. Future research is needed to investigate how targeted neck strengthening interventions could help to prevent injuries associated with falls.

References


Design for All (DfA) has been considered as a fundamental and innovative strategy to design inclusive spaces for everyone's needs and wishes. However, there is the gap between theory and practice in this discipline. Accordingly, DfA theoretical studies and principles are not yet applied in the design project. Indeed, accessibility of the built environment is too often associated with application of policy (norms) through a prescriptive approach. Conversely, designers should adopt a DfA descriptive approach, which is performance-based and requires understanding, in order to apply consciously design indications considering users' needs. Therefore, tools that support designers to implement DfA through a descriptive approach in architectural practice are necessary.

The paper discusses the research development of a manual that supports architects in the application of DfA strategy. The research was conducted at Hasselt University (Belgium) and it is part of a wider Master thesis research developed at both Hasselt University and Politecnico di Milano (Italy). The manual's development is based on four main criteria defined by a precedent literature review: communication, design information, users' needs and built environment. Each of the four criteria defines a fundamental issue on transferring DfA knowledge.

The outcome of the research is the definition of a DfA manual's structure and a section's sample about outdoor public space developed as example. In particular, the manual provides architects design indications for the different spaces of the built environment, focusing on haptic design, which studies the perception of the built environment through the body, referring to the sense of touch. Design indications derive directly from users' needs addressed in haptic design and they are organized according to a framework of architectural elements of the public space. The manual strives to transfer knowledge through a descriptive and performance based approach, which means to apply conscious design indications. For this reason, the manual also includes an extensive description of users' needs, to understand why indications are provided, references to case studies and laws on accessibility, which inspire architects and support them to find the proper design solution within one's own project.

Thus, the goal of the manual is to create a DfA awareness for many architects, designers and decision makers in their activities. Starting from the basic application of laws, the manual should be used as support tool during the design process to design inclusive spaces for all users. Therefore, the contribution of the research represents a basis towards a more detailed study to inspire and sensitize architects on the application of DfA strategy in architectural practice.
The Electronic Chart Display and Information System (ECDIS) has become a key element in bridges of ships, helping navigators to make the right decision. However, even with the constant technological advancement, the ability to make these decisions in the right time is still the determining factor for the safety of navigation, being directly related to the interaction between navigator and system.

The objective of this study was to identify fundamental factors to be incorporated in simulations to analyze the cognitive system shared between the operator and the ECDIS system during navigation, from the perspective of Resilience Engineering (ER). The identification of these factors aimed to elaborate scenarios very close to reality, so that they could improve the ability of navigators along with the ECDIS system and, consequently, navigation as a whole.

To this end, the following methodological strategies were used: a) CDM method: seven interviews with navigation specialists, for example a master with many years of experience in ECDIS and the operational function of the system. From these interviews it was possible to obtain critical situations experienced by the navigators using the system and the possible actions to be adopted to solve the problems. In addition, the deepening of the incidents allowed a greater understanding of the decision-making process followed and also of the whole configuration of the task; b) analysis of accident and incident reports: three in total, focusing on critical points in the use of the system, such as the accident with the ship Ovit in 2013, where inadequate ECDIS configurations, among other problems, led the ship to run aground on a bank.

After collecting and analyzing the data from the different sources used, it was possible to obtain a scenario with three critical points for the simulations able to bring the simulated exercise of the natural environment closer together, as well as to select the main techniques capable of validating the analysis of the behaviors of navigators.

Thus, the research resulted in an elaborate scenario, which were later validated together with the experts and applied in a course to enable ECDIS operators for the main purpose of the research: the analysis of the system shared between the operator and the ECDIS system during navigation, from the ER perspective.

In summary, this scenario covered navigation near the entrance of Guanabara Bay (Rio de Janeiro/Brazil) and the operator, acting as the officer in charge of a navigational watch on simulated ship, using ECDIS and should take the necessary measures to keep the navigation safe.
Work-related stress may be considered as the product of the dynamic interaction between the person and the social and organizational context in which he or she works, constituting the result of a (not equal) relationship between the stressors related to the task/role and the operator’s ability to cope with these. Over the past decade there has been a marked increase in the amount of interest in issues involving work-related stress in Italy. Firstly, with the promulgation of the fundamental law for the protection of health and safety in the workplace, stress has been included as an element to be considered in the mandatory risk assessment. According to the European Foundation for the Improvement of Living and Working Conditions, research in Italy demonstrated high levels of stress in the banking sector. Moreover, since 2008, a deep financial crisis has widely spread around the world. Scientists expressed their worry about this crisis by pointing out that potential negative health effects can be created by collective fear and panic. Economic stress appeared consequently as a new important aspect of mental health. With this in mind, a study was conducted to evaluate peculiarities of hindrance and challenge stressors and its links with recovery in Italian banking population.

We contacted HR and H&S managers of a large Italian banking group and invited them to participate in a stress assessment. The questionnaires were administered online through the intranet company portal. Anonymity and confidentiality in the responses were, however, fully assured. Work-related stress was measured with the Stress Questionnaire (SQ) which assesses several psychosocial working variables. One of the most important aspects of the questionnaire is the psychosocial risk scale; it is based on five main psychosocial risks which might lead to stress-related negative outcomes. Recovery was measured using one scale (3 items) from the SQ. Demographic aspects were detected by some questions, in which information was requested regarding the gender, age, territorial area, job seniority and job position of responders. The analysis and tabulation of results was performed using the statistical analysis package the Statistical Package for Social Sciences (SPSS). The following statistical analyses were performed: Descriptive Statistics, Correlations, One-Way Analysis of Variance (ANOVA) and hierarchical regression.

Results of over 6,000 respondents demonstrated that female respondents lack more of job control and colleagues’ support as compared to male respondents. Employees over 50 years old lack of supervisor’s support. Employees with the shortest job seniority experienced greatest role ambiguity, lack of job control and colleagues support. Results of hierarchical regression analysis demonstrated that lack of colleagues’ and supervisor’s support as well as job demands and job control contributed in explaining recovery. The greatest contribution to the explained variance was of job demands and lack of colleagues’ support.
Analysis and Design of a Cyber-Physical Production System (CPPS) in sensor manufacturing. A Case Study

(type: Abstract Oral Presentation

Category: Manufacturing

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Analysis and Design of a Cyber-Physical Production System (CPPS) in sensor manufacturing. A Case Study

(Proposal for an Oral Presentation at the IEA Conference Florence, 2018, 16.-20. Aug.)

Cyber-physical Production Systems (CPPS) combine methods of artificial intelligence with robotics, new ways of man-machine-man collaboration, and the “internet of things” (Schwab, 2017). They create opportunities for individualized, one-piece-flow, and flexible manufacturing and assembly processes in tomorrow’s manufacturing plants.

In this case study, a new production system for the assembly of sensors in a small/medium sized enterprise (SME) has been designed, implemented, and evaluated. As a method, the “complementary design of complex man-machine systems” (Grote, Wäfler, Ryser, Weik, Zölich & Windischer, 1999) has been used, adapted and expanded.

The results show that manufacturing processes in CPPS

- allow for more self-regulation and self-organization in production teams,
- create higher complexity and dynamics in the work process,
- require more collaboration, communication and problem-solving skills of the operators, and
- enable new ways of man-machine-man collaboration.

The case study has been carried out as part of the research project “PRÄDIKATSARBEIT” (“Work of Excellence”), sponsored by the Federal Ministry of Research and Higher Education of Germany. The results shall be shared in the IEA community to promote new ways of man-machine-man collaboration in the “Industry 4.0”. For more information about CPPS and manufacturing in inter-connected production cells see (Gilchrist, 2016) (Schwab, 2017) or (Porter & Heppelmann, 2014)

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Designing urban smart furniture for facilitating migrants' integration: the co-design workshop as tool for supporting an inclusive approach in products/services design

Abstract. European cities are changing due the immigration of people from different cultures. There are many issues related to the integration and dialogue between cultures. Urban design plays a key role in how migrants participate in their host community and it is an important driver for the inclusion process. Facilitating the participation of residents in designing public spaces and their use helps to create a better sense of belonging. Promoting in public spaces the interaction of different cultures becomes a crucial element to facilitate social cohesion and living together.
The research project explores an innovative approach in the use of public spaces, through the design of smart urban furniture. Based on a survey of the user’s needs, and on co-design activities, the project investigates innovative solutions for facilitating migrants’ integration and the dialogue between different cultures, through the design of innovative urban furniture, with smart technologies embodied inside.

The project, based on the co-design approach of rapid prototyping, creates different kinds of new interaction among urban space and people, and between users of different social or cultural background.

The results presented in this paper, were conducted by the research unit of the University of Florence, in cooperation with the Human Tech Institute and the School of Management of the University of Applied Sciences and Arts Western Switzerland.

Keywords: Human-Centred Design, New Technologies, Public Space Design.
Motor control with assistive force during isometric elbow flexion

Type: Abstract Oral Presentation

Category: Healthcare

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[Motivation and Objectives] In the modern society, the development of assistive technology has advanced rapidly. For example, an assistive/powered suit has been developed to enhance the limb and trunk movements by mechanical force. Such products will be used widely in human daily living and manual working in the near future. On the other hand, effective output of assistive products needs cooperation between the users, that is, human beings, and the machine. In addition, combinations of level of human exertion and machine assistance greatly vary to properly control human motion. With this background information, we produced simple experimental devices to provide workload and assistive force at various levels, and investigated motor control of external forces that assist with physical exertion.

[Methods] Sixteen right-handed young adult male participants performed isometric elbow flexion under two conditions of submaximal workload (20% and 40% of maximal workload) and four levels of assistive force (0%, 33%, 67%, and 100%, as theoretically expected) for 30 seconds (10 seconds with assistive force and 20 seconds thereafter with assistive force). During flexion, the electromyogram (EMG) activity of the agonist and antagonist muscles (biceps and triceps, respectively), the tension of the elbow flexion, and the rating of perceived exertion (RPE, Borg's CR-10) were measured. The coefficient of variation (CV) for the tension was qualified as an index of steadiness in force.

[Results and Discussion] The EMG activity of the biceps and triceps, and the RPE score decreased with increased levels of assistive force under both workload conditions. At the lower level of assistance (33%), the rate of maximal voluntary contraction (%MVC) was near the expected values, which denotes that the participants made good use of the assistive force. However, at the higher level of assistance (100%), the %MVC was far from the expected values. This phenomenon was observed at both workload levels. The CV for the tension decreased with the level of assistive force only at the 40% workload condition. These results suggest that the effectiveness of assistive force changes according to the level of workload and assistive force, and that various human physiological regulations and motor control would be required during cooperative work with assistive force.

This work was supported by JSPS KAKENHI (Grant No. JP 15K14619 and 17H01454).
Designing a user-centered approach to improve acceptance of innovations on the shopfloor using Rogers' “Diffusion of Innovations”

Type: Abstract Oral Presentation

Category: Manufacturing

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Today’s challenge for manufacturing companies lies in shaping the fourth wave of industrial revolution. In the automotive industry the use of smart wearables, robotics, autonomous transports or i.e. predictive maintenance advance with the aim of creating smart factories. While robotics change assembly, autonomous transports impact greatly on intra-logistics. Specifically in order picking processes the degree of automatization differs depending on tools in use (pick-by-paper, pick-to-light, pick-by-voice, pick-by-vision, etc.).

The human is at the core of all these systems since especially order picking processes benefit significantly from the picker’s flexibility in task management, reaching and grasping objects with high accuracy (cf. Klug 2010). Appreciating the employees’ skills I focus in my research project on testing the use of assistive devices such as smart glasses. Most research projects do not sufficiently involve the shopfloor-employee from the beginning of the innovation process. Comparing the frequently cited process model in Rogers’ “Diffusion of Innovations” (Rogers 1962) and usual innovation process management in automotive industry, I found the same tendency in being output- or process-focused instead of being user-centered. For this reason, I saw the opportunity to modify Roger’s model. Especially on the shopfloor there are two principal initiators for innovations, first the planner and second the shopfloor-employee. They pursue different aims, such as economic reasons (improvement of time, quality and costs) and ergonomic reasons. Regularly shopfloor-initiated innovations are based on the outcome of CIP (continual improvement process). In contrast to said incremental innovations, it is necessary to pursue disruptive innovation in order to shape the dynamic change towards a smart factory. In such a project the involvement of the workers may just be as difficult as it is important.

Rogers’s model includes five phases: knowledge, persuasion, decision, implementation and confirmation. Actually planners and management pass through all phases, whereas the worker only influences the innovation development from the decision phase onwards. In order to tackle this lack of early involvement, this paper proposes to attach a separate consultation cycle consisting of a (continual) knowledge, persuasion and decision phase for the shopfloor-employee. By consulting the workers, their skills and needs at operational level as well as their ideas influence the final decision and design the solution to be implemented. I hope to gain higher acceptance of disruptive improvements by creating consensus in the shopfloor environment.

To apply this user-centered cycle approach to practice, this project started by conducting interviews to create knowledge and start the workers persuasion phase. The survey, which included 14 employees of different roles in the logistics department, focused on previous experiences with augmented reality, their knowledge about the technology, their idea about possible changes of the process, the suspected advantages and disadvantages and the beneficiaries of smart glasses-assisted order picking processes.
ABSTRACT
The study presented the mathematical approach to determine the Peak expiratory flow rate of male bakers in Abeokuta, Ogun State, Nigeria with the relationship of the peak expiratory flow rate and the anthropometrical parameters. A total of One hundred and Eighty (180) individuals were investigated with ninety (90) bakers (study group) who are exposed to flour dust and ninety (90) control subjects. The entire subject both study and control group are male. Peak expiratory flow rate (PEFR) and anthropometrical parameters were measured using mini-Wright peak flow meter (PFM 20, OMRON) and Detecto PD300MDHR (Cardinal Scale manufacturing company USA) column scale respectively. PEFR measured were compared using T-test and regression analysis. A mathematical model was developed to determine the peak expiratory flow rate (PEFR) with four factors of body mass, height, age and year of exposure where applicable. The study showed that PEFR in bakers was 182.67 ± 16.34 L/min as against 287.67 ± 17.03 L/min for control group from the regression analysis. Similarly, the model revealed that baker has 182.69 L/min and 285.77 L/min for control group. The Study concluded that using the developed model will serve as a great importance to workers to determine the level of their health and subsequently prevent untimely death.
Keywords: Bakery, Flour, Dust, Workers, Peak expiratory flow rate, Exposure, Asthma
Tremendous growth of motor powered two wheelers (motorbikes, scooters etc.) sector, not only creates problems related to traffic and pollution but also imposing a big concern for parking space management. In one hand, the use of main/central stand is strenuous due to load lifting while on the other hand, use of side stand occupies more parking spaces due to inclined position of the motorbikes/ scooters. It is often found that female and young-adults avoid using the manually operated main-stand due to high amount of force requirement. They generally prefer to use side-stand. Keeping in mind the fact of space constraint, in the present research an attempt has been made to demonstrate design and development of user-friendly innovative main-stand for motorbike. Following identification of bio-mechanical problems (excessive force exertion and uncomfortable operational posture) associated with commonly available main-stand during parking; literature review was carried out to find out the current status of research and development in the aforesaid field of main-stand design. After user survey, brain storming was performed to develop initial concept models by using black box diagram and functions tree based morphological matrix. The best concept was selected using QFD analysis. In embodiment design, Ashby charts used for material & manufacturing process selection for the best concept. The 3-D CAD model was developed & FEA analysis performed. Following virtual ergonomics evaluation of the CAD model of the main-stand using digital human modeling software, prototype was built for real user testing. Usability of the newly developed main-stand was compared with the existing/available one in terms of physiological and bio-mechanical variables (posture, heart-rate and electromyography) of the user during the use of the stand. It was found that newly developed stand is not only superior to the existing manually operated main-stands but also better in terms of user satisfaction and cost.
The state of the art regarding comfort/discomfort evaluation shows the need for an objective method by which to evaluate 'effects in the internal body' and 'perceived effects' according to the most afforded schemes of comfort perception. Postural comfort is one aspect of comfort/discomfort perception, and this work adds to existing knowledge about a more objectified posture evaluation for comfort purposes.

For doing this, authors have used the concept of Range of Rest Posture (RRP), as proposed in Apostolico et Al. (2015), that shows to be of use for comfort evaluation.

This study is focused on the identification of RRP within the Comfort Range of Motion (CROM) for the following lower limbs' human joints: hip, knee and ankle.

The method is based on extensive experimental work involving 114 healthy individuals (59 males and 55 females) ranging from 20 to 40 years old. The age range was so narrow in order to avoid an age-clusterization of results due to inhomogeneity of the statistical sample. The experimental data were processed using statistical methods for identifying the RRP in the experimental CROM.

Several Maximum Level of Comfort (MLC) positions in the RRP have been found too. These positions appear to be the most important information in comfort evaluation analysis.
Drivers get driving related information mainly through visual, auditory, and haptic sensory channels but it is predominantly based on the information received through visual senses. In working memory visual information fades away faster than the auditory information and in order to retain the visual information for a longer duration it gets recoded into phonological information through Articulatory Rehearsal Mechanism (ARM) (Baddeley, 1983). After every 2 seconds, ARM recites and rehearses the phonological information making it to re-enter into the phonological store, where it starts to decay again immediately (Baddeley, Thomson, & Buchanan, 1975; Baddeley, 1983). Individuals when engaged in processing visual information in order to perform driving and if there is suppression of ARM chances are high that visual information processing will be compromised. This distraction is ought to suppress the visual information from being rehearsed and remembered acoustically. The present study investigates the effect of suppression of ARM on driving performance in terms of driving errors. 30 drivers voluntarily participated in the study. They drove an instrumented vehicle and were required to follow certain directions displayed on signboards. The signboards were installed along a two-lane track. Drivers were randomly assigned to one of the three conditions of suppression of ARM namely non-suppression, simple suppression, and complex suppression. Driving errors were analyzed in terms of slips and lapses. The results indicate that there are significantly more driving errors under complex suppression as compared to other two conditions of suppression (i.e., non-suppression and simple suppression). Further analysis reveals that there are significantly more cases of slips than lapses.

Key words: Suppressed Articulatory Rehearsal Mechanism, Distracted Driving, Driving Errors, Slips, and Lapses.
Abstract

This paper aims to present considerations about project and methodological support, and their obstacles, present in fashion design regarding people with disabilities and reduced mobility, intending to provide instruments for the designers to effectively engage in designing for inclusion.

Considering the notion that clothing functions as an extension of the body (MARTINS, 2008), it is crucial to understand the demands of the users and consumers and treat that information as a guiding element in product and project development.

Projectual possibilities, methods or tools, must consider ergonomic and functional aspects, the body representation in the contemporary society (CASTELLS, 1999; CASTILHO 2004) and the consumer/user as an individual with not only restrictions but also potentialities.

Perceiving the insufficiency in product development, specifically regarding methods and instruments in fashion design field (MONTEMEZZO, 2004; PIRES 2002) to effectively achieve usability (JORDAN, 1998), the paper intends to explore interdisciplinary tools and its application in fashion design product design. The study is a summarized part of the dissertation research of the authors and aimed to develop a methodological tool to contribute in the process of designing fashion products for people with some kind of reduced mobility.

The method of this research is a qualitative, exploratory and applied research, regarding contexts about people with disabilities and low motility, ergonomic approach, fashion design and project development as well as methods, tools and instruments related to projectual context and its concepts. Supporting the theoretical basis, an analytical approach was performed regarding methods of project from design, fashion and ergonomics aiming at a macro understanding of the processes of projects (BONSIEPE, 1984; LOBACH, 2008; MUNARI, 2008, BACK et al., 2008; MONTEMEZZO, 2003; IIDA, 2005; MARTINS, 2005).

The research resulted in projectual guidelines that enhance and optimize the clothing design process focusing on people with reduced mobility, providing a creative possibility in fashion regarding methodological tools and increasing inclusion and accessibility. The guidelines propose as a final result an ergonomic approach in fashion aiming comfort, safety and usability.

Understanding the project specifications required for a development that encompasses users with reduced mobility, focusing on usability and comfort, it is possible to provide a
better approach to those users in the teaching/learning environment, instrumentalizing students and professionals in designing for disability.

**Keywords:** Fashion Design. People with Reduced Mobility. Comfort. Fashion Design Methodology.
Human factors/ergonomics (HF/E) in Canada is a relatively new profession: the Association of Canadian Ergonomists (ACE) was founded in 1968. A paper encouraging universities to develop major and minor programs in HF/E was first presented at the Association’s Annual Conference in 1990. At the time, there were only occasional independent courses in HF/E offered in various departments including psychology, kinesiology, systems design engineering and industrial engineering. ACE was attracting members, and HF/E specialists were working across Canada in defense, private and public sectors, as well as in education. In 1998, the Executive Council of ACE formed the Canadian College for the Certification of Professional Ergonomists (CCCPE), and appointed a Board. That Board includes representatives of both official languages (English and French), each geographic region, and the range of physical and cognitive HF/E domains. Certification requirement criteria were developed under two categories: Canadian Certified Professional Ergonomist (CCPE), and Associate Ergonomist (AE) for those without sufficient practice. Educational requirements for both CCPE and AE were designed, consistent with those of the International Ergonomics Association (IEA), to cover the entire breadth of HF/E. CCCPE designated minimum educational hours in specific HF/E topics (physical, macro, cognitive, design), laboratory work, and supervised field work. When applying, CCPE applicants must demonstrate that they devoted the majority of their work time to the application, practice and/or teaching of HF/E for five years (or four years, including one year mentored). A “grandfathered” certification was created for those with 25+ years of experience. Applicants also must include work products demonstrating HF/E competencies, including preliminary project definition, systematic analysis, participation in the design process, and other competencies. From 1999 to 2015, 237 people were designated as CCCPE and another 60 as AE. The majority of applicants come from educational backgrounds in kinesiology or human kinetics from universities including Waterloo, Simon Fraser, Windsor, McMaster, UQAM, Queen’s, Dalhousie and Guelph. Over time, ACE and CCCPE recognized applicants’ challenge meeting the minimum number of educational hours, as well as laboratory and field work specific to HF/E in current undergraduate programs. In response, the minimum hours were changed in 2017. Some new programs were designed specifically to facilitate certification. A one year program began in 2016 at Fanshawe College to provide CCPE required coursework, laboratory and field hours specific to HF/E for those with an undergraduate degree in kinesiology. CCCPE is currently processing approximately 13 CCPE applications, and partly as a result of Fanshawe’s program, 30 AE applications. Most certification applicants still require education beyond one undergraduate program. It is expected that changes to both educational requirements and new programs like Fanshawe’s increase numbers of Certified HF/E specialists in Canada. Furthermore, ACE and CCCPE are applying for IEA recognition of CCPE certification.
The role of design in use in agriculture: the case of Brazilian crops

Type: Abstract Oral Presentation
Category: Agriculture
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Introduction:

Brazil is the world’s biggest supplier of sugar, orange juice and coffee (OECD/FAO, 2015). Harvesting is one of the most critical phases in any crop once it determines the quality of raw material obtained and future production for the next seasons. Sugarcane crops are more uniform allowing the complete mechanization of harvesting. Orange crops, on the other hand, present variability and require special handling to preserve quality so the harvesting process remains manual preponderantly. The aim of this research was to explore how the distinct characteristics of sugarcane and orange crops influence the construction of instruments, promoting a discussion about design in use in Brazilian fields and its role to improve productivity and safety.

Method:

Multiple case study was conducted at 9 sites: 3 sites of sugarcane crops and 6 sites of orange crops. Task analysis, observations, interviews, questionnaires and video footage were undertaken at each site. Through the mentioned techniques, it was possible to analyze workers’ perceptions and to deepen the understanding about harvesting processes of both crops.

Results:

The design in use was identified in the simplest artifacts used in manual orange harvesting and also in the complex sugarcane harvester machine. The modifications made by the harvesting teams in all studied sites aimed the appropriateness of objects to local conditions and real needs, transforming them in instruments, improving reliability, safety, health and productivity.

Discussion:
In agriculture, a sector where working conditions still need to be significantly improved especially in developing countries, it is argued that design in use appears as a solution for the problems faced by workers in the field, as a essential mean to maintain health and productivity at work. The design of artifacts (varying from tools to complex machines) can be improved if there was an effective participation of workers in design process, as in the dialogical approach proposed by Béguin (2016).

**Keywords:** sugarcane harvest, orange harvest, instrumentalization, ergonomics

**References:**


Recommendations for the development of accessible games for people with Down syndrome

Type: Abstract Oral Presentation
Category: Others
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In Brazil, there isn’t a census which indicates the number of people with Down syndrome, but it is estimated that 270 thousand people have it (MOVIMENTO DOWN, 2012). This syndrome has several degrees of impairment, which causes intellectual and motor delays. In face of it, this team started to think in a way to help these persons to develop their abilities and quality of life. As a result, mobile games were a solution found, because as Vygotsky (1991) said, games promote the intellectual, social and moral development, and the type chosen was based on the fact that mobile is the most platform used to play nowadays. So, before solutions were projected, this research aims to create a list of accessibility recommendations for designing games based on the people with Down Syndrome characteristics. Is it important to know, that it represents the first step of the master’s thesis study and other guidelines were added to complement the guide. Therefore, an exploratory research was made to get to know the impairments that the trisomy 21 could cause. This study was based on Silveira (2012), Danielski (1999), Movimento Down (2013, 2015), Lima (2011) and Marques (2012) and establishes 6 recommendations for visual, auditory, speech and language, short memory, concentration and abstract thoughts difficulties. Although this list was not tested yet, because a mobile game is being created following the criteria, the team believes that they can contribute to making accessible games and the recommendations do not prejudice the gameplay or the game design cycle of production. It just suggests some inputs on interface and configuration modes to help this and other people.
[1825] Development and testing of an IMU based arm tracker for sensorimotor tasks in Virtual Environments

Type: Abstract Oral Presentation
Category: Robotics

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Advances in computing, sensor and display technology mean that immersive virtual and augmented reality environments are becoming increasingly more realistic and affordable. Humans can now easily experience virtual environments (VE) through visual means.

However, in order to reap the full range of benefits these technologies can offer, it is of essence to provide the ability to control an avatar body within a VE and especially the upper limbs. The integration of arm movements in such environments both increases the immersion of the user, and opens new pathways for exploring and interacting with the VE. Moreover, it allows for increased capabilities in training and assisting humans in various tasks.

Systems that achieve this integration already exist, but most are based on tracking the user’s movements via externally mounted cameras, thus restricting the user’s capabilities of moving through the real world to the area the cameras can track. Using three MPU9250 IMUs and an Arduino Nano microprocessor, we developed a wearable system for unobtrusively tracking the movement of the arm from the shoulder up to and including the palm. The system was used in conjunction with an Oculus Rift DK2 and an environment designed in the Unity Game engine, to create a VE “shooting target practice” task. The above setting allowed the virtual arm to be completely controlled by the movements of the user’s arm in the real world with negligible lag.

In the proposed communication we will present a series of experiments designed to determine whether the visibility of one’s limbs movements in real time in a VE, improves the effectiveness in the execution of sensorimotor tasks within that environment. Extending from the above, we also explore the degree to which a human can assimilate a virtual representation of their arm with their body image, and subsequently incorporate this representation into their body schemas, as well as the speed and ease with which that assimilation occurs.

Twenty participants were asked to complete a virtual laser beam shooting task. Targets were randomly appearing within a 360° egocentric globe. Each participant executed a series of one minute trials in four experimental conditions adequately counterbalanced for learning effect: (i) full visibility of the virtual arm and visible laser beam, (ii) visibility only from the wrist down and visible laser beam, and finally the above two conditions but with an invisible laser beam. Task efficacy and efficiency metrics were obtained as well as the dynamic position of their palms.
The results of the experiments (analysis undergoing at the time of writing) will provide evidence on the effect of avatar arm visibility on the users’ performance and learning curve in the VE task.
Interactions between car drivers and pedestrians constitute a key issue of driving in urban settings. Especially, in mixed traffic situations with no specific signalling, drivers and pedestrians alike seek informal signs from each other in order to anticipate the other road-user’s intent and trajectory. Specifically due to close distance and low speeds in such settings, drivers and pedestrians are able - and often do - communicate with each other through hand gestures, head nod and other head movements, eye contact, vehicle signals (e.g. flashing lights or honk) and intention movements. The communication with these signals greatly improves road users’ safety, and traffic effectiveness.

This paper presents our initial findings from a field study regarding interactions between drivers and pedestrians in an urban mixed traffic environment. Twenty experienced drivers were asked to drive their own passenger car for half an hour in a predefined course with several signalled pedestrian intersections and mixed traffic streets, while wearing an eye glass mounted gaze sensor. After the end of each driving session, the participant Drivers were asked to watch selected parts of the eye gaze video recording referring to interactions with pedestrians and to comment aloud on the process of their decision making for each case of interaction.

Driver’s eye gaze and scene video as well as their retrospective commentary were later analysed per typical interaction scenario (e.g. pedestrian vertically crossing one way street at intersection, pedestrian diagonally crossing on straight street section, pedestrian moving parallel to cars sharing road space, group of pedestrians in the above conditions). Specifically, (i) participant-drivers gaze direction on pedestrians in search of cues to anticipate their intent (ii) implicit cues of pedestrian intent (e.g. head orientation, body orientation, movement) and explicit signals (e.g. hand gestures, head nodding) (iii) participant drivers’ explicit and implicit signals to pedestrians as recorded in the video and (iii) retrospective participant-drivers comments were annotated to reveal the types of different signals and cues used for effective driver – pedestrian coordination.

Preliminary results show that explicit interaction is only necessary in marginal situations and that a complex web of implicit cues, cultural practices and conventions is at the basis of effective and resource efficient driver – pedestrian coordination.
The findings from this study can be used to develop improved trajectory prediction algorithms and external communication systems for automated vehicles, so that their behaviour is more in accordance to human road users’ expectations.
At present, work injuries represent a high cost to companies, mainly those that involve manual work in their activities. The analysis of hand and finger strength in these types of tasks is essential in the design of work stations and the reduction of upper limb injuries. Studies have been carried out in many countries such as the United States and Singapore to determine the strength of hands and fingers of their respective populations, however, there is no evidence of similar research in Mexico.

OBJECTIVE: The main objective of this research is to determine the maximum grip strength and pinch with and without gloves recommended for the population of northwestern Mexico, with the purpose of establishing force standards categorized by age and gender. An experiment was carried out in which 698 volunteers (468 men and 230 women) between 18 and 30 years of age participated. All the volunteers were students with little or no industrial experience. Age was arbitrarily categorized into three groups: 18-19, 20-24 and 25-30 years.

METHODOLOGY. The research subjects were asked to perform their maximum muscular effort voluntarily of grip and pinch in three attempts, holding this effort for three seconds, spaced for a minute, in both hands, with and without gloves and the average of the three efforts was taken as a definitive data.

RESULTS: The results show significant differences between males and females. There is a positive correlation between subject weight and grip strength. Finally, when comparing the strength of grip and pinch with populations from other countries such as USA, Brazil, and England, statistically significant differences were found in the results obtained for the population of northwestern Mexico, so the use of foreign standards (grip and pinch) is not recommended in the design of work stations.
Signal passed at danger events (SPADs) continue to impact safety-risk on rail networks, despite the introduction of novel technologies aimed at addressing their cause and effect. The term “SPAD” describes the incidence of a train encroaching into a section of unauthorised track, usually though a stop signal or other end of limit boundary. Whether the train crosses by a metre or by a mile, a SPAD is treated as a serious situation because safe working within pre-prescribed limit of authority have ultimately failed. Much of the literature has had a tendency to focus on activities within the cab, placing the spotlight on “errors” within the train driving role at what is ostensibly seen as the sharp end of the system. However, a train is not propelled by a single person—it is propelled by a team where distributed driving and train controlling activities must work in concert.

This study set out to explore key contributors to SPAD-risk from the train controller perspective. Interviews were conducted with a total of 52 train controllers from a mixture of rail organisations using a generative forward scenario simulation task (Naweed, 2015) to externalise knowledge and establish sequences of events. This approach not only identified the tangible risk factors in train control activities that could inadvertently lead to (or increase) SPAD-risk, but also the specific strategies that are actively used to mitigate them.

Data were collected from seven organisations across Australia and New Zealand (Adelaide (SA), Perth (WA), Brisbane (Qld), Sydney (NSW), Melbourne, (VIC), and Wellington (NZ)). More than 60 scenarios were created, identifying a milieu of decisions, actions, inactions, mitigations and ways of working that inadvertently led to SPAD-risk. In many cases, the scenarios emphasised key dimensions of the “teaming” aspects of the task, and differences in the underlying values and philosophies between the train controlling and driving cultures. This presentation will show hitherto unforeseen risks and strategies for SPAD-risk mitigation from the train controlling perspective. Drawing on previously collected train driver data, it will also outline a unified conceptual model of train operation combining both the driving and controlling perspectives for further research direction for communities of interest.

References

In industrial manufacturing as well as in private and commercial sector, sales of robots as well as the use of robots in direct interaction with humans are increasing. The different categories of human-robot-interaction and robots are complex and can be divided into communication channel, robot task, physical and temporal proximity, kind of interaction, field of application, robot morphology, human interaction role, degree of robot autonomy, and team composition. This development raises the question of how human-robot interaction can be designed and evaluated ergonomically. In a commitment issued by the International Ergonomics Association from 2000, “Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimize well-being and overall performance”. Due to the heterogeneous categories of human-robot interaction and wide variety of questionnaires and measurement methods, a general answer to the research question of how human well-being and system performance in human-robot interaction can be designed and evaluated is not possible. Every work system and human-robot interaction will have to be designed and evaluated individually.

In the final paper, a literature review with regard to methods for the evaluation of human well-being and system performance in human-robot interaction will be presented. In order to conduct a scientific survey with regard to human well-being and system performance in the context of human-robot interaction, a systematic literature search in Web of Science and IEEE Xplore databases was carried out. Thus, 27 relevant contributions were analysed out of 3854 studies by multistage filtering. In principle, the evaluations used in the studies can be differentiated between questionnaire-based surveys and psychophysiological measurement methods. In some cases, several questionnaires were combined and supplemented with a psychophysiological measurement method. Furthermore, the survey methods differ on whether human well-being or system performance should be assessed.

It is noticeable that the studies examined do not explicitly raise the human well-being but different factors. In the following selected factors and corresponding survey questionnaires are listed based on the literature review: usability (e.g. system usability scale), trust (e.g. trust scale questionnaire, human robot trust scale, trust in automation, general trust in automation), acceptance (e.g. technology acceptance model for human-robot cooperation in production systems), workload (e.g. NASA task load index), and anxiety (e.g. negative attitude towards robots, robot anxiety scale, state-trait anxiety inventory). Performance was examined with primarily examined with regard to effectiveness (e.g. quality, number of errors, accuracy) and efficiency (e.g. processing time). Finally, with regard to
psychophysiological measurement methods, for example, heart rate, electrodermal activity, oculomotor activity, and muscle activity were recorded.
Agricultural work has been known to pose ergonomic hazards due to requiring repetitive force exertion and awkward postures. In Thailand and many Southeast Asian Countries, the rice production industry generates a significant market volume of agricultural products. The rice cultivation process involves multiple stages, of which most tasks rely heavily on strenuous manual efforts and require prolonged working in muddy terrain. Such viscous muddy environment causes farmers to preferably perform tasks without footwear. Due to a lack of comprehensive ergonomics assessment and intervention programs for rice farmers, we conducted a series of studies to examine work postural and environmental factors contributing to lower extremity (LE) pain and malalignment in Thai rice farmers.

Initially, we surveyed pain perception and examined LE alignment in 250 participants, primarily comprising rice farmers (age 18-60 years with experience >= 1 year) without secondary employment, who reside in Khon Kaen province, Thailand. The results showed that farmers perceived the highest hip and knee pain (rating 6.08 and 3.55 respectively) during planting activity. Physical examination indicated that farmers exhibit a high prevalence of abnormal alignments of foot pronation (20.89%) and knee valgus (18.49%). A risk factor analysis revealed years of experience to positively correlate with the degree of specific malalignments.

Detailed analyses were subsequently conducted on a smaller group of 30 farmers. Two-stage ergonomic risk assessment, conducted independently by three expert analysts, indicated the planting process to pose the highest risk of farmers’ LE injury. For the planting process, statistical analysis showed knee pain perception to be significantly induced by motion and posture factors; while foot pain perception was primarily due to force exertion. The environmental factor of muddy work terrain was investigated on participants’ LE during the simulated planting setup on rigid and muddy work surface. A specific posture, involving lifting a foot off the work surface, was selected due to strong association with tensile viscous force. A 3D Static Strength Prediction Program was used to estimate force loading on the LE joints. Muscle activity was captured using electromyography (EMG) during a 10-session simulated task. According to computation results, the knee was found to be exposed to the greatest force increase due to mud
resistance. EMG results showed muddy ground to induce significantly higher levels of biceps femoris and gastrocnemius (knee and ankle) muscle exertion, as compared with rigid ground.

The findings suggested that further development of interventions for rice farmers should focus on reducing awkward posture and forceful muscular exertion due to mud viscosity, particularly for knee and foot during the planting process. The implications of this research are anticipated to benefit the development of low-cost, durable and comfortable footwear coated with materials that reduce the resistive force while working in muddy environment.
A recent systematic review of the literature examined human factors that were linked to poor product quality in manufacturing operations, (Neumann et al., 2016). The main risk factors for Musculoskeletal Disorders (MSD) are high forces, certain postures and vibration, all modulated by time (expressed as repetition, duty cycle or duration). Our research question is, “What is the relationship between risk factors for Musculoskeletal Disorders (MSD) and those factors associated with poor quality in manufacturing operations?” Based upon a consensus process amongst the authors, the relationship of the factors related to poor quality was compared to those leading to MSD. The relationship was rated on a scale of 0-10. A rating of 10 was noted when the quality factor was a strong MSD risk factor. A rating of 0 was give when there was no known relationship between the factors.

Quality factors were present at the product design, process design, workstation design and individual levels. The total number of identified quality factors was 204, of which 54 related to product, 75 related to process, 49 related to workstation and 26 related to individuals. Examples of relationships rated high included the quality factors of “assembly force to insert components” which relates to high forces; of “posture during assembly” which relates to awkward postures; and “forward inclination of the trunk” which relates to high spinal load. Intermediate ratings were given to less direct relationships such as a “small screen font size”, which, in turn, could lead to leaning forward, which in turn, could lead to poor neck posture and higher neck shoulder muscle fatigue. A rating of 0 was given to the “sanitation system of the workplace”. For some types quality factors, such as Load in the Product classification or in Workstation, strong relationships were observed. Other types, such as Environment showed much less commonality of factors. It is of interest that there was a frequently mentioned intermediary, fatigue, in the relationships between the MSD and quality factors; e.g., high force -> fatigue -> poor quality.

In summary, many strong and direct relationships between human factors related to poor quality and MSD risk factors were seen. These factors appear to be largely amenable to control in the engineering design process. Product design and process design that is sensitive to operators’ capacities should lead to both improved operational system performance as well as a reduced risk of developing MSD.
1. I) Introduction

Creative processes and the capacity to innovate are of crucial importance in various areas (academics, industry, political leaders …). This is particularly the case in areas in which stakeholders have to collaborate in order to design new products for users. In order to face national and international competition, companies must indeed offer innovative and attractive products. This is why designers are regularly faced with a challenge: to reach design solutions and develop products that are both new and adapted to future users (Bonnardel, 2012). In order to favor their creative activities, the designers can use different methods (Brainstorming, TRIZ method, C-K method, etc), among which we propose a new kind of method of personas.

1. II) Conceptual framework

The personas method

The personas method presents the interest of providing designers with user models developed from field data. Indeed, archetypes of users are formed and generally associated with concrete representations including both textual descriptions and photos. They allow designers to learn and collect data about the needs, values, aspirations or frustrations of future users, and they could also favor the creativity of those involved in the design process. Bonnardel et al. (2016) recently proposed a new and improved method derived from the original persona method: the ‘dynamic personas’. In this method, the new types of personas are represented by avatars taking place in a virtual environment. This dynamic representation is intended to foster designers’ empathy with the fictitious user, while providing them with progressive information elements in order to facilitate creative design activities.

Virtual environment

The virtual environments in which the personas take place are information spaces that are computer generated and then shared between different stakeholders. MUVEs (Multi-User Virtual Environment) are one of the most representative examples of emerging technologies that could have a significant impact on the psychological dimensions of individuals as well as on the social and economic dimensions (Fox, Arena & Bailenson, 2009). One of the major advantages of EVMUs is that they allow the collaborative activities to take place at distance, in various professional fields, which has become an increasing necessity in our society (Forens, Bonnardel & Barbier, 2015). Several aspects of virtual environments suggest that they could enhance creative capacities, starting with the fun side of virtual media for users.
The objective of the study presented in this research paper is to propose and test the ‘dynamic personas’ method by comparison with the use of the classical persona method (qualified here of ‘static’ for our comparison).
The reliability and validity of six observational methods for manual and repetitive work

Type: Abstract Oral Presentation
Category: Others

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Introduction

Musculoskeletal disorders (MSDs) are still a major concern in working life and can, besides suffering for the individual, cause employers economic consequences due to sick leave and reduced productivity. Risk assessments of physical factors are of importance for identifying harmful work tasks and for prioritizing and designing workplace interventions. Risk assessments should be cost effective, valid and reliable, but as concluded by Takala et al. (2010)1, many methods are insufficiently tested.

The purpose of this project was to evaluate six selected risk assessment methods, concerning their reliability and validity.

Method

The risk assessment methods were:

1. Occupational Repetitive Actions checklist (OCRA)2
2. Quick Exposure Checklist (QEC)3
3. Strain Index (SI)4
4. Assessment of Repetitive Tasks (ART)5
5. Hand Arm Risk-assessment Method (HARM)6
6. Repetitive work model by the Swedish Work Environment Authority (SEWA)7

Ten video-recorded (3-6 minutes) work tasks were included: 2 supermarket work tasks, meat cutting and packing, engine assembly, hairdressing, 2 cleaning tasks and 2 post sorting tasks. For each work task data of work task length (2-7 hours per workday), pause schedules, handled weights, physical factors, as well as the employees’ ratings of force exertion, work demands and control were given in text.

Twelve experienced ergonomists made assessments using the six methods – twice – with a wash-out period of three weeks. Before the first assessment, the ergonomist were trained in each method.
As alternative for predictive validity, consensus assessments were carried out by three experts and their assessments were used as gold standard for concurrent validity of the ergonomists’ ratings.

Linearly weighted Kappa, $K_w$, was chosen for inter- and intra-observer reliability and validity.

**Results**

The $K_w$ of the inter-observer reliability for over-all risk in three levels were in OCRA 0.37, QEC 0.54, HARM 0.65, and SWEA 0.28. The $K_w$ for specific body parts were, in QEC, 0.44 (shoulder), 0.49 (back), 0.67 (shoulder), 0.86 (neck), SI 0.47 (hand), ART 0.58 (left side) and 0.65 (right side).

The relatively high reliability of HARM seems to depend on data that were given to the ergonomists in text, for example “work task length”, since for the separate items that had to be determined through observation the $K_w$ were low. For the items repetition, movements and postures the $K_w$ was < 0.3. Throughout the methods, the $K_w$ was generally the lowest for ratings of body postures.

As expected, the intra-observer $K_w$ was somewhat higher than the corresponding inter-observer $K_w$ in all methods, and the validity $K_w$ correlated with the inter-rater $K_w$.

**Conclusions**

There is a considerable variation only between ergonomists’ assessments of risks levels for MSDs in the observation methods, and it may be time to, to a larger degree, combine observations with validated methods of direct measurements.
Creating safety in care: Student nurse perspectives

Abstract

Background

Nursing is a social and technical process where nurses create safety and care for patients and themselves. Safety is socially constructed and through interactions with patients and colleagues, student nurses learn to create safety through practice. In healthcare, interactions that promote effective utilisation of job resources (equipment, skills and staffing) are fundamental to optimising safety. Nurses evaluate and reconcile risks during patient encounters by prioritising combinations of risk factors using experiential knowledge to optimise resources. This vignette study examined student nurses’ responses to two patient scenarios, aiming first, to identify the risk factors students prioritise in their safety decision-making and second, how combinations of risk factors influence decisions during delivery of care.

Method

Scenarios involving patient aggression and patient handling were developed into vignettes. Each scenario included four vignettes in a 2x2 design manipulating risk levels (high and low) presented by the patient and available resource levels. For each vignette, participants selected priority risk factors, their decision about care, rated perceived risk to own safety, and level of control.

Participants were recruited from a final-year cohort of 600 nursing students attending an on-campus workshop. Participant groups received alternate presentation of each vignette.
Results

Participants were 257 final-year nursing students, mean age 28.23 ± 8.26 years and 78 per cent female. Responses to the vignettes were 133 for aggression and 124 for patient handling.

In decisions about aggression, risk from the patient was significant $F=9.73$, $p=.002$. High versus low resource level did not affect perceived risk. Care decisions were most influenced by concern for own safety, patient condition and clarity of procedures. For patient handling, risk to self from higher patient risk was significant $F=6.37$, $p<.001$. Care decisions were most influenced by availability of other staff, equipment and clarity of procedures.

Implications for practice

Participants' perceptions of risk were influenced by experience in patient encounters. Resource levels become more important with higher risk from patients, though what combinations of resources are optimal was less clear in aggression than patient handling scenarios. The findings identify implications for practice related to:

- building skills in risk assessment and control through training in simulated conditions to enhance contextual experience
- promoting risk communication within teams for optimising available resources
- evaluating the adequacy of equipment and design of spaces
- ensuring adequate numbers of skilled staff, and
- providing timely access to comprehensive and current patient information.

Conclusions

Student nurses perceive patient handling and aggression risks as qualitatively different, leading to different risk management strategies that emphasise patient condition and assistance of colleagues. This vignette study suggests that enhancing risk communication skills to assist nurses collaboratively evaluate subtle differences in risk situations may promote creative problem solving.
Traditionally, the allocation of function operation has had the purpose of deciding which tasks in a socio-technical system are more appropriate for enactment by humans or machines. Complex sensory tasks and decisions requiring careful judgement have tended to be in the human domain whilst ‘physical’ operations requiring large forces, maybe at high speeds, or fast calculations have been ascribed to automated equipment.

In some systems, however, where technological inputs may not be viable or available, then the use of animals may be introduced to the system, where they have a better capability than the human inputs they replace, to enhance performance and productivity. Animals may be found in many socio-technical systems, and in given situations, which support human endeavour because they are readily available and able to provide superior strength, speed, power or greater sensory capabilities than can be provided by direct human inputs. A wide range of examples of the use of animal inputs in productive systems or processes is given and the reasons for their selection explained. These are based on their suitability for a given task or tasks as indicated by allocation of function.

To make the most effective contribution to system performance, it is appropriate to apply the concepts and principles of ergonomics to the use of these animals. Examples are presented of ‘animal ergonomics’ that demonstrate the validity of applying ergonomics – physical, cognitive and organisational, depending on the context – to improve the performance of systems incorporating animal inputs, and the benefits it can deliver. These examples include system design, human-animal-machine interfaces, biomechanics, work physiology, fatigue, thermoregulation, quality of work output, work efficiency, comfort and welfare, perceptive processes (particularly olfactory), team work, risk management etc.

Finally, the novel concept of animals being regarded as biomechatronic systems components, and thus equivalent to cobots (collaborative robots), is explored and the lessons that may be learnt from developing this comparison, for the benefit of systems including either (or both) these types of component, are discussed.
The theme of human well-being is now at the center of the scientific debate regarding the building design.

The control of the living conditions of the built spaces is a key aspect in the work of the designer in order to guarantee the final user to live in healthy and safe spaces. This importance is also recognized in the field of green rating systems that, in fact, present criteria on well-being, with particular link to the physical well-being of users.

However, in this context it is important to adopt an ergonomic approach that addresses the interaction between the user and the environment as a whole, considering both the factors that affect physical well-being (i.e. thermo-hygrometric, acoustic, lighting, air purity), and those that complete the complex sphere of well-being, that is psychological and social.

In this context, the aim of this study is to appraise how the green building evaluation tools are able to bring out the user well-being in all its complexity, in an user-centered vision.

The study analyses three relevant and widespread rating systems (LEED, BREEAM, HQE) related to the environmental quality all-round e and one with the specific focus on building performance evaluation that affect the user well-being (WELL Building Standard).

The results show that the analyzed tools give sufficient space to the users well-being, even if with some differences in the aggregation and weights of the criteria. However, the attention is mainly referred to the environmental quality criteria, especially in LEED, BREEAM and HQE. Some efforts are still needed to increase the criteria that highlight the features of the building able to promote the well-being in its entirety.
[1745] Effect of fall prevention measures from scaffolds in Japan

Type: Abstract Oral Presentation

Category: Building and Construction

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On the construction sites in Japan, approximately 300 workers are killed by work related accidents every year. From the results of the classification of cause of fatal construction accidents, approximately 40% of the accidents were caused by falls from height and next were caused by collapses. Therefore, the Ministry of Health, Labour and Welfare, Japan (MHLW) has introduced and strictly enforces countermeasures with various safety guidelines for prevention of falls from Scaffolds. Typical guidelines are as follows.

1. Guidelines for the Methods to Erect Handrails First for the Scaffolds Erection
2. Guidelines for the Methods to Erect Scaffolds First

In this study, the features of these guidelines are introduced including the human factor, and the effects on the prevention of the fall accidents are evaluated. Outlines of the results are as follows.

1. Guidelines for the Methods to Erect Handrails First for the Scaffolds Erection

More than ten years ago, there was no guardrail during the scaffolds’ erection works. In this method, upper handrails of the scaffolds are always set from lower platforms using advanced handrails. Then, workers are constantly protected from falls by the advanced handrails at the top of a previously erected scaffold. The MHLW established safety guidelines aimed to increase the adoption of this method in 2003. The guidelines were amended in 2009 for the purpose of fostering enhanced safety in work environments. The MHLW gave the subsidy for using the methods, and sent advisers to construction sites. The use rate of the methods was investigated on 3,657 construction sites in 2011. Approximately 34% of construction sites use the methods. Therefore, it was found that the use of the method was during expansion, but the effect of the guidelines was not evaluated because of the low use rate.

2. Guidelines for the Methods to Erect Scaffolds First

More than twenty years ago in Japan, many fall accidents occurred, because there was no scaffold during the frame erection works of the low-rise house construction. In the methods, scaffolds are assembled before the frame of the house is erected and are used in all construction stages to prevent falls by guardrails of scaffolds. The MHLW established safety guidelines aimed to spread the use of this method in 1996. The guidelines were amended in 2006, to ensure improved safety in work environments. The MHLW gave the subsidy for using the methods, and supported to educate the methods at construction sites. By the enforcement of the guidelines, almost all low-rise house construction sites (more than 90% of the sites) use the methods, and fall accidents at these sites are decreased drastically. The construction methods for low-rise houses improved safety drastically by the spread of the methods.
Seasonal effects of occupational falls on the same level in Japan

Type: Abstract Oral Presentation
Category: Others
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Introduction
In 2005, occupational falls on the same level were the most common accidents in Japan. These falls accounted for 18.0% of accidents at that time. However, by 2015, they increased to 22.3%, indicating a 4.3 point increase in only ten years. Because of the increase of fall accidents, Japanese administrative organization began a campaign from 2015 and February and June were the designated months to cope with the accidents. However, there is no statistical evidence regarding when it is most effective to cope with them and which type of fall accidents (e.g., slip and trip) occur. For example, it is unknown how many falls occurred in each month and how many slips occurred on wet and iced surfaces in each season. This study aimed to identify the cause of fall accidents and the number of falls occurring in each month.

Method
Approximately one-fourth of the occupational accidents reported in 2011 and 2012 published by the Japanese government categorized the causes of fall accidents based on randomly sampled reports of more than 4 days of absence from work. Each report included the date and hour of the occurrence of the accident and a brief description of each situation. Using keywords in each report, these data were categorized for each month as slip, trip, misstep, and others.

Results
The trend of the cause of occupational falls was identical in both years. In 2011, slip falls were the most common and occurred 2,689 (43.1%), trip falls were the second most common and occurred 1,063 (17.0%); and misstep falls were the third most common and occurred 361 (5.8%). In 2012, slip falls occurred 2,766 (42.3%), trip falls occurred 1,158 (17.7%), and misstep falls occurred 333 (5.1%). Slip falls were the most frequent in January 2011, accounting for 20.6% of all slip accidents and the second most frequent slip falls in December. However, the number of slip falls in December was less than half of that in January. Because slip fall accidents occurred most in winter, the 2012 trend closely resembled that observed in 2011.

Discussion
Wet or iced road and floor surfaces contribute the occurrence of slip falls. Slip falls were the most frequent in occupational falls and also slip falls most frequently occurred in winter, especially during the 3 months from December to February. Regional differences could not be identified because the reports did not include prefectures and cities. However, measures for preventing slip falls should be prioritized in winter.
The Differences Between Bowing as among adult members of society in Japan and the Bowing of Japanese Students

Type: Abstract Oral Presentation
Category: Education and Training
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Regarding bowing in Japan, the bowing of students was compared with the bowing of adults. The bowing data of the students was analyzed. The subjects were junior high school first year and second years students (N=12). Data on the bowing as among adult members of society in Japan was based on previous studies.

For the measurement, three infrared cameras and TEMA, high-performance moving image analysis software, was used. In the experiment, motion capture observation points were attached to the head, neck, waist and ankle of the subject.

The recorded data was analyzed with TEMA, and the numerical values for the following six points were calculated.

- Time from start to end of bowing.
- Time and speed from start of bowing to the bottom.
- Time and stopped holding position at bottom.
- Time and speed from the bottom of the bowing to the starting position.
- Change in neck angle during bowing motion.
- Change in waist angle during bowing motion.

Moreover a questionnaire was conducted to survey students about their impressions of bowing.

By comparing the bowing of adults and students, the following points were identified.
First, it was observed that the variance in bowing between students differs greatly. Students are only provided opportunities to practice “master-servant” style relationship bowing, and do not get to learn proper social bowing manners. It can be thought that the bowing behavior of students is strongly influenced by school teacher relationships.

The second observation is the difference in angle of the neck. In social bowing, it is important that the angle is hardly changed. However, in students’ bowing it was found that most subjects were bending the neck around 30 degrees.

The third observation is the difference in angle of the waist. In social bowing, waist angle is said to be suitable from 15 degrees to 30 degrees. However, in students’ bowing it was found that most subjects were bending the waist over 30 degrees.

The fourth observation is the difference in awareness of bowing. As an adult, bowing is a behavior of courtesy. It is necessary for mutual communication, and it is important for building trust in business relationships. On the other hand, the bowing of students is mainly an act of submission in the master servant relationship, and doesn’t allow for a sense of equality.

Through this study, it is demonstrated that there are many differences between the bowing of students and adults. Also, it was found that there are many differences between subjects. It is necessary to better clarify the definitions of social, in order to reduce students’ bowing variance and to develop and implement educational programs that encourage students to become aware of the social benefits and chances for increased communication of social bowing.
OCCUPATIONAL HAZARDS: AWARENESS AND LEVEL OF PRECAUTIONS AMONG PHYSIOTHERAPISTS IN SELECTED HEALTH INSTITUTIONS IN LAGOS, NIGERIA.

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ABSTRACT

INTRODUCTION: Physiotherapists (PTs) are healthcare professionals with immense burden to deliver on the musculoskeletal and general health of patients and clients. Exposure to occupational hazards (OHs) may negatively affect the quality of healthcare delivery. Identification, precaution and control of workplace hazards is key to good service delivery by PTs.

METHODOLOGY: This analytical cross-sectional survey involved 112 PTs, evaluated using a 52-item questionnaire comprising sections on bio-data, job content, physical, mechanical/ergonomic and psychosocial health hazards, precautionary measures, physiotherapy- specific hazards and influence of OHs. Data were analysed using Statistical Package for Social Sciences version 20. Chi square test of association was used to find the relationship between variables.

RESULTS: Forty-seven (42%) respondents reported that their job output is reduced as a result of OHs; forty-five (40.2%) that their motivation is dwindled as a result of OHs; fifty-four (48.2%) that OHs led to their frequent musculoskeletal symptoms. Whereas forty-nine (43.8%) respondents felt that OHs led to their permanent injury/disability, thirty-seven (33%) admitted that they are often exposed to communicable diseases such as Tuberculosis, HIV and Hepatitis. Chi square analysis showed no statistically significant association between highest educational attainment and level of precaution among PTs. However, there was a statistically significant association (p= 0.015) between duration of time spent at work daily and level of precaution.
CONCLUSION: Early identification, precaution and control of OHs by PTs is imperative. Improved knowledge, perception and practice of occupational health and safety will further enhance work health, safety and productivity.

KEYWORDS: Occupational hazard, work health, precaution, physiotherapist, Nigeria
User-centered design: ethical issues

Type: Abstract Oral Presentation

Category: Education and Training

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In this article we discuss the ethical aspects involved in the application of the methodology of the user centered design. In the design practice, the designer faces situations, which deserve preparation and training to obtain the desired success with the users. When the target audience are people with disabilities there is a need to develop specific protocols for approaching subjects. In certain cases, it is necessary the support of specific professionals of the health area in the data collection stage and in the monitoring of the activities in the observation of the accomplishment of tasks. We present to the readers some user-centric application-centric applications of educational practice that have been applied to the development of assistive technologies. And the vulnerability points of the user-centered design method, which expose both the project team and the users in situations of emotional insecurity, expectations and frustration, are discussed. In the specific case of people with disabilities, there were situations of dispute for the authorship of the final project, as well as the transfer of information to third parties. In these cases, causing discomfort for both. It is also highlighted in this discussion the situations that presented excellent results, in which there was a perfect harmony between the designers and the users, converging to very positive results. And after presenting the elements of observation of the design practice of user-centered design, we discussed the need for certain specific practices and guidelines to be applied for the development of assistive technology. And we conclude that the application of user-centered design requires above all a higher level of perception and skills of the design team when it comes to subjects with disabilities. And that in the case when it comes to blind or deaf users, the preparation of the project team should be much higher, it should also involve the expansion of capacities of tactile, olfactory perception. It is also recommended the learning of languages such as Braille and sign language, as well as the knowledge of specific softwares of languages of accessibility.
Worldwide, health has been a major concern as the population grows and ages. This propagates the increasing demand on more sustainable and effective healthcare system that will benefit the people as well as the constraints on the side medical field. This type of issue is very much abundant in rising countries such as the Philippines where resources are scarce and misutilized. In order to possibly mitigate the issue, TeleHealth system in a form of smartphone application is considered as a possible solution for it given the increase in smartphone adoption and connectivity in the said country. One of the pioneer in this channel is SeriousMD which aims to fill in the gap between patient to doctor interaction. Conceptualized in 2014, the developers recognized the need that patients and doctors needed a better medium in order to connect and understand each other better and the availability of the channel that can make records, consultation, and assessment accessible and efficient aiming the fix the imbalance between the healthcare and patient demand. But then, in order to fit with the current demographical characteristics of the Philippines, usability and user experience should be considered in order to catalyze adoption of it. Considering for it to be pioneer in the said channel, this study evaluated for affective and pleasurable design considering the stakeholders under the Philippine setting. Pinpointing objective design that limits and propagates better usage. More so, connecting to the inherent human factors for a more effective design that can translate for adoption and use behavioral intention - considering theoretical aspect of the design. In the end, various recommendations are given focusing on a more sustainable and effective design.
Chronicle workshop as a data collection method in evaluation of national work environment intervention

Type: Abstract Oral Presentation
Category: Others

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Include in: ‘Chronicle Workshop in intervention and evaluation research and practice’

This abstract assesses the value of chronicle workshop as a data collection method in intervention evaluation.

Chronicle workshops were used in two case study hospitals to create an overview of: i) the hospitals’ use of a national guideline on moving and handling people (MHP); ii) their implementation of the guidelines; iii) events and conditions that hindered and facilitated the implementation; and iv) who had been involved. Data from the chronicle workshops were supplemented by in-depth semi-structured interviews with key stakeholders and document reviews. The purpose of the case studies was to explore for whom in what circumstances and why (or why not) the guidance in the guideline worked. The chronicle workshop method was chosen to use the synergy created by bringing people together with different backgrounds and perspectives on MHP in the hospitals and to minimise the time spent on stakeholder interviews.

One chronicle workshop was conducted at each hospital. The participants were chosen by the hospital’s MHP coordinator in consultation with the researchers. The participants included representative from senior management, the MHP coordinator, trainers and representatives, people engaged with MHP, and health and safety representatives. Each workshop took four hours and was structured in two parts as used in previous studies (Gensby, 2014; Limborg & Hvenegaard, 2011): 1) Developing a timeline that identified important events, influential stakeholders and emerging debates and issues; 2) Interpretation of key trends, dividing the story into chapters and identifying factors that have supported and hindered implementation of MHP. Based on workshops, the stories were then written by the researchers and sent to the participants for comments.

The two stories identified overall external and internal events that had influenced implementation of safe MHP practice and when the events had occurred. The stories identified how contextual factors like budget constraints, facility design and organisational processes facilitated or hindered implementation. In relation to the national guidelines, this helped to explain what worked or not, under which conditions (contextual factors), and who in the organisation had helped make them work. However, the stories did not provide details about how people had facilitated the implementation or why they had not been able to overcome resistance. This information needed to be collected through interviews with the key stakeholders. In conclusion the chronicle workshops provided good information on contextual factors, important events and factors that hindered and facilitated the implementation. However, they did not provide enough details on individual strategies and why they worked or did not work. Thus chronicle workshop is a good method to gain
overview of implementation effort but details need to be collected via other methods to inform how national programmes can help implementation in organisations.
The work of emergency brigades impose very high physical and mental demands, mainly because they can occur at any time and may reach unpredictable magnitudes. Unfortunately, in many companies, emergency brigades are organized with people who perform different types of work, often of a sedentary nature, without special training to comply with these dangerous tasks.

With the aim to evaluate the impact of formal physical training, the objective of this study was to compare the physical fitness, in terms of body composition and response to controlled exercise, of two groups of workers with different degree of physical training.

The subjects worked for the same company, but in two different industrial plants. In one of them they had a physical training program, guided 3 times per week during working hours by a physical educator, while in the other plant there was any consideration neither facility for training of the volunteers who were part of the emergency brigade.

Age, body mass and stature were recorded and the body mass index (BMI) was calculated from the last two variables. Fat mass was estimated from the technique of Durnin and Womersley which has been demonstrated valid for estimating body composition of Chilean workers. With respect to response to exercise, the classic extrapolation method developed by Maritz et al was used to estimate aerobic capacity after applying three workloads in a bicycle ergometer. Additionally, physical working capacity 170 (PW170) was also estimated. The techniques used in this study have been described by Apud and Meyer (2009).

Results showed that age and stature were the only variables not significantly different. In fact, aerobic capacity was, as average, 20.8% higher in the trained brigade. Body fat content was significantly higher in the untrained brigade. A further analysis showed that according to Chilean standards for emergency brigades, 58% of the untrained brigade members do not reach the recommended level, while only 19% of the trained workers are below the reference level. Furthermore, percentage fat mass revealed that 58 % of untrained workers had more than 25% body fat and there were no workers with less than 20% fat mass. In other words, all the untrained subjects had some degree of overweight or were obese.

As conclusion, the results only confirmed the importance of physical training to improve working capacity of subjects exposed to heavy manual work and this is particularly valid for workers who in their daily occupations perform light activities and in isolated occasions have to face very high and dangerous demands. Therefore, the main recommendation is to stimulate physical training within working hours as part of the necessary preparation of the brigade members to attend emergencies.
PREVALENCE, CORRELATES AND PREDICTORS OF MUSCULOSKELETAL DISORDERS AMONG NIGERIAN PHYSIOTHERAPY AND ARCHITECTURE UNDERGRADUATES

Type: Abstract Oral Presentation
Category: Education and Training

Echezona Nelson Dominic EKECHUKWU1,2; Ifeoma Nmchukwu ONUORAH1,2; Antoninus Obinnra EZEUKWU1; Amarach EKPEMIRO3; Deborah Duru4

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OBJECTIVE: To estimate the prevalence of Musculoskeletal Disorders (MSD), its correlates and predictors among undergraduate students in a Nigerian University.

METHODS: A cross-sectional study of 200 undergraduates from Architecture and Physiotherapy departments. MSD, General Health (GH), Perceived Stress (PSS) and Emotional intelligence (EI) were assessed. Data obtained were analyzed using descriptive statistics, chi-square, Spearman rank correlation and binomial logistic regression at α = 0.05

RESULTS: The total prevalence of MSD was 77%. There was a significant association between Knee MSD and department of study ($X^2 = 5.604, p = 0.018$). There was a significant relationship between Neck MSD and duration on the drawing board ($r = -0.244, p = 0.043$). MSD was significantly predicted by each of the length of sleep (OR = 0.128; $p = 0.034$), weight (OR = 1.471; $p = 0.036$), height (OR = 19.510, $p = 0.037$), BMI (OR = 12.547, $p = 0.037$), EI- self management (OR = 5.136; $p = 0.032$) and EI- social awareness (OR = 5.918; $p = 0.015$)

CONCLUSIONS: There is a high prevalence of MSDs among undergraduate Physiotherapy and Architecture students. Length of sleep, EI and some anthropometric variables are important predictors of MSD in this population.

Key Words: General Health, Perceived Stress, Emotional Intelligence, Anthropometry
Conceptual and practical strategy work to promote Human Factors and Ergonomics in Sweden

Type: Abstract Oral Presentation
Category: Education and Training

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The rationale of the Swedish Ergonomics and Human Factors Society (EHSS) is to strengthen the quality of human factors and ergonomics (HFE) knowledge and practice in Sweden. The aim is to create value for members and form a multidisciplinary platform for collaboration across disciplines and professions, and disseminate research results, methods and tools into practice.

This paper describes the results of the conceptual and practical strategy work performed by EHSS of today. The work is inspired by the notion of joint strategies at national and international levels to strengthen and develop the HFE discipline and profession. Further, it is a continuation of EHSS work presented at the IEA conference 2015.

EHSS consists of 350 members, representing different occupations in industry, academia and the public sector. Together, EHSS members hold knowledge and experience in physical, cognitive and organizational ergonomics. The composition of the EHSS’ board purposely mirrors the diversity of the members in gender and professions.

To evoke societal awareness and need for high-quality HFE work, EHSS is currently active in the following arenas: Education and training (university and vocational), Research and development, and Ergonomics design for all, aiming to spread knowledge of inclusive and universal design among different stakeholders towards a more social and sustainable society in Sweden.

EHSS members have recently participated in the development of a launched Massive Open Online Course (MOOC) about work on human terms, and a masters’ program on technology, work and health. EHSS activities has resulted in one research project investigating visual ergonomics in control room environments and another evaluating activity based office solutions.

The EHSS board members perform evaluations of ergonomic products on the market and participate in three standardization work groups for ergonomics. To provide arenas for networking and knowledge dissemination, EHSS has started three networks for visual, physical and voice ergonomics, and regularly organise After Work and breakfast seminars.
(also broadcasted online). Also, the EHSS newsletter, which covers current HFE news and activities, is digitally distributed to members four times a year.

The annual Nordic Ergonomics and Human Factors Society (NES) conferences have become a meeting ground for HFE researchers and practitioners. Every five years, the conference is held in Sweden, arranged by EHSS. All members are eligible to apply for a scholarship to be able to participate in any Nordic HFE conference, and EHSS also annually administers a student thesis prize.

To summarize, the EHSS’ activities are one step towards broadening the knowledge and application of HFE in Sweden, and to comprise new arenas of specialization. The mission is that together, practitioners, product developers, researchers, teachers and authorities can improve safety, efficiency and well-being for all people working and living in the society.
Interventions for improving working environment in home care work. Result from a Scientific Review.

Type: Abstract Oral Presentation
Category: Others

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Home care services are an important part of the Swedish social welfare system. Considering the size of the sector and the increasing future needs for home care, due to growing elderly populations, it is worrisome that problems in terms of injuries, sick leave and staff turnover appear common in this occupation. A problem for managing the situation is, however, that the current knowledgebase is fragmented and not much developed. One of the most obvious features is that home care is characterised by a homogenous workforce in terms of gender, dominated by women. A common perception is that this work is low skilled and something that can be done part time in parallel with household work.

To improve the working environment in home care work, we initiated a project in which one of the goals were to create a better overview of published results of interventions and practical examples from community practice. Accordingly, we undertook a systematic review of the scientific literature with the purpose to find and map practical examples of interventions.

The preliminary result of this work suggests that there is a considerable lack of knowledge and often poor analyses of the consequences of the unequal gender balance in home care work. Further, the results could be grouped into four types of interventions: scheduling, education and training, organizational change and digitization. Interestingly, it seems as if single problems to a larger extent is covered in the scientific literature while problems on the system level are more seldom addressed. In this presentation the result will be discussed and proposals for improvement will be presented.
Excavator operator is a creative profession that optimally combines solid crafts-manship with modern technology. It requires extensive training to become skilled. Safety is of highest concern in education, since several risk factors are involved when unexperienced operators control powerful machines. An instructor needs constantly supervise real-life training. Training simulators are useful tools. Simulator technology enables a safe and effective environment no matter of weather conditions, for a low cost in a non-polluted way. Students can practice as much as needed without an instructor and follow-ups are easy to assess.

The purpose of this study was to further develop an excavator full-scale training simulator. The aim was to identify tacit knowledge and key parameters that characterise a skilled excavator operator and develop instructive training assignments to improve students' skills in regard to safety, quality, economy and environmental sustainability. The assignments should be appropriate for student training, repeated training and for evaluation of competences when selecting new employees at construction sites. The methods used were literature studies, cognitive theory, interviews with instructors, professional expert drivers and students, observations at construction sites, focus groups with simulator developers and usability tests with students and instructors of implemented changes.

The key parameters found for being a skilled excavator operator were divided into physical and mental capabilities. Regarding physical abilities coordination, reaction time, fine motor skill and peripheral vision are most important as well as possibilities to reach and grab various operating devices such as levers, knobs and regulators. Regarding mental capabilities attention, perception, ability to concentrate and simultaneous capacity are essential, which in over-all can lead to achieving high situation awareness.

In the simulation software the abilities became about 30 metrics and were registered as physical and mental abilities in real time. Advanced algorithms were developed for continuous evaluation of combinations of metrics to find hazardous behaviour, environmental sustainable operations and high quality operations. This resulted in three final scores describing achievement of safety, quality and economy when executing a training task in the simulator. When executing a task, the students are provided with continuous feedback on the screen about their present success rate regarding safety, quality and economy.

The results from the usability tests showed that the students became more motivated and enthusiastic, due to the continuous feedback of their performance and the possibility to understand what to improve. To compare results from time to time individually as well as informal competitions between students could make them gain better skill in a shorter time. To conclude, presenting results of how well you perform excavating in a safe way with high
quality and economy and understanding how improvements of performance can be done are important aspects for the student's adaption to real working situations.
Upper arm elevation in blue-collar work with and without exclusion of arm elevation during sitting

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Extensive work with unsupported elevated arms is associated with increased risk for neck-shoulder pain (1,2). Unsupported arm elevation above 60° for more than 10% of the workday has been suggested to be an action limit for when to intervene (3). Tri-axial accelerometers may be used to measure upper arm elevation over the full workday. But accelerometers cannot identify whether the arms are supported, which will likely occur more often during sitting than standing/walking.

The aim of the present study was to compare upper arm elevation data calculated with and without exclusion of upper arm elevation during sitting, and to determine the extent to which exclusion led to changed associations between arm elevation and neck-shoulder pain.

In the NOMAD (4) and DPHACTO (5) studies, arm elevation was measured for several days using accelerometers. Periods of sitting were identified using an additional accelerometer on the thigh.

In NOMAD, arm elevation was compared for work and leisure in 13 occupational groups (n=197), including some known to contain work tasks requiring workers to have unsupported and elevated arms to a considerable extent.

In DPHACTO, the association between arm elevation at work and neck-shoulder pain during the following year (n=660) was determined among transportation workers, cleaners and manufacturing workers.

In both NOMAD and DPHACTO, analysis were performed with and without exclusion of upper arm elevation during sitting.

In NOMAD, arms were elevated above 60° (%timeAbove60°) for, on average, 10.4%time (SD 7.2) during leisure and 7.4%time (SD 5.5) during work. None of the occupational groups showed a higher %timeAbove60° during work than during leisure. When arm elevation during sitting were excluded, %timeAbove60° decreased to 2.3%time (SD 1.3) during leisure and 4.4%time (SD 4.4) during work. With arm elevation during sitting excluded, construction workers, garbage collectors, manufacturing workers and cleaners had a significantly larger %timeAbove60° during work than during leisure.
In DPHACTO, transportation workers had 10.2 %timeAbove60° (SD 6.5), cleaners 5.5%time (SD 2.4), and manufacturing workers 6.0%time (SD 3.7). This decreased to 4.2%time (SD 4.3), 4.0%time (SD1.4) and 4.3%time (SD 3.1), respectively, when arm elevation during sitting periods were excluded. In contrast to previous studies (6–8), no significant association were found between %timeAbove60° and neck-shoulder pain. An explanation may be that exposure to elevated and unsupported arms, as estimated by excluding sitting periods, was too low to entail a risk.

These results show that a large proportion of time with elevated arms may derive from sitting. Data without arm elevation during sitting may better reflect unsupported arm elevation than unadjusted data. Thus leading to more trustworthy associations between upper arm postures and neck-shoulder pain.
Considering the percentage of elderly people in Brazil – 60 years old or more, have doubled between 1960 and 2010, in 1960, 3.3 millions people (or 4.7% of the population) were included in this age group, and in 2010 the number escalates to 20.5 millions (or 10.8% of the population) – the tendency is that this number escalates even more on the next few years. The population aging is a notable tendency, but even so the Brazilian market has few options for home furniture adaptations to attend the specific needs for this group. Two rooms call for a special attention for adapting those needs: bathroom and kitchen, those are the rooms were the biggest part of accidents occurs. The objective of this study is discuss the participation of elderly people on design projects of furniture’s for home kitchens focusing on better safety and comfort. To do so, applying 3D scanning technologies, we generated digital human models of a sample of volunteer elderly people that made possible the development of architectural projects and products projects in 3D, contributing for an improvement of this population life quality. The participation of the elderly on the design process of solutions that could attend the space already built and of products that interact with this space is considered to be fundamental. The elderly contribution results on more accurate solutions that conduct us in a faster way to reach the project goals, but also make the project more innovative and help to prevent prejudices and stereotypes.
Virtual Ergonomics and serious game were considered as tools to increase the health and safety of the workers in the workplace. The new approach uses methodologies such as Interactive Design, User-Centered Design and serious game fully compliant with smart manufacturing approach; the activity faces the safety question in Industry 4.0, with attention to new generation technologies that are transforming the safety design and management, as, for example, Digital Manufacturing tools useful to improve the prevention of worker's injuries. The paper shows the case studies developed in Tower Automotive Italy, involving the application of AR, VR and interactive techniques in the improvement of the safety conditions of the operators involved in the workplace. Using simulation software, an unsafe condition was recreated in a virtual environment and using virtual manikins ergonomic analysis on tasks were carried out and, finally, the digital mock up and virtual human were used for the creation of a Serious Game, destined to operators training. The activities to be simulated were chosen after an internal investigation of the potential critical aspects in the company production process and an assessment of the potential improvements that technology can bring in these situations. The ergonomic analysis has specifically dealt with the handling of industrial trailers, in order to identify which is the correct posture to be taken to carry out this operation. The serious game concerned a so-called SOP (Standard Operating Procedure) focused on a critical situation of the moulding department (the management of the block of a semi-finished product into a mould). Both situations could lead to injuries. Finally, the results of the application of these technologies were analysed; the ergonomic analysis was exposed to the operators through a Safety Talk (a meeting whose subject matter is safety), showing the data and the ergonomic indices of the various postures analysed. The workers involved in testing phase were a dozen. A part of them tested the simulation, while others filled a questionnaire focused on the same simulated procedure. The results of the serious game were compared with those of the questionnaire to understand the advantages of the simulation to speed up the learning process of the operators. The work was carried out at the Fraunhofer Joint Lab IDEAS at the Department of Industrial Engineering of the University of Naples Federico II and at the company Tower Automotive Italy S.r.l. (Pignataro Maggiore, CE).
In the spirit of the classical Athenian time (508–323 BCE), resulted from a long-term socio-political transformation from aristocracy to democracy, the system of the law-courts had been set up to ensure both (i) randomness concerning the citizens chosen for a day with responsibility for making judgement, and (ii) procedure transparency as a means for controlling and validating the judicial process.

To meet the above societal values/needs, a constellation of material artefacts was developed (e.g. allotment-machines, coloured sticks corresponding to the courtrooms' colours, official tokens), in order to ensure impartiality in a number of sensitive organizational choices, namely, for allocating: (i) cases to courtrooms, (ii) a particular number of archons (the magistracies of the ten Athenian municipalities) to act as daily court-presidents, (iii) a particular number of hellists to act as daily jurors (the hellists being a selected group of 6000 Athenian citizens chosen yearly by lot), (iv) jurors to courtrooms, and (v) a particular number of daily officers assigned with critical auxiliary services in the course of a trial, e.g. men to regulate water-clock, to hand out ballots, etc.

Based on the description made by Aristotle in his book Constitution of Athens as well as findings from excavations in ancient Agora of Athens, this study aims to demonstrate how the system of the law-courts meets contemporary ergonomic principles for user-centred and service design. In particular, using specific examples of the artefacts involved, it is demonstrated how these constellation(s) enabled citizens (i.e. end-users) to effortlessly follow the steps of a highly complex process by recalling rather than remembering the procedure; by minimizing errors through physical, logical and semantic constraints (i.e. pokayoke); and also, by facilitating the officers, other witnesses and the jurors themselves to readily identify accidental or deceptive acts. At the same time, these artefacts acted as “mistake proofing” and efficiency tools, ensuring that the judicial process would meet a set of goals, namely (i) representativeness, since the final judgment needed to be based on a representative number of jurors from the ten municipalities and (ii) efficiency of flow, since the entire process needed to be completed by dusk.

Furthermore, it is shown that the system of the ancient Athenian law-courts represents an exemplar case of a highly sophisticated sociotechnical system, designed around the understanding of societal values and the users' micro-moments throughout their entire journey. This approach lies at the heart of modern service design literature.
In recent years competitive computer gaming – eSports – is becoming increasingly mainstream as audiences, general interest and acceptance of its status as actual sports grows. Its representativeness is backed by numbers: more than 33 million unique viewers on average watched the 2017 World Championship (a League of Legends championship) and the prize pool for Dota 2, The International championship earlier this year topped the 20 million dollars mark, according to the eSports analytical service ESC. As eSports consolidate itself as a possible career path, it is a natural step to start investigating its particularities regarding athletes’ work, from an ergonomics perspective. This exploratory study aims to achieve a better understanding of the constraints and issues faced by eSports athletes in their work. To that extent, we analyze 36 interviews conducted with professional players of Counter Strike: Global Offensive (CS:GO) in 2017 by the HLTV.org website, a news organization focused in covering CS:GO competitions. The interviews analysis followed the general inductive approach for qualitative data analysis and focused on gaining insight on players’ work, uncovering possible issues related to ergonomics and human factors aspects on the physical, cognitive or organizational domains. Although the interviews were not designed by the researchers and hadn’t ergonomics as their main subject, they still provided useful information about players’ work, the dynamics in their teams and their overall work strategies, thus being a prolific start point for better understanding eSports, its particularities and the main challenges and constraints players face. Furthermore, the inherently digital dimension of their activities, intensive need for communication and coordination in-game and long time spent in front of the computer screen are some of the most salient aspects of eSports athletes’ work uncovered from the interviews’ analysis. This exploratory study can be seen as a first step for an ergonomics and human factors understanding of this emerging work situation. Further studies on this theme are necessary to understand the work of professional eSports’ athletes and, possibly, improve its conditions.
Currently Autonomous Driving is one of the dominant trends in the automotive industry. Cars that no longer need the driver’s attention will be used in a completely new way than is currently the case. Fully autonomous driving would allow drivers to participate in the so-called “non-driving secondary activities”. In the future, the car would be a place to work, a place to socialize, to relax, to meditate, spend quality time with the family, take a nap, to meditate and a whole lot more. The autonomous driving vehicle would be more of a living space, rather than just a mode of transportation.

In order to facilitate these non-driving activities, the interior of the vehicle and the vehicle seats would be reconfigured and redesigned differently, as compared to the conventional vehicle interiors until now. Given the fact that the space available within a classical vehicle is limited, a lot of importance needs to be given to human anthropometry. In order to offer optimal space and comfort, the interior of the vehicle needs to be flexible and needs to be adaptable and customizable to the anthropometry of the occupant.

The paper helps to understand the importance of human anthropometry in the design and development of the vehicle seating and seating configuration. Discussed in the paper are potential advantages, if human anthropometry is used as a parameter in the design and development of the interior of autonomous driving cars.
This paper presents a new accommodation assessment method for vehicle occupants using a statistical body shape model in an augmented reality (AR) environment. Vehicle occupant accommodation assessment is an important aspect of vehicle interior design. Variability in body dimensions of the target population is a key component in determining the overall user accommodation. Statistical body shape modeling enables quantitative representation and assessment a wide range of variability in anthropometry and posture. UMTRI has developed a range statistical body shape models based on 3d anthropometric data for children and adult men and women with a wide range of body size and age. The models, some of which are available online (humanshape.org), provide a way to efficiently generate a realistic 3d body shape surface along with the standard body dimensions, anatomical landmark locations, and joint locations. In the current study, an automotive posture body shape model based on data from 255 men and women ages 20 to 95 years old was used in a demonstration of AR technology. Typically, quantitative assessment of a physical vehicle requires time-consuming scanning to obtain a computer model that can be used with virtual assessment tools. We addressed this issue by using AR to enable assessment without an explicit model building. Apple ARKit on an iPhone was employed in this study to implement the model in an augmented vehicle environment. The system allows the user to place a human model in a vehicle by detecting the seat surfaces. The user is able to manipulate the body shape to assess accommodation across the range of anthropometric variability. Interior accommodation was assessed by measuring the distances between the certain points from both the model and the augmented physical environment, in addition to a qualitative visual inspection. Opportunities and impacts of the proposed AR approach with digital human modes in more applications are discussed.
The effect of support from supervisor and colleagues between occupational stress and mental health among Japanese sport facilities workers

Type: Abstract Oral Presentation
Category: Sports Entertainment and Leisure
Myunghee Park

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Background: Social support is a influencing factor on health. It is assumed that social support from supervisors and colleagues is an important factor to alleviate the stress response caused by workplace stress factors, and one of the main dimensions of the job satisfaction for exercise instructor. Meanwhile there has been little research on what kind of effect it has on support from supervisor and colleagues at Japanese sports facilities workers. This study examines the occupation stress and support at work experienced by sports facilities workers in Japan. and the effects of support at work on the occupational stress and mental health.

Objective: The aim was to clarify the effect of support at work between occupational stress and mental health among Japanese sports facilities workers. Concretely, for the sports facilities workers, investigate their occupational stress factors and support of their supervisors and colleagues to verify the buffering effect of support of supervisors and colleagues between mental health and occupational stress. Then we verify the buffer effect of support at work between occupational stress and mental health through comparison of two

Method: A questionnaire survey was conducted between May 8 and June 7, 2017 for 500 employees of sports facilities in capital areas. The subjects were ultimately 426 workers (mean age: 33.3 years, SD = 11.3) divided into two groups of the office staff group (N=219) and the exercise instructor group (N=207). Questionnaires used Japan Brief Job Stress Scales (occupational stress factors, superiors and colleagues support), and GHQ 12 items. First we examined correlations between the study variables, and differences in demographic characteristics between the two groups either by t-tests (continuous variables), or cross-tabulation and Chi-square tests (categorical variables), and hierarchical analysis were performed.

Results: The office staff group shows a high score and desirable status on demand of quality and physical than the exercise instructor group. Meanwhile the exercise instructor group has a higher score and desirable status on job insecurity, utilization of skill, job suitability, and meaning of work. In the moderated regressions we found that supervisor support moderated the relationship between interpersonal relationships and mental health for office staff group. Meanwhile support of colleagues moderated an interaction effect of job insecurity for exercise instructor staff group on the relationship of mental health. Similarly, support of colleagues buffered the negative association of quantitative demand and work circumstances on mental health

Conclusion: The role of support at work as a moderator implicates the prevention of occupational stress in the job place should place a stronger on improving social relationships at work.
Analysis of ankle joint motion with different types of sports climbing shoes

Type: Abstract Oral Presentation
Category: Sports Entertainment and Leisure

SEUNG BUM PARK1; KYUNG DEUK LEE1; DAE WOONG KIM1; JUNG HYEON YOO1; JAE MIN JUNG1; KYUNG HWAN PARK1

Footwear Biomechanics Team, Footwear Industrial Promotion Center, Busan Economic Promotion Agency, Busan, Korea, South

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Productive sectors and services
: Sports Entertainment and Leisure

Human Factors and Ergonomics Domains
: Ergonomics in Design
Climbing shoes are the most important and the most basic equipment needed for sports climbing. Different from other leisure sports, the importance of the shoes is emphasized. Climbing shoes stabilize the feet on the different types of holders on the artificial wall, improving climbing abilities of the wearer. The outsoles design of the climbing shoes are different based on the difficulty level of the climbing wall, which is related to different techniques required in different difficulties. Selection of unsuitable climbing shoes without taking into consideration the technical abilities of the wearer can lower the user’s climbing ability and could produce injuries. Therefore, in this study, different ankle joint motions while wearing different types of shoes and performing climbing techniques were investigated to determine the possibility of injuries on the ankle joint.

Twenty participants with over 5 years of sports climbing experience and who can perform the sports climbing motions required for this study were selected. All participants voluntarily participated in this study after detailed explanation of this study’s purpose. The shoes used in this study were Type A, which is for intermediate and advanced-leveled climbers, and Type B, which is for beginners and intermediate leveled climbers. In an artificial climbing wall, the participants were asked to complete 3 sections using intermediate and advanced techniques, including outside step, inside step, foot switch, counter balance, and heel hooking in order. While the participants were performing the techniques and completing the climbing sections, their range of motion of the foot joint was recorded with 12 of 3D motion analysis infrared cameras (3D motion analysis, USA) and data were collected.

The results of this study indicate that Type A shoes allowed larger range of motion for plantar flexion, which is equivalent to higher driving force, than Type B. Also, Type A shoes showed a narrower range of motion in terms of stability and shaking.

Selection of inappropriate shoes can produce inversion and eversion stress while performing intermediate and advanced techniques. Also, inappropriate shoes can negatively impact the ankle joint structures after repetitive climbing motions. Climbing shoes that allow stable support have large range of flexion, which could increase the effectiveness of climbing.
[3105] Analysis of foot pressure and toe spring in different portions of bobsleigh tracks to develop bobsleigh shoes specialized for Koreans in 2018 Pyeongchang Winter Olympics

Type: Abstract Oral Presentation
Category: Sports Entertainment and Leisure

SEUNG BUM PARK1; KYUNG DEUK LEE1; DAE WOONG KIM1; JUNG HYEON YOO1; JAE MIN JUNG1; KYUNG HWAN PARK1

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Productive sectors and services

: Sports Entertainment and Leisure
Title

Analysis of foot pressure and toe spring in different portions of bobsleigh tracks to develop bobsleigh shoes specialized for Koreans in 2018 Pyeongchang Winter Olympics

Bobsleigh is one of the fastest winter sports where the difference of only 1/1000th of a second identifies the winner. Improving time in the initial portion of the track is crucial to improve the overall time. At the start of bobsleigh, the shoe should be able to transfer explosive power to the slippery floor surface to effectively push the heavy sleigh. Although time in the initial portion of the track is very important, most of bobsleigh shoes are designed to fit Westerners’ foot shapes. Therefore, this study investigated the time in the initial portion of the track, foot pressure, and toe spring of Korean bobsledders while wearing sprint shoes in order to provide basis for the development of bobsleigh shoes specialized for Koreans.

Seven bobsledders who represent South Korea from Gangwondo association of bobsleigh/skeleton and Sangji Daegwannyeong high school were the subjects of this study. The sprint shoes used in this study were Type A, Type B, and Type C with different toe springs. Bobsleigh start motion was conducted in a small field. While wearing their respective sprint shoes, the participants pushed bobsleigh for 15m, where the time and the foot pressure was measured and analyzed in the peak speed. The toe bending angle was measured and analyzed 5m from the start point using a high-speed camera.

Although the results of this study were not significantly different, Type B shoes were observed to be more effective than Type A and Type C shoes in improving time in the initial portion of the track. The foot pressure in Type B was significantly different than in Type A in terms of contact area. In the mid-foot, Type B was significantly different from Type A and Type C.

The hardness of the shoe’s outsole and midsole are related to energy return, which is required to acquire driving force. Type B used in this study is a spiked sprint shoe designed for track & field, where the sole is harder than that of Type C, which was designed for mid-range and long-range races. Although no significant difference was statistically observed and Type A was also spiked shoes designed for sprinting, its toe spring was larger and starting record was slower than Type B. In summary, Type B shoes provided optimal toe spring and moment between surface-contact to toe off. Although the forefoot is similar to other control groups, Type B allows large contact area up to the mid-foot, which provides high traction on the ice track.
Comparison of the shock absorption function of new combat shoes by using plantar pressure analysis

Type: Abstract Oral Presentation
Category: Military

SEUNG BUM PARK¹; KYUNG DEUK LEE¹; DAE WOONG KIM¹; JUNG HYEON YOO¹; JAE MIN JUNG¹; KYUNG HWAN PARK¹; YU CHANG KIM²

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Productive sectors and services
: Military

Human Factors and Ergonomics Domains
: Ergonomics in Design

Title
: Comparison of the shock absorption function of new combat shoes by using plantar pressure analysis

Combat shoes are specially designed shoes that are worn by soldiers during wartime and non-wartime activities, and soldiers spend 98% or more of their activity time while wearing these shoes. Soldiers are known to be prone to musculoskeletal injuries, such as fatigue fractures and tendonitis, due to long hours of marching or training. Moreover, because soldiers engage in high-level activities on treacherous terrains, they are also susceptible to various physical aggravations such as fatigue, foot injuries, and physical loading. In the long term, these factors can weaken their combat abilities and physical strength. Accordingly, there have been recent efforts to develop combat shoes with superior functionality; however, testing of such footwear is still very limited. The objective of the present study was to measure the plantar pressure in participants wearing these newly developed Korean combat shoes, to provide quantitative data on the functionality of this new footwear, and develop combat shoes that can help enhance task performance and combat abilities.

The participants in the present study included 10 healthy adult men who received sufficient explanation on the objective of the study and volunteered to participate. The experimental combat shoes (Type A) used EVA material with lower hardness on the outsole (to reduce fatigue and load on the feet) as compared with existing combat shoes (Type B), while the outsole pattern was designed to deliver driving force during walking. Moreover, the upper part of the shoes is made of Goretex material instead of cow leather as in Type B. The weight of Type A and B was 668.25 g and 773.51 g, respectively. For plantar pressure analysis while wearing the combat shoes, Pedar-X (Germany) from Novel was used.

In the present study, the results of mean pressure analysis showed that Type A combat shoes had wider CA in the midfoot and lower MF throughout all regions of the foot than Type B combat shoes, and lower MMP was also generated by Type A.

It is believed that these findings may be attributed to the reduction of shock and pressure generated based on the wide CA during stance phase from the use of material that minimizes pressure from the upper of the
shoe, as well as lower hardness of the sole for absorbing shock from the ground, as compared with the existing combat shoes. A future goal is to test the excellence of combat boots from Korea and abroad through a comparative analysis during the development of new combat shoes.
Effect of heel area on utilized coefficient of friction during high-heeled walking

Type: Abstract Oral Presentation
Category: Healthcare
Sumin Park; Jaeheung Park

Seoul National University, Seoul, Korea, South

Background/objective: Wearing high heels has been reported to increase the risk of slipping during walking with the increased utilized coefficient of friction (uCOF). The potential for slipping during high-heeled walking would be different due to the change of uCOF, if the heel area is different even with the identical heel height. The purpose of this study is to investigate the effect of heel area on uCOF during high-heeled walking and to explain the change of uCOF by understanding the change of gait patterns according to the heel area.

Method: Four shoes with different heel area (Narrow heel: 0.9*0.9cm, General heel: 1.5*1.7cm, Wide heel: 2.8*2.9cm, Wedge heel: one piece of the sole and the heel) having an identical heel height of 9cm were made of the identical outsole material from a manufacturer. Ten females were asked to walk at 1.25m/s on a treadmill, which has two force plates, wearing the manufactured shoes. The uCOF according to the heel area were calculated from ground reaction forces (GRFs) and analyzed using repeated measure analysis of variance with LSD post-hoc test.

Results: As the heel area became narrow, the peak uCOF increased significantly (narrow heel: 0.226, general heel: 0.223, wide heel: 0.209, wedge heels: 0.218, p=0.005). The peak uCOF when wearing the high heels of the narrow heel area was 1.08 times higher than the peak uCOF when wearing the high heels of the wide heel area (p=0.016). However, there was no significant difference in the peak uCOF between the high heels of the wide heel area and wedge heels (p=0.099). The change in peak uCOF with different heel area was related to the change in timing of the peak uCOF (narrow heel: 15.9%, general heel: 16.4%, wide heel: 18.9%, wedge heel: 18.4%, p=0.001) due to the changed timing of maximum anterior-posterior GRF (GRF_{AP}). The timing of the maximum GRF_{AP} occurred quickly as the heel area became narrow (narrow heel: 17.1%, wide heel: 19.1%, p=0.007), while the timings of the maximum medial-lateral GRF (GRF_{ML}) and maximum vertical GRF (GRF_{V}) were consistent regardless of the heel area. The magnitudes of the maximum GRF_{AP}, the maximum GRF_{ML}, and the maximum GRF_{V} and the patterns of the GRFs were also consistent regardless of the heel area. The peak uCOF increased when wearing high heels of the narrow heel area, since the shear force reached the peak quickly by the fast maximum GRF_{AP} before the vertical force was sufficiently large with weight acceptance.

Conclusion: The potential for slipping during high-heeled walking can be intensified at narrow heel area, especially at heel area less than 3*3cm, due to the fast timing of the peak shear force.
Cyberbullying has become increasingly related to children, adolescents and young adults. In spite of the pervasiveness of this phenomenon, however, very often neither bullies nor victims have the awareness of what is happening: cyberbullying may be the consequence of a reduced ability to feel what the others feel. This “emotional blindness” can result in strong discomfort on the side of the victim and provoke serious psycho-physical problems, such as anxiety, depression and loneliness (Nixon et al., 2014).

Research (Tangney et al., 2007; Kowalski et al., 2014) suggests that empathy can inhibit the occurrence of aggressive behaviour. Accordingly, empathy development appears crucial for moral behaviour.

Furthermore, recent studies in the field of neuroscience show that the so-called moral or social emotions, for example admiration and compassion, imply a slower information processing due to a more demanding request for reflection and cognitive appraisal. Contrary to this need, digital communication is very fast and often it does not allow the individual to process information carefully (Immordino-Yang et al., 2009).

The aim of this study is to shed some light on the complex relationship between cognitive, socio-affective and contextual (i.e. the technology and the way in which it is used) factors which intervene in the context of pro-social and antisocial behaviour, both in the real and virtual world. The study has been conducted through a survey on-line in which adolescents were invited to fill in a questionnaire aimed at analysing the use of the Internet and the participation to social networks, the affective and cognitive levels of empathy, moral disengagement, unethical and aggressive behaviour in the use of the Internet and in the real world.

Preliminary results coming from a sample of more than 250 subjects suggest that victims of cyberbullying express mainly anger, rage and contempt and interpret the unethical behaviour they suffer as induced by their physical appearance or their personality.

Bullies instead, contrary to our expectations, report that the emotions they feel most is the sense of guilt, and only in few cases a sense of satisfaction and a sense of justice do emerge. However, it is particularly interesting to note that they are not able to give reason for their misconduct on the web, as if their behaviour were due to a mismatch between cognitive processes and emotions, as if the computer screen could place a barrier between the individual and the perception of her/his own and others feelings.

From this analysis it could be possible to implement educational tools, based on the facilitation of more reflexive behaviour, to counteract aggressive and discriminatory actions in the use of social networks.
Online communication is characterized by the pervasive presence on social media of photos. Most of the photos portray people and particularly their faces. Many times faces are in social media interaction, like in real life interaction, the first and only information humans have to judge someone they have never seen before.

Human face is the basis for judgments about different variables such as gender, attractiveness, and personality traits (Zebrowitz, 2006). Many studies suggest that in response to an emotionally neutral face and outside awareness, people can make a decision about important characteristics of the person they are looking at. These decisions are made in 50 milliseconds after exposure and some stereotypes appear to come into play to modulate the process of attribution of specific personality aspects (Bar et al. 2006; Willis and Todorov, 2006; Todorov, 2017). Faces perceived as more criminal-looking than others can affect criminal justice decision, faces perceived as more trustworthy can predict political election, and cold looking and incompetent faces predict episodes of social exclusion (Rudert et al., 2017).

Judgment related to face perception involves a complex series of factors, due to the physical characteristics of the stimulus and to the observer. Individual differences may indeed contribute to differences in face evaluation. “Women’s trustworthiness judgments for example are affected by the gender of the face. Specifically, women judge faces of other women as slightly more trustworthy compared to male faces” (Mattarozzi et al. 2015).

The study investigates if and how the influence of some observer’s characteristics (gender, personality traits and the degree of empathy) can affect gender categorization process in response to a face. Particularly we examined whether gender categorization and gender stereotype affect the judgment of “victim” or “aggressor” in response to the observation of a male or of a female face.

The study has been conducted through an ad hoc developed questionnaire delivered online to 200 subjects. The questionnaire was aimed at collecting socio-personal data, information on the use of social media, information on the degree of empathy and on personality characteristics of the subjects. The questionnaire included 30 high-resolution, standardized photographs of faces, 15 males and 15 females.

A preliminary analysis suggest that stereotypes that influence the perception of a “victim-looking face” focus on subjects that are perceived as less typically “female” or less typically “male”, this effect being more evident with male faces.

On the basis of these results it should be possible to elaborate indications to improve online social relations particularly in those cases in which relations are mainly influenced by the
first impression of the interlocutor. A better understanding of the process determining social judgment can be useful to preserve network users from episodes of online aggression and victimization.
Recent evidence has shown that young-inexperienced drivers (YID) are more likely than experienced drivers (ED) to be involved in a crash mainly due to their poor hazard anticipation abilities. As any skill, it develops with practice and indeed a large body of evidence has shown that YID can partially improve their hazard anticipation skills by participating in various training procedures. Nevertheless, in so far, most training methods relies on explicit learning where YID are taught what are the hazards that they should look for and where they are located. This study investigated whether YID can implicitly learn to anticipate hazards trough implicit procedural learning. To test this hypothesis, 23 YID and 35 ED took part in the experiment that included a training phase and a testing phase. During training, participants were asked to observe three video clips such that each video clip included a different type of hazardous driving situation. Each type of hazard was presented three times resulting in nine target video clips altogether. Additionally, twelve video clips of filler scenarios were also included in the training phase to reduce familiarity effects in order to maintain the ecological validity of the implicit learning procedure. For each presentation of a given situation, participants were asked to press a response button each time they identified a hazard. No explicit information was provided during this training phase. Then, in order to evaluate the effectiveness of the training procedure participants underwent a testing phase composed of two novel hazardous situations that did not appear in the training phase. An additional group of 24 YID underwent the testing phase without performing the training phase. Behavioral data as well as eye tracking data was recorded and analyzed. This paper focuses on the analysis of drivers scanning patterns as a proxy to evaluate hazard anticipation performance.

During training, YID gradually increased their focus on a visible materialized hazard, compared to ED who demonstrated an opposite trend such that on later repetitions they tended focusing on items that were not related to the hazard. In addition, ED gradually increased their focus on both unmaterialized and the materialized hidden hazards. As opposed to that, YID did not show a learning slope with regard to hidden hazards. These results imply YID were not aware of the hazard as long as the hazard was hidden, regardless of the number of times that the hazard situation was presented. The observed learning effect was also evident in the test phase, by comparing the hazard awareness performance of the trained groups and untrained YID, toward novel hazard situations. Both trained groups focused on the hazards earlier compared to untrained YID. These results imply implicit procedural training might facilitate hazard anticipation acquisition among YID.
Design and evaluation of an enhanced auditory display for measuring a patient’s oxygen saturation

Type: Abstract Oral Presentation
Category: Healthcare

ESTRELLA PATERSON1; PENELOPE SANDERSON1,2,3; NEIL PATERSON1,4; ROBERT LOEB1,5

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Introduction: In the complex and often noisy environment of the operating room, it can be challenging for anaesthetists to monitor patients’ physiological states during surgical procedures. Oxygen saturation is an important measure of patients’ blood oxygenation levels: low oxygenation can result in tissue damage, and even brain damage or death. The pulse oximeter device provides visual and auditory displays of heart rate and oxygen saturation (SpO2) levels. While monitoring the patient’s condition, anaesthetists have many other tasks to perform, most of which demand visual attention. At such times, the auditory display becomes an important source of patient information: its tone rate corresponds to heart rate and tone pitch to SpO2. However, people have difficulty judging SpO2 levels using the current auditory display of the pulse oximeter alone. In a simulated setting, we compared participants’ ability to judge SpO2 parameters using (1) a standard auditory display comprising varying pitch plus alarm and (2) an enhanced auditory display with additional acoustic dimensions of tremolo and brightness, while they performed two distracting tasks. We predicted that performance would be better with the enhanced display compared to the standard display.

Method: The experiment was a within-subjects design with two auditory display conditions: (1) standard display and (2) enhanced display (see Figure 1). After training, 28 non-clinician participants completed two experimental blocks, one using the standard display and the other using the enhanced display. Participants monitored displays while SpO2 varied over three designated ranges—Target, Low, and Critical—and while they made arithmetic judgments and detected spoken keywords. Participants identified when SpO2 transitioned the Target–Low threshold and they identified SpO2 range at the end of each trial. In addition, we measured participants’ target transition latency, arithmetic accuracy and latency, keyword detection accuracy and latency.

Results: When using the enhanced display, participants were more accurate at identifying SpO2 range (p=.007) and target transitions (p<.001), were faster at detecting target transitions (p<.001), and more accurate (p=.003) and faster (p=.049) at detecting spoken
keywords than when using the standard display. There was no difference across conditions in accuracy or latency of arithmetic task (p>.05).

**Discussion:** These results indicate that current pulse oximeter auditory displays can be improved to better support physiologic monitoring. In the challenging sociotechnical environment of the operating room, an effective auditory display would allow anaesthetists to accurately identify SpO2 parameters at a pre-attentive level, attract focal attention when important changes occur and reduce reliance on alarms, and at the same time, allow for safe engagement in other perceptually demanding tasks. Such an innovative display may lead to more accurate and timely decisions about patient treatment, and potentially enhanced patient safety.

**Keywords:** Auditory perception, Data display. Patient monitoring, Pulse oximetry

![Figure 1: Properties of auditory displays](image)

**Figure 1:** Properties of auditory displays.
Serious Game as a creative tool to approach the history of design

Type: Abstract Oral Presentation
Category: Education and Training
Isabella Patti¹; Laura Giraldi¹

¹DIDA Department, University of Florence, Florence, Italy

The purpose of the research is to identify creative learning scenarios in the context of the education of university students attending courses of History and Criticism of Design.

The idea is to integrate the principles of Serious Games in traditional higher training programs to enhance the potentialities of a multimodal educational system that includes Edutainment Approach and the GBL (Game-Based Learning) principles and to implement the active knowledge achieved through simulated experience of the game.

The research integrates the elements that characterize the Serious Games, understood as digital tools for education, with the interactive didactic theories (meta-cognitive, fantacognitive) and the conventional educational approaches, and transforms the results of the research in an innovative serious game called Mu.SA.

Method
The document describes the phases of design/planning of the contents, frame the data acquired within a specific module, connected them in a method of training-learning.

This method inserts the historical-critical contents of the Design (objects, styles, concepts and meaning) into conceptual maps of "enhanced information" that integrate different learning metaphors and has a game-loop based structure.

Main reference context
- Flow concept: "is the experience people have when they are completely immersed in an end-to-end activity that extends the body and mind to the limit in a voluntary effort to achieve something difficult and profitable" (Csikszentmihályi, 1975).
- Five Ludic learning Metaphors (Acquisition, Imitation, Experimentation, Participation, Discovery) and the application of the Tetrad Theory (Shell, 2015).
- Abductive reasoning (C.S. Pierce, 1878) applied to the game Play40 designed by Isao Hosoe in 2008.
- Data obtained from the active participation of students (Design History Course, DesignCampus, DIDA, Florence from A.A. 2015/16).

Goals
The fantacognitive direction of Mu.Sa Method is a training-learning experience centred on the subject, on the use of his experiences as starting point to enhance knowledge.
The aim is to enrich students-players, open them to novelties of the History through an action directed to the subject that make him conscious of his limits and of his resources (theory of ludic-narrative dissonance). In this direction, the tools of Mu.SA Method stimulate experiences that don’t aim to isolate the subject in the self-referential ludic world, but to extend his aesthetic dimension towards a new ability to see, express and explore the project according to its areas of interest rather than by necessarily following a sequence of linear arguments. Mu.SA Method is based a “significant gaming experience that generates gratification and knowledge for players and improves nonlinear vision, critical analysis, and problem solving” (McGonigal, 2011), and create Quality Ludic Experiences by shifting focus to creativity that moves the ideas and creates new ones, enhances individual sensitivity and above all collective work for an innovative way of learning the design.

Type: Abstract Oral Presentation

Category: No productive sector applicable

Gunther Paul1; Leyde Briceno1

1James Cook University, Mackay, Australia

Human modelling tools have been increasingly used in various industries over the last two decades, and consequently software programs have been developed across multiple platforms. MakeHuman is an open source software rarely used in Ergonomics/Human Factors studies. Developed on open source Python code, the program creates realistic appearance 3D virtual human models, which focus primarily on morphing details. It has an intuitive graphical user interface which is working with sliders, controlling input parameters on normalized [0…1] scales. The main parameters are gender, age, muscle mass, weight, height, proportion and ethnicity, all ranging from [0…1]. These input parameters control associated output values, which are partially normalized (weight, muscle, proportion), while others, such as height, are defined on a proportional numerical scale. MakeHuman Blender tools are available, which connect the MakeHuman and Blender software and allow users to modify a base mesh shape, create clothes, apply static poses or produce animations. In recent research works, MakeHuman has been employed most often to generate sets of virtual subjects. However despite an increasing use of this software, limited information was found about its modelling conceptual framework. For this reason, in this study we applied an explorative analysis method to review the MakeHuman software, based on the official source repository of the MakeHuman project and the application design and code documentation freely available. We examined the parametric modelling approach, and the procedure to apply real human poses to the underlying biomechanical model (skeleton), using the MakeHuman Blender tools. MakeHuman is a virtual human modelling tool based on templates. The template model is transformed by means of scaling factors, resizing its segments and proportions, to create a set of human bodies compatible with the original template or base mesh. The template model is divided into parts, or so-called ‘areas of influence’, and form factors are calculated to detect contraction or expansion improving the use of targets in these parts. Fuzzy logic rules are employed in order to obtain the information from the sliders, and then sliders are linked directly to membership functions of the fuzzy sets. There is one morphing target file for each parameters’ extreme values, and if multiple sliders are moved, the values are amalgamated to form a character, using an inference engine that permits to produce a diversity of human bodies. Additionally, we studied the body posing procedure for the spine, specifying joint rotational range of motion and constraints, when manual posing is used in the MakeHuman Blender tools. The study aspires to assess the practicability of using the software in a Human Factors/Ergonomics framework.

Keywords: Digital Human Modelling (DHM), MakeHuman software, parametric modelling, fuzzy logic, Blender software.
Towards parametric modelling of skin cancer risk: Estimation of body surface area covered by protective clothing using base mesh modelling

Type: Abstract Oral Presentation
Category: Others

Gunther Paul\(^1\); Briceno Leyde\(^1\); Harrison Simone\(^1\)
\(^1\)James Cook University, Mackay, Australia

The accumulated exposure to ultra-violet radiation creates an occupational and public health risk, and is carcinogenic to humans. Australia has one of the highest rates of skin cancer in the world and as a consequence, requires essentially more emphasis on appropriate body coverage for prevention. The body surface area coverage by clothing (BSAC) is a requirement in international standards on sun protective clothing and now is included in the latest revision of AS/NZS 4399:2017. BSAC is usually calculated utilizing human subjects or physical mannequins using coating methods (such as: alginate method, or plaster bandage), indirect methods (3D scanner) or direct measurements estimating the fraction of body covered by clothing. These methods are laborious, inflexible and time-consuming; furthermore they do not support standard methods of modern computer based apparel design and development. For that reason and in order to obtain a simpler, process integrated and faster method, we examined a methodology in this study to determine the proportion of potentially exposed body surface area using variable digital human models as virtual subjects, and image processing tools. Parametric, neutral posture human bodies of varying body stature, weight, muscle and age, including females and males, were generated in the public domain software package MakeHuman v1.1.1, and a protective clothing mesh, covering the minimum BSA specified in AS/NZS 4399:2017 was created and assembled. The MakeHuman definition of a human is based on fuzzy logic, and as a consequence the main parameters are normalised. The normalized weight parameter is linked with gender, age, ‘muscle’, height and ‘proportions’ in a non-linear relation. Therefore, changes in body weight were measured with secondary parameters such as waist and hip circumference. The Whole Body Surface Area (WBSA) and the BSAC were obtained employing MeshLab, as the sum of all the elements on the respective surfaces. Surfaces involved were processed to make the surface area precision higher and a procedure was developed to control the geometric inconsistencies (such as gaps) between the body base mesh and the clothing mesh. The selected methodology was used to analyse different representative groups of subjects in a comprehensive approach, and in order to study more detail and generate a better understanding of BSAC by generalizing subjects. While this approach reduces time to calculate BSAC and offers a pathway for a process integrated assessment, it can also assist the evaluation of exposed body areas in a wider spectrum of different occupations with their respective typical workwear and protective clothing conditions.

Key words: Digital Human Modelling (DHM), virtual human body, body surface area, body surface area cover by clothing (BSAC), protective clothing, sun protection, skin cancer
Injuries occurring in connection with bathtubs and showers in the USA in 2010 injured approximately one million people seriously enough to seek professional medical treatment. An estimated 72 percent occurred to people under 65 year of age. Examination of short narratives available for over 7,500 documented hospital emergency department visits in the US in 2010 revealed injuries occurred with bather movement before, during and after bathing due to:

1. Geometry of the impediments one must traverse (e.g., bathtub walls and high sills for dedicated showers)
2. Hard, unforgiving surfaces
3. Slippery underfoot surfaces
4. Insufficient, effective points of control

Of these four key dangers, slippery underfoot surfaces are relatively easily addressed—but in an unorthodox way. In the field of underfoot slip resistance, water is not typically considered as a “friend.” Surprisingly, when applied to an underfoot terry cloth towel, water dramatically improves slip resistance in otherwise slippery dedicated showers and in bathtubs used for standup showers. This is now empirically established but, as it defies convention and occurs in a relative research vacuum, there is reticence about adopting the practice of simply having a wet—or even better—damp towel underfoot while entering and exiting the shower facility and while having a shower.

This paper presents what is known and what remains to be learned about why water and terry cloth are a potent slip-resistance combination that, qualitatively, solves one-quarter of the safety problem with conventional bathtubs and even more with dedicated showers not having a raised sill or other feature for water control.

Combined with code-required improvements to another quarter of the problem—namely lack of effective points of control—new, cost-effective practices in bathroom usability and safety can greatly reduce the injury toll in a more aesthetically pleasing fashion. Such points of control can also be unorthodox—using poles either vertically or horizontally fixed in place between wall, ceiling and other bathroom surfaces, rather then being cantilevered from, and screwed into, walls as is the case with conventional grab bars. Besides less than ideal placement, the latter are relatively vulnerable to corrosion and other deterioration from water.

The paper describes efforts in North America to have the latter, points of control features adopted in requirements of national standards and model building codes. The 2018 editions of NFPA standards and model codes already contain a nearly full set of new
requirements applying to new bathtub and shower facilities in homes and other buildings. Other efforts, begun in late 2015 through January 2018, are underway with other North American codes and standards.

All of these efforts hold important lessons for ergonomists interested in having typical built environments provide both improved usability and safety in cost-effective ways based on ergonomics and biomechanics evidence.
Effects of ‘blue-regulated’ full spectrum LED lighting in clinician wellness and performance, and patient safety

Type: Abstract Oral Presentation
Category: Healthcare

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Short wavelength (‘blue’) light is known to mediate ‘non-visual’ effects of light in humans. These effects, that go beyond the pure ‘visual’ function, can affect human wellness and performance, as it has been reported in previous scientific research in laboratory, office, education, clinical and aero-space setups. Lighting has been recognized in the fields of human factors, ergonomics, and systems engineering, as an environmental factor that can affect clinician wellness and performance, and the occurrence of medical error. The aim and novelty of this doctoral research is to study the potentially beneficial ‘non-visual’ effects of lighting in the clinical environment to advance ‘patient-safety’.

The hypothesis of this study is that clinician wellness and performance in the execution of clinical procedures at the emergency department (ED) can be improved through controlled, indirect, ‘blue’-regulated, full visible spectrum, tunable, solid state, ‘white’ lighting, compared to prevalent fluorescent lighting conditions.

To conduct our inquiry, we perform a randomized AB/BA crossover experimental lighting study with actual ED clinicians that execute clinical procedures, in a realistic ED clinical setting, at Mount Sinai Hospital in New York City, under two lighting conditions. We use the existing fluorescent lighting as control condition. To provide the appropriate experimental lighting condition, we develop a novel multichannel solid state lighting system for precise control and assessment of the light spectrum, with specific emphasis in the short wavelength spectral area. The experimental condition lighting design prevents direct eye exposure to any of the light sources. Indirect lighting delivery minimizes glare perception and prevents issues such as the potential “blue-light hazard”.

This study suggests that it is possible that indirect, ‘blue-enriched’, full visible spectrum, tunable, solid state, ‘white’ lighting, might reduce clinician sleepiness and workload perceptions, might reduce clinical procedures execution time, and might reduce the occurrence of medical error (compared to prevalent fluorescent lighting conditions).

Future work is to expand the scope of our study to advance ‘patient-safety’ in related clinical situations, such as: clinician cognitive recovery from medical error, hand-offs, and improvement of teamwork conditions. These are known clinical scenarios where prevalence of adverse events has been observed, that might be prevented and precluded through environmental interventions such as controlled lighting. Dynamic lighting, temporal effects, ethics, human variability factors, and the interoperability between lighting systems and human objective psycho-physiological variables will be considered.
In a research project involving home care organizations in Sweden, we have examined the need for improvements in the physical environment. The aim was to generate useful and attractive solutions to create a healthy workplace for the home care workers while retaining a homelike atmosphere for the care recipients and relatives.

The research project was divided into three phases: exploration, innovation and evaluation. This abstract presents results from the evaluation phase. In the exploration phase we identified the main challenges of providing care in the home environment, such as lack of surfaces to work on, huge amounts of material lying in various places, poor work postures, poor lighting, abundant handling of medicine, and difficulties maintaining decent hygiene (results presented at IEA 2015 conference). In the innovation phase, these challenges were addressed by design students in an effort to create new concepts and products that can facilitate the work tasks for the health care workers while still providing safe and aesthetic devices for the home environment (preliminary results presented at HEPS 2016 conference). In the evaluation phase we have evaluated the generated concepts and products in participation with home care workers, care recipients and relatives.

A total of 48 concepts and physical models of product ideas were generated. 47 of these were student projects on different level, ranging from smaller course projects to bachelor’s and master’s degree projects. One idea came directly from a nurse working in elderly care. A few of the most promising ideas were developed into functioning, full-scale models that were more thoroughly evaluated. One example was a cupboard developed to store all the material and provide hygienic working surfaces. This cupboard was placed in two different homes and used in the ordinary care situation for several weeks. A leg support for dressing leg wounds was also tested on patients. Workshops with home care nurses and an exhibition for home care workers in one municipality were carried out. A questionnaire was distributed to the participants in order to elicit feedback on the new ideas. A set of interviews were also conducted to examine the opinions of the care recipients and relatives.

A continuous exchange with home care workers and care recipients throughout the design process has been central for developing concepts that are grounded in the real context of the home care environment and the user experience. The general response has been positive, although we have received a lot of ideas for improvements and adjustments. One challenge is to identify the market for these types of products which are not necessarily aids for the care recipient, nor considered to be work equipment.
Investigation reports of accidents and incidents in the process industries among others reveal that application of ergonomics and human factors is crucial in the design of alarm management and alarm systems. Some reports more specifically refer to inappropriate design of alarm generation and presentation and call for improvements in interaction interface design, organisation and training issues in alarm management. However, a broad range of design requirements and recommendations is available in relevant guidelines or human factors and ergonomics literature referring to the design of alarm management and alarm systems. As far as the investigation reports concern at least some of the knowledge available is not transferred into practice. Therefore a research project initiated by the FSA (http://www.fsa.de/en/home/) addressed questions, such as

- What is the current quality of the design of alarm systems and alarm management in industrial control centres referring to human factors and ergonomics?
- What are options to improve systems design, if required?

A review of national and international guidelines, standards and human factors and ergonomics literature resulted in requirements for the design of alarm management and alarm systems. This served the development of a computer-based checklist with 148 items, arranged in the following design areas:

1. alarm generation/alerting, 2. alarm presentation, 3. alarm prioritization, 4. alarm system functionalities/technical measures, 5. consideration of operator performance limitations, 6. action guidelines and system interactions, 7. control and feedback, 8. alarm culture and philosophy, 9. targets, performance and continuous improvement, 10. documentation and 11. training.

A pilot study was conducted to test and modify the checklist. The final version of the checklist was applied to control rooms in different industries; i.e. electrical power generation and distribution, food industry and chemical industry. The investigation aimed at analysing the status quo of the ergonomic design and at identifying potential for design improvements. In addition, psychometric properties of the instrument were analysed. Alarm systems design was evaluated by two occupational psychologists. In some cases, also experienced practitioners from the companies such as technicians, system engineers, and safety experts used the checklist to analyse alarm systems design. In total, 15 alarm systems were investigated in 14 control rooms at 12 companies.

Results indicate deviations from ergonomic requirements with regard to the design of human-machine-interfaces, alarm prioritisation, alarm management and systematic operator training concerning the alarm systems and the handling of alarms. Selected
results of the study will be presented and discussed with a view to improving alarm system design and management.
Production in high-wage countries such as Germany is characterized by a high degree of automation. This results in a high adjustment effort for new product versions or variants, which gains in significance as the production is characterized by a high variety of variants and shortening product life cycles nowadays. Therefore a greater flexibility of the production systems is required, to adapt quickly to changing market conditions. The flexibility of the production process can be increased by integrating human beings into the assembly process in the form of a human-robot collaboration (HRC). The combination of the human cognitive and sensorimotor skills with the precision, speed and fatigue-free operation of the robot results in an effective collaboration. However, this new form of cooperation raises new questions: How can work safety be guaranteed during collaboration? Even if human security is guaranteed, how can trust and acceptance of the system be ensured? How can the human-machine interaction be designed, to work in an intuitive and transparent manner for the human partner of this working relationship? How must such a workplace be designed to meet ergonomic criteria? To explore these and further questions, a workplace for practical use in manual assembly for a wide variety of applications has been developed and set up. It is characterized by its ergonomic design with regard to conventional industrial requirements. At this workplace the robot assists the operator by handing over parts and tools. A lightweight robot has been positioned in an innovative way, covering gripping zones that are difficult to reach ergonomically and enabling both autonomous and collaborative work, while intelligent sensors monitor the actions of all actors. The data is used to guarantee security and serve a user-centered design of the HRC. This is also supported by the height adjustment of the entire workplace and adaptation of the system behavior to the respective operator. Special emphasis was placed on the design of the human-machine interaction. It is important to avoid incomprehensible and challenging methods of interacting with the system in the everyday production, since among other reasons the objective is not the creation of robot-interaction experts but the intuitive and effective usage of HRC in the production, which is accessible with little or no further education effort. This article presents the ergonomic and human-machine interaction concepts of the HRC workplace and their implementation. The focus of this paper is in an equivalent manner on generating requirements for such a workplace and the realization of a workplace based on these requirements.
French dairy farmers have an increased risk of lower airway diseases that is likely related to occupational exposures to airborne contaminants. Nevertheless, occupational determinants of dairy farmers’ exposures remain poorly documented and the biological effects of the contaminants chronically inhaled by farmers need to be fully characterized.

In this context, an occupational exposures characterization work has been conducted aiming at i) identifying the occupational determinants of exposure to thoracic bioaerosols (organic dusts, endotoxins, bacteria and moulds), to ammonia and acetaldehyde, ii) at characterizing the pro-inflammatory effects of thoracic dusts emitted during the mechanical spreading of straw bedding, a task well known to generate to generate a strong exposure to bioaerosols.

In order to achieve these goals, a 112-repeated exposure measurement campaign has been carried out on 29 dairy farms located in Brittany. Using multivariate mixed-effect regression models, we have demonstrated that farmers’ exposures to bioaerosols were mainly induced by tasks related to bedding material distribution and cow feeding (straw, hay, silage). Exposure levels to ammonia are highly dependent on cow numbers and time spent by farmers in stable and milking parlour. Acetaldehyde exposure was modulated according to farm size and time spent on distributing silage. Our work has also highlighted that an increase of the area of wall opening significantly reduces exposure to mould, acetaldehyde and ammonia. Finally, our study has shown that dusts emitted during mechanical straw spreading have (1) a size small enough to allow them to deposit in the tracheobronchial regions, (2) a complex bacterial and fungal composition, and (3) strong in vitro pro-inflammatory effects that induced TNF-α, IL-1β, IL-6 and IL-8 expression in human macrophages.

In conclusion, these results have made it possible to identify various dairy farm characteristics and occupational tasks that significantly increased the exposure levels to chemical contaminants and thoracic organic dusts. Statistical models built in the scope of this research project already allow to reconstitute dairy farmers’ exposures that may be of use in future epidemiological studies and in the development of new preventive measures.

Finally, those results also represent an opportunity to question: (1) the various methodologies used to analyse and understand exposure modalities to a work situation and (2) the articulation between disciplines and how to achieve better improvement of work conditions (ergonomics, occupational hygiene, expology, sociology...).
What ergonomic methodologies to question management? The case of cooperatives in France (SCOP)

Type: Abstract Oral Presentation
Category: Others
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The current managerial and organizational problems still cause companies many tensions, conflicts and the leaders take them quite simply in an inter-individual angle. The impacts of conflicts arising from the managerial organization affect the employees and also extend to the decision-makers themselves. The ergonomic interventions show the progression of the subject and the dysfunctions created within the organizations. The relationship between management - organization - work and collectives remains in tension. So, what methodology (s) is it possible to develop with the managers, CODIR, were they restricted and how can we move from tension to sustainable collective working conditions? These questions remain very present for “traditional” companies, but ask about companies with special status that are among others SCOP. Indeed, we have to do to companies where employees are directly involved in decisions, dividends and consequently to the internal management organization.

Is this a guarantee of building more serene organizations providing guarantees of well-being and, moreover, more efficient and innovative? This is the subject of an ongoing study with the General Confederation of Scops, Regional Unions and Cooperatives of 4 different regions. Accompanied also by a research team in social psychology, we will propose to shed light on the innovative forms of management in these companies, in light of current trends; “liberated” company, co-working, holacracy ...

Through this ongoing experiment, we will try to examine whether the forms of ergonomic support based on experiences of colleagues ergonomists who offer reflections to equip managers and to anticipate organizational dysfunctions, are inspired by “models - Managerial cooperatives. Innovative methods will be part of a health prevention strategy for employees, executives, managers and greater efficiency of business operations.

It is also by developing "innovative" ergonomic analysis methods that we will approach the question of management, through different but complementary experiences in France. Several axes can be discussed. They will rely on recognized methods of the ergonomics of French-speaking countries from field studies in situ. This way of understanding the management activity can be done by accompanying the managers, by creating discussion spaces, by simulating situations, by modifying the hierarchical sphere and by knowing more precisely the activity of the managers. This is not so obvious a priori for other countries.

Accompaniments in the form of working group animation with relay actors can also be presented and in any case, we will develop our comments around managerial methodologies from cooperatives, assets, limits, etc.

Bibliography


Human Factors Engineering (HFE) is primarily a design and engineering activity. A project case study is defined as the systematic design and implementation of a work system within the context of an investment project. A HFE case study paper should include a system ergonomics design approach, an actual HF intervention, and feedback on project results and methodology. HFE activities are only a small part of a project. Other disciplines are involved and usually leading. Finally, a case study is not a scientific experiment within a company setting, a task analysis without the intention to intervene, or a company-wide health & safety improvement program.

HF Professionals interpret and integrate the results of scientific research. They apply methods developed by scientists, such as task analysis methods, or operator workload assessment methods. Feedback on research outcomes, as well as on methodology benefits researchers and practitioners. However, HF practitioners seldom publish case material, as it usually is not part of the project scope, it is not permitted due to confidentiality, or they are just lacking time and some encouragement. In particular, the scientific community does not show much interest in material with a sample size n=1. In an effort to change this, IEA world congresses since 2006 included company case study sessions (Pikaar, 2015).

Another reason to publish project case studies has to do with new technology - a technology push - for example related to autonomous shipping, real time remote control, and big data. In the maritime area there is hardly HF knowledge available compared to 50 years of HF research and HF application in process industries. HF Professionals know about the effects of a high degree (and high levels) of automation from one area of industry. They know the risks, and how to cope with it. Within new application areas (shipping, traffic control, remote operations) the wheel is invented over and over again. The transfer of proven HF knowledge and solutions could be beneficial.

This paper will present an introduction on the topic of project case studies, gives an overview of literature on case studies, and proposes a framework for a systematic report of cases. An example of such a report will be given. Next, some typical new technologies and automation trends will be addressed, whilst showing the benefits or the need of knowledge transfer.

Business Case = Company Case Study
Ergonomics, Sustainability and Corporate Social Responsibility: A review towards integrating pathways

Type: Abstract Oral Presentation

Category: No productive sector applicable

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Purpose of the paper: This paper aims to investigate the relationship between ergonomics, sustainability, and corporate social responsibility, identifying the link factors towards an integrative perspective.

Design/Methodology/Approach: The research design is a systematic literature review, combining bibliometrics, content analysis and mind maps. The sampling process was carried out in the Scopus and Web of Science Core Collection databases. The search strings used were the following: "ergonomic*" AND (sustainab* OR "triple bottom line" OR "corporate social responsibility"). The document types filter was applied selecting "article" and "review". After the screening process based on the inclusion and quality criteria, the final sample was composed of 141 articles. The bibliometric analysis was developed with VosViewer and Minitab 17 software. Descriptive statistical analysis of the data and networks analysis were performed in articles citation, keywords, and outliers. For the content analysis, a coding schema was developed. A methodological triangulation of the three methods applied was applied.

Findings: The link between ergonomics, sustainability, and corporate social responsibility is an emerging research area, with the major part of the sample published in the last five years. Both links with the environment, as green ergonomics, and social issues, have been explored. However, there is a gap in theory and practice for driving possible integrative. The main motivation factors, barriers and organizational and worker responsive strategies are identified. Successful research in integrating pathways will depend on the cooperation between researchers multiple expertise domains because distinctive expertise is required.

Research limitations/implications: Some limitations have to be acknowledged. First, the sampling process has some bias due to the review strategies related to the database selection (Scopus and Web of Science), the search strings adopted and inclusion and quality criteria applied in the screening process. Thus, some relevant paper can be lost in these processes. Second, both content analysis and mind maps are qualitative-based methods, brings subjectivity to the process accordingly the researchers judgment on the screening process, coding scheme and framing approach.

Practical implications: Ergonomic in organizational level has been encapsulated in some broader organizational programs linked with sustainability and corporate social responsibility. It can bring several challenges for practitioners. These discussions can help governments to better design bidding process avoiding negative factors discussed. For companies, the lack of integration among these programs can compromise the results.
Originality/value of the paper: As a result, this study presents an integrative framework, linking ergonomics to sustainability and corporate social responsibility at an organizational level of analysis. Moreover, the main challenges for adopting an integrating pathway are identified.

Keywords: ergonomics, sustainability, corporate social responsibility; bibliometrics
The particular view: the user's environmental perception in architectural design

Type: Abstract Oral Presentation
Category: BUSINESS CASE - No productive sector applicable

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From the analyzes on correctional facilities, the ergonomic approach is still relatively strict. Thus, although this work is not innovative, the application to the physical space of these institutions reveals a gap. In this way, this research seeks to increase the knowledge of the architecture and to reduce the existent gap on the subject in the brazilian ergonomics literature. The analysis aims the perception of the users as a determining factor in the elaboration of correctional facilities for adolescents in sanction compliance. For the purpose, we use the theoretical and methodological apparatus of the Ergonomic Analysis of Work and Cognitive Ergonomic, with the support of the technique idealized by Abraham Moles for the extraction of the user's perception about the environment in focus and its application in projects, called the "Constellation of Attributes". This technique collects data about the idealized space and the occupied space, explaining its (in) compatibilities. The research also explored the analysis of perception based on characteristics such as: gender, time in the public service and post, seeking to identify the relationship between these characteristics and the interviewees' perception. By examining the collected data, the distance between the space project and its respective user was ratified, generating conflicts in the activity dynamics, damaging the mental health and the results of the public policy, besides the financial impact after the occupation of the building due to adaptations and reforms. We also identify a certain distance between the users' imagery and the socio-educational determination of public policy, which allows us to question how much architecture contributes (can contribute) to the effectiveness of adolescent resocialization.
Increased hand-rung force is associated with increased ladder fall risk

Type: Abstract Oral Presentation
Category: Building and Construction

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Introduction
Falls from ladders are the leading cause of fatal falls to lower levels [1]. After a ladder climbing perturbation, the hands and feet are reestablished back onto the ladder [2]. These responses generate an upward force on the body to slow falling momentum and support body weight [3]. However, the relationship between the hand-rung force magnitude and fall severity is unknown. This study aims to investigate the relationship of hand-rung force with fall severity after an ascending ladder climbing perturbation.

Methods
Thirty-five participants were recruited to climb a vertical ladder. The 8th and 9th rungs of the ladder were equipped with uniaxial load cells (2kHz) to measure the applied horizontal and vertical forces. Participants wore a safety harness that was equipped with a load cell (1kHz) to measure the weight supported by the harness. Participants experienced six ladder climbing perturbations, three in each climbing direction, and performed 3-6 regular climbs prior to each perturbation. A ladder climbing perturbation was controlled by releasing a rung below the participant’s foot [4].

Fall severity was quantified as the peak force supported by the harness between perturbation onset and end of perturbation [4]. The peak resultant force applied to rungs 8 and 9 was found between perturbation onset and end of perturbation for the hand that was moving and the hand in contact with the ladder during the perturbation. In addition, the summed force across the hands was considered. Harness force and peak resultant hand-rung forces were normalized to body weight.

Two linear regressions were performed with harness force (square root transformed) as the dependent variable. Moving hand and nonmoving hand-rung force were predictors in one regression and combined hand-rung force was the predictor in the other regression.

Results
The average (standard deviation) normalized harness force after ascending perturbations was 0.18 (0.17). The average (standard deviation) normalized resultant hand-rung force for the moving hand, nonmoving hand and combined hands was 0.47 (0.19), 0.58 (0.16) and 1.05 (0.32), respectively. Higher harness force was associated with higher moving, nonmoving, and combined hand-rung force (Figure 1).

Discussion
Increased hand forces were not associated with a reduction in fall severity. Instead, higher hand forces may occur in response to more severe perturbations. Presumably, these hand forces would increase until the hand’s force capacity is reached, and the hand decouples from the rung (a.k.a. breakaway strength). The normalized forces generated by each hand (0.47 to 0.58) approached previously-reported breakaway strength values [5], indicating
hand-rung decoupling risk. Participants that do not reestablish their feet with the ladder rungs rely more on their upper body to arrest the fall [3]. Thus, interventions that reduce the required hand-rung forces, like enabling better foot contact through wider rungs, may prevent falls.

![Graphs](image)

*Figure 1: Normalized harness force per normalized peak resultant rung force for the a) moving, b) nonmoving, and c) combined (moving and nonmoving) hand.*
Introduction
A medical adverse event is damage to health occurring during or resulting from contact with medical services, but not related to the main pathological problem. According to the WHO this affects 10% of hospital patients. It is caused mainly by latent errors existing in the health care system, but frequently originates from outside the system. Improvement of the system requires identification of all possible factors which may lead to adverse events.

Material and methods
97 experienced nurses participating in a professional course were approached with an anonymous questionnaire aimed at identifying the causes of disturbances of work, potential sources of errors, fatigue, equipment and error-provoking circumstances.

Results
69.6% of respondents reported erroneous oral and 48.4% parenteral medication. In the opinion of the nurses errors were caused by wrong design of packages (78.4%), similarity of packages (73.2%), similarity of names (42.3%), too small lettering on packages/ampules (52.6), damage of important information after partial use of blisters (50.5%). 64.9% of nurses perceived the architectural features of objects as potentially enhancing medical adverse events. Vertical transportation (lifts, stairs) is not effective according to 44.3% of respondents, and coded doorlocks could be sources of problems according to 30.9% of nurses. In the opinion of 79.1% of respondents the ban on cigarette smoking does not solve the problem of risk of fire on health service premises. Inadequate staffing was reported by 85.3% of nurses and constant time pressure by 73.2% of them.

Conclusions
The majority of potential sources of medical adverse events have a typically ergonomic character. Identification of latent errors in the health care system requires replacement of the blame culture by a safety culture based on mastering of the system.

Key words: medical adverse events, ergonomic factors, nurses opinion,
A Usability Study of an Enterprise Resource Planning System: A Case Study on SAP B1

Type: Abstract Oral Presentation

Category: Education and Training

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Enterprise Resource Planning (ERP) System is a very powerful productivity tool in operations management. However, ERP systems, such as Oracle, Microsoft, SAP, are notoriously difficult to use. The scope and complexity of their functionality can be overwhelming for users, who must typically undergo extensive training before they can make effective use of these systems. Several studies in industry have revealed that the complexity of ERP systems has resulted in user interfaces (UIs) which suffer from poor usability and user frustration. The poor usability makes it difficult for users to interact with the ERP system and to complete required tasks, which further impacts the time taken to learn the system.

The usability and user perception is questioned in the information system literature. Literatures deal more with the successful implementation or adoption of these ERP systems in the companies rather than in directly discussing ease of use of an ERP system based on usability guidelines. Therefore, understanding specific usability issues in the ERP system while simulating how it will be actually used can provide useful insights in making it more usable. This research investigated the effects of external independent variables such as conceptual know-how of respondents, inquiry from researchers, instruction type (general or specific instructions) and task type on the usability of SAP Business One (SAP B1). The usability experiment showed that the combination of independent variables have a significant effect on the user satisfaction in terms of perceived usefulness, user guidance, compatibility, flexibility, system capability, and learnability as well. The single usability measure (SUM) of SAP B1 is at 2G level only. Specific problems with regards to the interface attributes were also identified such as tab pane design, grid view design, placement and design of buttons and screen based control labels confused the users making it hard for them to complete the task in the system. These interface attributes issues were analyzed and considered in the redesign of the recommended SAP B1 interface. Thus, increasing the SUM level to 3.26

Keywords: ERP system, SAP B1, Tab Pane Design, Grid View Design, Button Design, Single Usability Measurement
Objective

Compared to optical motion capture systems inertial motion capture systems (IMCS) have many benefits like the degree of freedom regarding the environment, the good portability of the system and the basically simple use. Known disadvantages concern not only the lower position accuracy but also a positional drift. Additionally, we detected some more difficulties when using IMCS. These problems concern the complexity and error-proneness of the preparation and calibration procedure as well as some construction aspects of the attachments. Therefore, the focus of this study is to improve the pre-, intra- and post-usage of the IMCS regarding the hardware and whole procedure.

Methods

The development guideline VDI 2221 is utilized which starts with the benchmark and analysis of problems when using IMCS. The revealed problems were included in the conception phase. After an assessment the best concept was developed. A multiple measurement approach consisting of a subjective and an objective part for validation of the usability-facts effectiveness, efficiency and satisfaction of the new construction was accomplished. The subjective part includes the interview method with 8 subjects about the comfort of the attachments (bipolar seven-stage rating scale from -3 to +3). The objective part consists of the comparison of IMCS-angles, angles from a 2-perspective video-analysis and predetermined laser-angles with 23 participants. To assess the accuracy of IMCS and the grip of the attachments, the subjects had to assume 40 predetermined different standing and sitting postures with the standard IMCS and the optimized IMCS. The evaluation was done with SPSS.

Results and Discussion

The revealed problems of the standard IMCS are: position accuracy, positional drift, the complexity of the preparation procedure, the risk of incorrect positioning of sensors by the investigator, accuracy and reproducibility of the calibration posture, the stick-slip-effect during wear and the discomfort for subjects. Therefore, several different aspects of the procedure were optimized. To simplify the preparation procedure a usable and intuitive suitcase for the storage of the attachments and a bracket for the initialization of sensors were built. New attachments with neoprene surface for good grip and markings for the correct positioning of the sensors were created. To optimize the calibration procedure a mechanical construction consisting of a backplane, a mirror and four line lasers for frontal and sagittal position targets were utilized. These tools help the subjects to take the calibration posture more easily and to hold it during calibration. The results of the validation show significant improvements with the optimized IMCS. The mean deviation
compared to predetermined laser angles is better and the attachments do not slip anymore. Additionally, the subjective wearing comfort of the optimized IMCS is superior. Altogether the new procedure for preparation and calibration works well and helps the investigator to avoid mistakes.
This paper has the goal of demonstrating the development of a design process based on the ergonomics' concepts, interdisciplinary and participatory design in order to aid the respiratory physiotherapy treatment of children with acquired and congenital visual disability. This process was conducted in a reference physiotherapy center in Niterói city, Brazil. The Brazilian public healthcare system has several problems to afford medical equipment for public hospitals and physiotherapy centers. Thus, this kind of facilities is hardly accessible for the majority of population, specially failing to attend the needs of the visually disabled. Therefore, providing an affordable product (LUFT Incentive Spirometer) truly efficient to be used in the respiratory treatment for children with visual disability was a significantly relevant goal. Through an ergonomics approach with participation of many specialists from different fields of knowledge and user-centered design concepts it was possible to design a facilitating tool to stimulate a playful and more active attitude from the blind child patient during the treatment.

The process' development consisted of systematic observation, interviews, brainstorming sessions and meetings with the users in search of a participatory approach. Alongside, an interdisciplinary team formed by experts and students specialized in physiotherapy, physics, engineering, psychology and industrial design worked across disciplines' boundaries in order to build effective solutions. Lastly, a respiratory physiotherapy equipment was designed and tested with the final users.

Keywords: Participatory design; interdisciplinary; healthcare; visually blind children; visual disability; medical equipment; respiratory physiotherapy.
Introduction: Although an understanding of the patient work system has been increasing in the field of Ergonomics and Human Factors, the role of family caregivers within the patient work system remains largely unexplored [1,2]. For many persons managing chronic illness in the community, family caregivers are integral members of the healthcare team. In dementia care in particular, family caregivers play a major role in providing care for persons with dementia (PwD) living in the community. Due to compromised cognitive capabilities of PwD, family caregivers are required to take on advanced levels of care, often beyond their capabilities and capacities [3]. Further, family caregivers often find it difficult to identify, discuss, and define their roles as caregivers, which can lead to negative consequences such as role ambiguity and role conflict [4]. Role ambiguity refers to being unclear about role expectations [5], and role conflict refers to a state in which individuals recognize incongruences between their perceived role and societal expectations [6].

Objectives: The goals of this study were to (1) identify and categorize the roles of family caregivers providing care for a PwD, and (2) identify sources of role ambiguity and role conflict. Results will provide insight on the family caregiving work system and inform future efforts to improve caregiver performance and increase overall caregiver satisfaction.

Methods: Semi-structured interviews with caregivers (N=13) focused on daily experiences in providing care for the PwD. Thematic analysis was directed by role theory and the classification of caregiver tasks into different roles caregivers take on in the caregiving process [7,8].

Results: Results revealed 3 major caregiver roles: (1) primary, (2) secondary, and (3) tertiary. Within each of those categories, we identified additional role delineation. Primary caregiver roles commonly segmented into a logistical role (e.g., schedules/remembers appointments), healthcare provider role (e.g., secures appropriate medical attention when needed), and companion role (e.g., ensures patient has social interactions).

Caregivers experienced characteristics of role ambiguity when they were separated from the PwD’s physical environment and when PwD experienced comorbidities. Additionally, when the primary caregiver did not set specific expectations for other caregivers, these other caregivers experienced characteristics of role conflict. Role conflict occurred when secondary and tertiary caregivers overlapped responsibilities with primary caregivers.
Conclusions: This study presents preliminary findings about the roles of family caregivers for dementia patients. Results suggest that family caregiving for PwD involves multiple roles at multiple levels resulting in complex interactions that lead to role ambiguity and role conflict. These findings may serve as a foundation for future work in PwD work system design. By defining roles more clearly for family caregivers, we hope to reduce negative work system outcomes such as role ambiguity and role conflict and increase caregiver satisfaction.
Interactions among drivers are an essential part of the driving task. Humans use multiple means of explicit communication means, such as gestures and vehicle signals, and implicit cues, such as approach speed, to anticipate the intention of the other drivers. Although the exact means of communication can differ across different regions and cultures, they allow effective coordination of future motion plans between different road users. Very limited research of such drivers’ interactions are available and empirical data is needed, to properly design the interaction mechanisms of automated vehicles which are expected to enter the market soon.

This paper presents our observations regarding the interactions between drivers while navigating through unsignalized intersections in an urban environment. Twenty experienced drivers were asked to drive their own passenger car for thirty minutes in a predefined course with several left and right turns onto traffic, while wearing an eye glass mounted gaze sensor. After the end of each driving session, the participants were asked to watch selected parts of the eye gaze video-recording referring to interactions with another driver and to comment aloud on the process of their decision making for each case of interaction.

Eye gaze and scene video as well as retrospective drivers commentary were later analysed per typical interaction scenario (e.g. left turn from a two-way street with on-coming traffic, right turn on two way street with congested traffic). Specifically, (i) participant-drivers gaze direction on other cars in search of other drivers’ intent (ii) their own explicit and implicit signals as recorded in the video and (iii) retrospective comments were annotated to reveal the frequency and types of different signals and cues used by drivers to anticipate other drivers’ intent and to communicate their own intent.

The findings from this study, although preliminary, can be used to develop improved trajectory prediction algorithms and external communication systems for automated vehicles, so that their behaviour is more in accordance to human road users’ expectations.
Optimizing the design of a workspace using a participatory design method

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Today, lots of companies work on the quality and on the image of their work spaces, as that has a real impact on the quality of their productions. Generally, this consideration involves the redevelopment of a space favourable for the well-being and the communication between users. Whereas in the past, the consideration of an “unusual” work space was only intended for creative industrial firms, today, this phenomenon includes all business sectors [1], [2], [3], [4], [5].

Currently, companies lean towards an office design with playful, innovative, layout in order to attract and keep competent and talented people [6], but also for the well-being of their employees. The companies aim to make their employees want to invest in their work, to improve their performances and to reflect the ideology of the company. Jhon Seller said, that to currently not work in this way is a waste of human, temporal, intellectual resources… [7]

Yet, lots of companies have a very simplistic approach to this phenomenon [1] [8], [9], [10], [11], and think they can coordinate their innovation goals with their work space simply by taking down walls and creating so-called lofts and big open-spaces. Indeed, these redevelopment, without real approach, are imitations of mythic companies, more inspired by the trends effects than the reals need of their users.

This random approach of redevelopment of work spaces is often very counterproductive. For example, the open-spaces, very developed today, often have more harmful than positive effects. According to a research by Stockholm University, the risk of absence increases due to infectious disease, but especially due to the stress generated by the noise, the lack of privacy, a work space out of control…

Some methods exist to implicate the users in the design process and to correctly answer a problem according to their need [12]. Our study submits the redevelopment of work space aimed at collaborative work, introducing the final users like real co-designers and decision makers.

Inspired by the collaborative design method, we developed a method aims to introduce the different users of the work space to each stage of the project. We submit our approach, as well as the methodology which allowed the introduction of the users on the design process. Finally, to validate the interest of our method, we measured the impact of this approach of participative design next to the users by way of emotional indicators.
From the perspective of a teenager: a better inclusive design service of the public transportation

Type: Abstract Oral Presentation
Category: Transport

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Guadalajara is the second largest city in Mexico, which public transportation works under the lack of regulatory and legislative regimes. It is a developing city, where service is crowded and driving styles are unsafe and uncomfortable for passengers. The most consulted populations in the investigations on the use of public transport are frequently the elderly and children, rarely adolescents.

The stage of adolescence has a dynamic transformation, where the individual evolve from dependent child to autonomous adult; these transformation is potentially important in designing products and services that can be inclusive of adolescent audiences. Part of this transition of independence is the use of the public transport service.

Four focus group were carried out with forty adolescent users of bus service to investigate which stages of service impose difficulty in terms of accessing and using it. We used the inclusive service blueprint, which allowed a more dynamic interaction of the participants. Each stage of the public transport service was evaluated, on a scale of 1 to 10 to know the user's satisfaction, and each participant mentioned which problems have been presented during these stages. This study found that adolescent users of public transport service have issues, such as perception of safety during the journey, the absence of information, infrastructure of the bus and the bad treatment of the drivers; are some of the most outstanding results. These results show a dissatisfaction in aspects of: usability, safety and comfort in the use of public transport by adolescents in Guadalajara.

Public transport in developing countries has reported complications for older adults: in previous studies of the public transport service problems of perception of safety, usability and comfort have been reported, similar complications present adolescents in developing countries.
In 2010, the World Health Organization published its report on “Healthy workplaces: a model for action. For employers, workers, policy-makers and practitioners”. The report addresses means and measures to create, promote and foster occupational health, safety, well-being and sustainability and offers guidance on how to improve the physical, organizational and social work environment, including highlighting the need of collaboration between employer and employee. This paper presents findings from a study concerning the work environment on board Swedish passenger vessels. The study explored work-related experiences of personnel in the service department (hotel, restaurant, catering, shops) based on individual and group interviews, observations, survey data and social insurance statistics concerning sick leave longer than 60 days. This paper focuses on findings based on the interview data. The aim is to present differing perspectives on how to create and promote a healthy work environment, with emphasis on any discrepancies between what is identified as essential health promoting measures by the Human Resource (HR) department and the crew working on board.

The results presented here are based on semi-structured interviews and group interviews with in all 18 respondents, as well as a workshop with 33 participants. Data collection was conducted between February 2015 and summer 2016. The respondents represented a variety of positions; HR personnel from six shipping companies, crewmembers, and administrators at the Swedish Social Insurance Agency that handle all sick-leave cases related to seafarers.

The results show that in the HR personnel’s perception, healthy work environments are often associated to individual personal health activities, such as access to a gym or healthcare, lectures or other measures directed towards the individual seafarer and offered by the company to promote a healthy life style. Aspects of the organizational and social work environments were barely mentioned as stressors or as contributing factors to an increasing sick leave. In contrary, several of the HR respondents concluded that a considerable number of absences is associated to an unhealthy lifestyle, or embedded in the shipping culture and cannot be dealt with in better ways than through the measures already offered.

The interviewed crewmembers and administrators at the Swedish Social Insurance Agency highlighted the need for both organizational and social measures to foster healthy work environments. The need for employee participation within the organizational design and decision-making processes, including methods on how to conduct risk assessments prior to physical and organizational changes and follow up their consequences were emphasized. Finally, the results also show examples of successful cooperation between crew and company with regards to work environment improvements, such as setting up a mock-up for test the workability of a new layout.
Ergonomics is a discipline concerned with achieving the optimal synthesis of well-being and system-performance in the context of work (Dul et al., 2012). However, the ever-changing concept of work as such entails a wide variety of different scenarios in which work is being carried out. From agricultural workspaces over traditional production workers up to office clerks, there are almost no workspaces that are exactly alike. Nevertheless our domain strives to find common rules and laws to ensure aforementioned design goals.

To be able to better refer to and discuss the different types of workers, several attempts have been made to classify them. One of the most common distinctions is the one in blue and white-collar workers. In recent years however a new type of worker has gained increasing attention: The creative worker, knowledge worker, or gold-collar worker (Bubb, 2006; Kelley, 1985; Roongrerngsuke & Liefooghe, 2013). These terms refer to a specific type of worker whose main asset for the company is the acquisition, procession and ultimately generation of knowledge. It is reasonable to assume that this kind of work will only increase, since product development cycles are shortening and the need for innovation increases. Digitalization, industry 4.0 and artificial intelligence are predicted to advance and cover further areas of human expertise, leaving the human worker obsolete but for his/her ability to think creatively. This will ultimately leave only the task of generating novel ideas and knowledge for humans to execute. Many of the steps to achieve this on a daily basis cannot be described in traditional fashion and generate a variety of new demands that have only been poorly addressed by ergonomics so far (flexibility, creativity, ...). Dividing the creative process into four phases, preparation, incubation, illumination and verification (Wallas, 1926) it is possible to identify different fundamental psychological needs. These result in conditions for the different categories of tasks necessary in order to generate novel results. By combining these needs and categories with the increasing flexibilization of work models (home-based work, blurring of core work-time, work-life flow), a set of recommendations can be derived, determining which conditions the work environment should meet and where in a flexible work model said specific tasks should best be executed in order to facilitate the optimal results. This paper describes the challenges that we have to face already, discusses the journey that we will have to embark on in the future and poses a set of possible solutions as well as cautions that provide a foundation on how these challenges could be approached.
Impact Analysis on Human Body of Falling Events in Human-Exoskeleton System

Type: Abstract Oral Presentation
Category: Robotics

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Recently, powered low limb exoskeletons (LLE) have emerged as devices that can support and ambulate individuals with paraplegia due to spinal cord injury in an upright posture, and meanwhile bring rehabilitative benefits. An important consideration in the design of LLE is safety of the user. However, the safety of human-exoskeleton system is still a big challenge. The type and extent of probable risks of these devices have not yet been understood. Falls can result in serious injuries for LLE users and awful consequences. Herein, impacts of falling events for the human-exoskeleton system were assessed and analyzed based on finite element method in the current study.

In order to collect kinematics of the human-exoskeleton system for simulated impact analysis, an experiment platform consisting of an air bend and a ceiling rail was designed. A motion capture system named VICON was used to record movements of the human-exoskeleton system. A volunteer wearing an exoskeleton was asked to lean body in different direction (e.g. forward, side and backward) until inevitably falling. Based on kinematic data of the human-exoskeleton system, velocity and joint angle of the system were analyzed and used as initial conditions in simulated impact analysis of fall events. Collision analysis between in the simulation is based on finite element method (FEM). A 3D human-exoskeleton model were built in ANSYS. Impacts on human body were assessed based on simulation results from ANSYS.

The results of the current study indicated that the main injury parts were head, thorax, spine, arm and pelvis when human-exoskeleton system fall. Head and spine can be easily injure in backward fall, as thorax and arm in forward fall, pelvis to side fall. The maximum impact velocity of head can be 6.0m/s, if no buffer action be taken. And fall accidents may cause bruise, cerebral concussion, skull fracture, rib fracture and pelvic fracture etc. Compare with side fall and forward fall, backward fall can be more serious due to the difficult of buffer action. It is anticipated that the study of human-exoskeleton falling event will useful in making safety regulations and safety exoskeleton design.
Simulating the Impact of Patient Acuity and Staffing-ratios on Nurse Workload and Care Quality

Type: Abstract Oral Presentation
Category: Healthcare

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Problem statement:
Given the increasing demands for healthcare, policies have been implemented to improve system throughput by discharging patients earlier than previously. This leads to increased acuity levels for patients in the hospital, contributing to higher workload among nurses. These high workload demands fall directly to an already overworked nurse population (Daly & Barbara, 2009). Hence, a tool is needed to test combinations of Staffing-ratios and patient acuity, to predict their impact on nurse workload and care quality – Discrete Event Simulation (DES) is a potential solution.

Research Objective / Question:
How can Discrete Event Simulation (DES) be used to quantify the possible impacts patient acuity and Staffing-ratios on nurse workload (WL) and care quality (CQ)?

Methodology:
The Simulated Care Delivery Unit (SCDU) model is created using the DES methodology to imitate the nursing environment of an inpatient unit of a hospital. Patient acuity is defined as the level of illness of the patient and is associated with the intensity of care required by a patient. In this study, patient acuity is operationalized as a function of required care task frequency and task duration, only for tasks that are affected by patient acuity.

The model was run for 9 trails based on the combination of following conditions:

<table>
<thead>
<tr>
<th>Staffing-ratios</th>
<th>Low (1:2)</th>
<th>Medium (1:4)</th>
<th>High (1:6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Acuity</td>
<td>-10% (of the Base case)</td>
<td>Baseline</td>
<td>+30% (of the Base case)</td>
</tr>
</tbody>
</table>

The inputs to the model are taken from a real care unit, a metropolitan hospital in downtown Toronto, reflecting actual care delivery volumes. Inputs: Task frequency, Time duration, Physical Layout and Work logic. Outputs include Nurse WL (Task in queue, Walking distances), and Care quality (Missed care).

Results:
This study helps administrators quantify the effects of Staffing-ratios and patient acuity on of CQ and WL. Preliminary results indicate an increase in Missed care up to 250% (79 tasks), ‘Walking distance’ up to 141%, and ‘No. of tasks in queue’ up to 201% (44 tasks)
for high acuity and high staffing ratio in comparison to base case (medium staffing ratio and baseline acuity).

Discussion:

Preliminary results indicate a decrease in CQ and increase in WL – Further testing is required. Future work includes testing new design factors, a validation study and extension to WL and CQ indicators. A scarcity of published work suggests research is needed in this domain.

Conclusions:

This study demonstrates how DES can be used to quantify the possible impacts of patient acuity and staffing ratios on nurse WL and CQ. Preliminary results suggest: when staffing-ratios and patient acuity are increased, nurse WL increases, and CQ deteriorates. Detailed testing is required to examine response patterns and possible tipping point effects.
Information technology (IT) is dramatically changing the way clinical care is delivered to patients. IT systems can assist in standardising work practices, which can positively impact safety. However, information systems can also constrain clinical practice, and force staff to create workarounds in order to deliver safe care.

Long-term aged care facilities in Australia have started adopting electronic medication administration records (eMAR) to facilitate the administration of medications to residents. Certain medications are known to create challenges for eMARs in terms of workflow. One such example is transdermal patches. Transdermal medication patches deliver medications through the skin via a patch. These patches often contain opioids, which have been the source of significant safety concerns, as errors in their use have resulted in harm, including death. In contrast to most medications where no further action is required following administration, patches need to be applied, removed, as well as monitored to ensure they remain in place. Complicating this process is the fact that many patches need to be left in place for up to a week at a time.

eMARs do not currently adequately address all these tasks associated with the safe administration of transdermal patches. Thus, workarounds are being used to ensure the completion of all the required tasks by staff. The data generated by electronic systems provides an opportunity to identify the various ways in which health care workers workaround system limitations, by, for example, creatively using system features designed for other purposes. Understanding these workarounds is important for the design and development of IT systems.

This presentation will describe the frequency and nature of workarounds related to transdermal patches using data extracted from an eMAR system across 70 aged care facilities. The facilities are in New South Wales and the Australian Capital Territory, and have approximately 5000 residents. Of the residents on transdermal patches, approximately 60% have evidence of a workaround used in the system. Details of the ways the eMAR was used to compensate for its limitations in safely managing the administration of medication patches will be presented. Using data from this large sample of facilities, variation in the ways in which workarounds were implemented within a facility and between facilities will be examined. This will provide insights into the potential safety risks associated with these workarounds.
This study looked at the effect of three different non-driving related tasks (NDRT) (Surrogate Reference Task (SuRT) (ISO14198:2012, 2012), n-Back Task (Kirchner, 1958) and a motoric task), instructed or free engagement into these tasks and the effects in two different take-over scenario after Conditional Automated driving.

Conditional Automated driving (Committee, 2016) allows drivers to engage in non-driving related tasks while the automation takes over the dynamic driving task. In case a system limit is met, a request to intervene is issued (Marberger et al., 2017). Drivers must regain control of the dynamic driving task.

We conducted a study with 53 participants in a static driving simulator. Participants were split into three groups and each group was assigned one of the three NDRT's. Each participant per group experienced two different take-over situations twice, two times medium complexity and two times high complexity. In addition, the independent variable (within) “type of instruction” was added. Prior to a take-over, participants were either instructed to engage in the task assigned to their group or could choose their NDRT’s freely (SuRT, n-Back Task, motoric task or no task). Participants experienced a total of 4 take-over situations during the experiment.

Dependent variables were percent eyes on road, standard deviation of the horizontal gaze dispersion and blink frequency. The seat pressure mats allowed an analysis of the medium pressure, changes in the center of pressure (COP), changes in the contact area and variance of the maximal pressure, each for seat and backrest. Data from motion tracking was not analyzed since data quality was too limited.

To assess take-over performance, we looked gaze reaction time, take-over time, time to collision, SDLP, longitudinal and lateral accelerations and subjective ratings.

Results showed significant changes for the different NDRT’s for percent of eyes on road and blink frequency. In addition, we found significant differences among all three tasks for changes of the center of pressure, the contact area and the average pressure.

The type of instruction did not show differences in the take-over performance. We saw significant differences between the two situations, with the more complex situation leading to higher accelerations, slower take-over times and a lower TTC.

We concluded, that the influence from different take-over situations is high, while differences in the driver availability can be measured well with the right sensors, but do not necessarily translate into different take-over performances.
Take-overs in Level 3 automated driving – Proposal of the take-over performance score (TOPS)

Type: Abstract Oral Presentation
Category: Automotive

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The introduction of partially automated (Level 2; SAE International, 2016) or conditionally automated (Level 3) vehicles to the consumer market fueled human factors research on automated driving. Past and present research in this area has mainly focused on take-over situations. Level 2 and 3 automated vehicles will still encounter system limits at which drivers have to regain control and continue driving manually. A Level 2 system requires the driver to constantly monitor the driving automation system and the scenery with the requirement of an immediate ability to take-over vehicle control. A Level 3 system allows the engagement with non-driving related tasks, but the driver is supposed to be able to regain vehicle control in few seconds.

During a literature review of empirical studies on take-over performance in Level 3 automation, we found a variety of metrics describing a driver’s reactions in a take-over situation. Most prominently, these metrics represent reaction times, e.g. gaze reaction time, hands-on time, deactivation of system, first subconscious reaction, first conscious reaction, take-over time, duration of lane change, and end of driver intervention. In addition, many authors reported metrics of take-over quality, e.g. maximal lateral and longitudinal accelerations, minimum time to collision, use of indicators, checking the mirrors, trajectories, crash rate, standard deviation of lane position. Various authors also reported additional subjective such as ratings on perceived criticality and complexity of the take-over situation, time pressure or stress. Many different metrics impedes the comparison of take-over performance between different studies.

We propose an integrative framework, the take-over performance score (TOPS), that includes the most important metrics (depending on the take-over scenario) to allow a more consistent reporting of take-over performance. Individual metrics will be standardized and classified into:

1. **Vehicle Guidance Parameter**: crash (yes/no), time to collision, maximal lateral and longitudinal acceleration, standard deviation of lane position
2. **Mental Processing Parameter**: lane check (yes/no), gaze reaction time, eyes on road reaction time, take-over time
3. **Subjective rating Parameter**: perceived criticality and complexity of the situation, subjective time budget, comfort rating

The proposed classification allows for additional metrics to be added to the individual parameters.
Each Parameter will then combine the standardized metrics with individual weights. For example, if a crash occurred, the vehicle guidance parameter (combined) would always exhibit a low value since a crash represents the worst outcome in a take-over situation.

The final three parameters representing the TOPS create a common ground for authors and allow a consistent rating of take-over performance throughout different situations, studies, and reports while they simplify their comparison at the same time.
Automated Video Lifting Posture Classification Using Bounding Box Dimensions

Type: Abstract Oral Presentation
Category: Manufacturing

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Introduction: Computer vision was previously used for evaluating hand activity level (Chen, et al., 2013), exertion frequency and duty cycle (Akkas et al., 2016), and visualizing repetitive motion task factors (Greene et al., 2017). The current study investigates automatic classification of lifting postures using simple features extracted from 2D video. Rather than measuring joint angles, we take a practical approach that is insensitive to challenging workplace conditions, such as poor illumination, poor vantage points, and obstructions, by relaxing the need for high precision. We explore if features of a simple sagittal plane "elastic" rectangular bounding box encompassing the entire body while continuously tracking the subject, can classify standing, stooping and squatting while lifting.

Methods: Mannequin postures were systematically generated using the University of Michigan 3DSSPP software to encompass the range of hand locations (20 ACGIH TLV lifting zone boundary points) and anthropometries (5th, 50th, and 95th percentile height for males and females). After excluding locations that smaller mannequins cannot reach, 105 cases (training-set) were generated for analysis. Based on torso (40º) and knee angles (130º), there were 43 squats, 13 stoops, and 49 standing postures.

A bounding box was drawn tightly around the subject for each training-set case, and the stature normalized height and width were measured. After randomly ordering the data, a classification and regression tree (CART) algorithm was trained (Mathworks, 2017) to classify the postures (Breiman et al., 1984). Decision trees for splits ranging between 1 to 10 were generated to determine the optimal thresholds based on cross validation error. To test the classifier, nine industrial videos (Bao et al., 2016; Lu et al., 2013; safetyvideopreviews, 2012; UM, 2014, 2017) in each class, totaling 30 lifts (test-set), were randomly selected if the full body was visible in the sagittal plane.

Results: The resulting tree had three levels and three splits, misclassifying 0% training-set cases. For the test-set, the algorithm correctly classified 9 of 10 squats, 9 of 10 stoops, and 10 of 10 stands, misclassifying 6.7% cases. The sensitivity and specificity, respectively was 90.0% and 100.0% for squat, 90.0% and 95.0% for stoop, and 100.0% and 95.0% for standing.

Discussion: These posture classifications, which are related to hip and knee angles, were identified without direct angle measurements, instrumentation, markers, or fitting the image to a skeletal model. Although this study was limited to the sagittal plane, future work will investigate additional views. We have developed software to track a worker using this
bounding box approach which may be used for continuously quantifying the frequency and duration postures are assumed during work. It is anticipated that this simple algorithm can be implemented on a hand-held device such as a smart phone, making it readily accessible to practitioners.
The purpose of this research is to understand how sensitive two wheeler riders are, about the posture related co-ordinates of a two wheeler, specifically the co-ordinates of handlebar and foot peg locations. A better understanding of the extent of this sensitivity/perception will enable the manufacturer with more freedom and flexibility in fixing the handlebar and foot peg co-ordinates without compromising on postural comfort. The study involves analyzing the sensitivity on horizontal, vertical and lateral axes separately for handlebar and foot peg, by varying each co-ordinate individually in pre-determined steps with a statistically significant sample of subjects. The second phase involves understanding the correlation of this sensitivity/perception with rider characteristics such as body stature, age and gender, such that it facilitates in tailoring a riding posture for specific target groups.
Why do information technology professionals develop work related musculoskeletal disorders? A study of risk factors

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RECOUP Neuromusculoskeletal Rehabilitation Centre, Bengaluru, India

Introduction:
Work Related Musculoskeletal Disorders (WRMSD) are highly prevalent among Information Technology (IT) professionals. WRMSD is reported to be influenced by genetic factors, socio-economic factors, environmental factors, lifestyle and individual perceptions, high physical work demands, e.g., hazardous body postures, monotonous work, repetitive arm movements, prolonged standing, work with arms above shoulder height, and heavy lifting. However, the risk factors associated with the development of WRMSD in IT professionals are not clear. Hence, the objective of this study was to evaluate the risk factors that predispose IT professionals to WRMSD.

Methods:
A prospective analysis of 8200 IT Professionals (age 20 to 60 years, mean 33 years, 74% males), in an Industrially Developing Country was conducted. The employees were evaluated by a detailed questionnaire consisting of demographic data, job details, health status, physical risk factors, short-form Work Style Questionnaire and Nordic Musculoskeletal Pain Questionnaire. The data was extracted, and statistical analysis was performed.

Result and conclusion:
76% of the employees were diagnosed by an experienced occupational health physician to have a WRMSD. 65% of the employees were laptop users, 30% were desktop users and 5% used both. A total of 54% of the employees worked for at least 5-9 hours per day and 46% for 10-14 hours per day. Most of the male workers complained of low back and radiating pain in upper or lower limbs, compared to female workers who complained predominantly of neck and shoulder pain. Both the population had eye strain and increased fatigue in common. 78% had widespread body pain, 72% neck pain, 63% lower back pain, 52% shoulder pain and others with upper arm, thigh, knee and foot pain. 78% were diagnosed to have Myofascial Pain Syndrome, followed by Thoracic Outlet Syndrome (36%), Fibromyalgia (35%), Tendinopathies of shoulder, elbow or wrist (21%), Patellofemoral Pain Syndrome (12%) and Type 1 Complex Regional Pain Syndrome (6%). Increasing age, high Body Mass Index, longer working hours, hazardous body postures, static loading, resting elbows and wrists on hard surfaces, and adverse work-style were positively correlated (r<0.01) with the presence of WRMSD. On the other hand, rest breaks during work, regular exercises and formal
ergonomics training were negatively correlated ($r<-0.01$) with the presence of WRMSDs, as more frequent breaks, regular exercises and prior ergonomics training showed lower prevalence of WRMSD. Also, the presence of co morbidities like joint hypermobility, diabetes, hypothyroidism, hyperuricemia, low bone mineral density, hypovitaminosis D and B12 had a positive influence on the prevalence of WRMSDs in the study population. Other specific factors like work experience, hand dominance, type of computer used also had an influence on the development of WRMSDs. The risk factor analysis gives an insight to the appropriate areas of ergonomic interventions amon
Biological intelligence and digital intelligence are converging at a rapid pace. A fast, smart and unobtrusive interaction with human cognition is necessary to achieve a symbiosis between human and machine intelligence. Automated Vehicles (AVs) are a leading edge epitome of this convergence, promising (i) fewer crashes, (ii) less pollution, and (iii) improved mobility. The arrival of such disruptive technology urgently requires radically new ways of thinking, because it dramatically changes the nature of the driving task. In AVs the primary driving task is (partially or fully) delegated to the driving assistance system. While the future features of AVs and penetration rates are uncertain, it is certain that existing driver behaviour models and theories that focus on the driving task no longer apply.

To date, the modelling of drivers in vehicles has been motivated by a desire to understand, predict and improve the driver’s driving performance and safety. After nearly 90 years of research, the extensive existing driving behaviour models are becoming obsolete since they are modelled after the driver performing the primary driving task. With AVs, the driving task will dramatically morph towards a supervisory role that cooperates with the AV. This will also have significant ramifications on how other road users such as vulnerable road users will interact with AVs.

Therefore, new driving models are needed to capture the notion of a cooperative task between human and machine as its foundation. A human-centric approach that explores cooperative Intention Awareness between road users and AV is required and will profoundly influence existing research on situational awareness, safety, predictability, trust, and usability in AVs.  

Overall, AVs call for a shift towards a more elaborate understanding of road users interactions, and new ways to address the pressing challenges that this transition towards cooperation raises. Theoretical constructs need to support novel cooperative principles such as negotiating activities, communicating and reconciling disparate perceptions of the environment, anticipating actions and sharing intention, to be able to effectively (co)operate (with) AVs and other autonomous systems.

The aim of this paper is to present a multidisciplinary approach towards defining a cooperative driving behaviour model for automated vehicles based on Intention Awareness. We use Intention Awareness as an investigative lens to explore driving as a cooperative task. To our knowledge Intention Awareness has not been explored with the view of increasing the human’s awareness of the system’s intentions or in the context of improving cooperation with AVs.
Participatory Ergonomics at the Scale of Hundreds of Healthcare Organizations

BACKGROUND

Assisted living facilities in the U.S. exhibit a diversity of organizational characteristics and management practices that raise challenges for performance benchmarking and improvement. Organizational heterogeneity includes license type, number of beds, corporate affiliation to other facilities along the long-term care spectrum, ownership and profit/non-profit status, and staffing model. Heterogeneity of practices includes differences in dose, frequency, and content of processes like care conferences, resident risk assessments, and infection control monitoring.

The Wisconsin Coalition for Collaborative Excellence in Assisted Living was founded in 2009 to develop a system and processes to organize performance benchmarking and improvement across Wisconsin assisted living facilities. WCCEAL is governed by a public-private advisory board representing diverse stakeholders from regulatory, payment, and consumer advocacy agencies, from provider associations representing assisted living facilities, from facility liability insurance companies, and from a university research center. WCCEAL was a multi-stakeholder response to a lack of U.S. federal oversight and resources for assisted living facilities compared to nursing homes, despite them now often serving comparable populations.

METHODS

The WCCEAL advisory board used a participatory ergonomics process to develop a secure web-based performance benchmarking system consisting of (1) an organization-level performance survey, (2) a resident-level satisfaction survey, and (3) interactive comparison reports that allow filtering results by a variety of organizational characteristics. The advisory board also used participatory ergonomics to develop membership policies and procedures to support and incentivize participating assisted living facilities, including (1) state approved quality improvement programs, (2) membership conditions, duties, and benefits, and (3) providing regulatory relief for member facilities in good standing that exceed state regulatory compliance requirements.

RESULTS

The advisory board has met monthly since 2009, continuing to bring together an unprecedented and unique combination of public-private assisted living stakeholders.
compared to other U.S. states. The program started with 180 early adopter facilities with 7365 licensed beds in 2013 and grew over 16 quarters to 437 facilities with 14096 licensed beds by the end of 2016, reaching over 27% of Wisconsin assisted living residents. This coalition is pioneering quality standards in assisted living; no other state has statewide mechanisms for benchmarking quality to identify high-value practices.

CONCLUSIONS

Organizing for high performance among hundreds of assisted living facilities was possible due to a sustained multi-stakeholder participatory ergonomics process and an information technology (IT)-driven performance benchmarking system with a functionality allowing facilities to compare their performance to different groups of their peers, addressing the diversity of organizational characteristics and management practices. Despite organizational diversity in U.S. assisted living facilities, a public-private coalition in Wisconsin succeeded in building a data-driven system and processes for performance benchmarking, using a multi-stakeholder participatory ergonomics process.
Comparative Workflow Analysis of Antibiotic Prescribing in Nursing Homes

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Background: Rising antibiotic resistance in nursing homes (NHs) has been attributed to antibiotic overuse and misuse. The impact of NH antibiotic stewardship programs have been mixed. However, identification of NH variations can provide guidance for developing targeted interventions. We mapped the antibiotic prescribing workflow in NHs in two states in the United States to identify similarities and differences in antibiotic prescribing workflows.

Methods: We interviewed 55 individuals (leadership, nursing staff, and prescribers) about antibiotic prescribing workflows at one-day site visits in six NHs in Wisconsin (3) and Pennsylvania (3). We created a workflow map based on facility observations and visit debriefs. We identified workflow similarities, differences, and variations through comparative content analysis of interview transcripts, guided by the workflow map.

Results: We found two sets of commonly occurring steps: (1) staff work-up (recognition of change in condition, initial survey, nurse assessment, 24-hour board, temporary care plan) and (2) nurse-prescriber communication (nurse preparation, contact attempt, direct prescriber interaction). Content analysis revealed pervasive variations in execution of common steps (Table 1), highlighting challenges leading up to nurse-prescriber communication, including recognition, nurse assessment, preparation, and coordination. Triangulation among nursing, leadership, and prescriber transcripts documented additional sources of variation, to guide future implementations of multi-level antibiotic stewardship programs.

Conclusions: We characterized antibiotic prescribing workflows across NHs and found the steps most prone to variation. Based on this study, interventions to improve workflows focused on preparation for and coordination of nurse-prescriber communication events appear to be prime targets for NH antibiotic stewardship programs. We present this approach to comparative workflow mapping and lessons learned for application to other settings.
<table>
<thead>
<tr>
<th>Step</th>
<th>Variation</th>
<th>NH 1</th>
<th>NH 2</th>
<th>NH 3</th>
<th>NH 4</th>
<th>NH 5</th>
<th>NH 6</th>
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<tr>
<td>Staff recognizes resident condition change</td>
<td>Family/resident recognizes change</td>
<td>x</td>
<td>x</td>
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<td>x</td>
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<td></td>
<td>Prescriber recognizes change</td>
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<td></td>
<td>Staff other than nurse's aides recognizes change</td>
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<td></td>
<td>Staff misses resident condition changes</td>
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<td></td>
<td>Insufficient documentation</td>
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<td></td>
<td>Suboptimal assessment</td>
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<tr>
<td></td>
<td>Prescriber assessment only</td>
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<td></td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>Nurse performs formal assessment</td>
<td>Insufficient preparation</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>Nurse prepares for prescriber communication</td>
<td>Fax labs and orders</td>
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<td>x</td>
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<tr>
<td></td>
<td>Difficulty reaching prescriber for direct communication</td>
<td>x</td>
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<td>x</td>
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<tr>
<td>Nurse communicates with prescriber</td>
<td>Receptionist or answering service</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
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<tr>
<td>Nurse communicates with clinic nurse</td>
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Anthropometric data, which describes the characteristics of body dimension, is the basis of human-centered design, esp. for usability and safety. It is also widely used in the industrial design of clothing, furniture, sports ware, consumer product, machinery, personal protective equipment, vehicles, architectures etc. For this reason, more and more countries carried out national body size survey and set up anthropometric databases.

In China, China National Institute of Standardization (CNIS) undertake national body size survey in China. CNIS is a non-profit national research body, engaging in standardization research. The main responsibilities of CNIS are to conduct general, strategic, and comprehensive research of standardization, to research and develop comprehensive fundamental standards, as well as to provide scientific evidence for government policy-making. Most importantly, CNIS is committed to anthropometry and biomechanics standardization researches.

Update for body sizes of adult people is in great request as current data was acquired about 30 years ago. Due to support limitations, an updated survey for about 3,000 adult people was made among 4 different regions in China in 2009. 3D body scanning technique is used in this survey again.

National anthropometric surveys are time and money consuming. It’s almost solely Chinese government who supported those past surveys, even though body size data is highly evaluated. That’s also a reason why there hasn’t been new nationwide survey for adult people for so many years. Fortunately, a new national body size survey for adult people has been almost finished by CNIS.

With the support of the National R&D Infrastructure Development Program, CNIS conduct the updated Chinese adult ergonomic parameters survey that is from 2013~2018 and to be collect above 200 items of human body characteristics parameters from over 20,000 Chinese adults (including elders over 60 years) on national scale, where the body characteristics parameters consist of body dimensions, biomechanics (strength), visual data, acoustic data and finger touch data.

With a vast territory, there are great differences among the human body dimensions in different regions in China. To collect more representative human body dimensions, the stratified random sampling is used in the anthropometric survey. According to the anthropologic studies, The anthropometric survey area are divided into six sampling regions in China, namely the Northeast and North China Region, the Mid-western Region, the Region of the Lower Reaches of the Yangtze River, the Region of the Middle Reaches of the Yangtze River, the Region of Guangdong, Guangxi and Fujian, the Region of Yunnan, Guizhou and Sichuan.
In this anthropometric survey, the advanced non-touch 3D body scanners are mainly used, together with Martin measuring instruments for manual anthropometric measurement. In combination of interactive measurement and auto-calculation, data-acquisition work is greatly reduced. Set of other measures are taken to guarantee accuracy.
Work ability and well-being among sick-listed women with long-term pain in neck/shoulders or back who return to work and who remain on sick leave: A prospective study

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Sick leave due to long-term musculoskeletal pain is an increasing public health problem, particularly among women, in Western countries. Studies have shown that reduced work ability and well-being are common in this population, but do they really matter for return to work (RTW)?

Purpose: The purpose of the present study was to compare work ability and well-being over time, among sick-listed women with long-term pain in neck/shoulders or back who had RTW and who remained on sick leave.

Methods: A postal survey was sent to 600 women receiving time-loss benefits according to the Swedish Social Insurance registers. Inclusion criteria: (i) age between 18 and 65 years, (ii) sick leave: ≥ 1 month of their ≥ 50% service, (iii) pain in neck/shoulders or back: ≥ 3 months, and (iv) understanding Swedish. Exclusion criteria: (i) rheumatoid arthritis, (ii) multiple sclerosis, (iii) stroke, (iv) cancer, (v) Parkinson, (vi) bipolar disease, (vii) schizophrenia, (viii) pregnancy. After 12 months, a follow-up survey was sent to the 208 women who answered the survey at baseline. At the follow-up, 64 women had RTW and 41 remained on sick leave. The Work Ability Index (WAI) and the Life Satisfaction questionnaire (LiSat) were used to assess work ability and well-being, respectively. To determine whether the groups (RTW and non-RTW) differed at baseline for WAI and LiSat, respectively, independent t-tests were performed. If significant differences were found, the baseline values were included as a covariate in univariate analysis of variance with change in WAI and LiSat, respectively, as outcome and groups as independent variable. The level of significance was set to \( p < 0.05 \).

Results: For WAI, the groups differed at baseline \( (t = -7.54, p < 0.001) \). In the univariate analysis of covariance, the groups changed significantly over time \( (F = 28.47, p < 0.001) \) after adjusting for baseline values. The group that returned to work improved more than the group that remained on sick leave. For LiSat, there was no difference between groups at baseline \( (t = -1.58, p < 0.471) \). In the univariate analysis of variance, the groups changed significantly over time \( (F = 9.30, p < 0.003) \). The group that returned to work improved, whereas the group that remained on sick leave showed the opposite pattern.
**Conclusion:** It appears that work ability as well as well-being do matter for RTW. The results for well-being in particular highlights the need to intervene against prolonged sick leave in this population.
Effectiveness of an intervention establishing a health and safety committee for youth workers in Danish supermarkets

Type: Abstract Oral Presentation
Category: Others

Kristina Karstad1; Dorte Ekner1; Anders Ørberg1; Sisse Grøn2; Søren Bjerregaard Kjær2; Charlotte D. N. Rasmussen1; Andreas Holtermann1; Hans Jørgen Limborg2; Karen Albertsen2; Marie Birk Jørgensen1

1National Research Centre for the Working Environment (NRCWE), Copenhagen, Denmark; 2TeamArbejdsliv, Valby, Denmark

Background: In the Danish retail industry, youth workers employed in temporary positions for few hours a week constitute the primary workforce. Youth workers get injured at work more often than their older colleagues, which may be due to a limited sense of belonging and involvement of youth workers at the workplace. It may be important to increase the youth workers' knowledge and involvement in the work environment to reduce their high injury rates.

Aim: The aim of the present study was to evaluate the effectiveness of an intervention where a health and safety committee for youth workers was established with the purpose of improving their influence on and knowledge of their work environment.

Methods: Between March and June 2017, we conducted a controlled before-and-after study with eight Danish supermarkets allocated to either intervention (n=5) or control (n=3). A total of 251 youth workers (age 15-17 yrs.) were employed at the supermarkets allocated for intervention (n=197) and control (n=54), respectively. The intervention lasted 8 weeks. First a worksite based health and safety committee for youth workers was established including two youth workers, an adult (safety representative or manager) and a researcher. Next, the committee performed a workplace assessment of hazardous work situations for the youth workforce. Based on this, the youth workers in the committee were encouraged to suggest improvements and develop action plans for selected interventions. Finally, the committee implemented selected actions and disseminated information regarding it on internal social media. Before and after the intervention, an online questionnaire was sent as a link through text messages. The primary outcome was the degree of involvement in decisions about work environment measured by the question “Do you get involved in decisions that affect your work environment?” (Response option on 5-point Likert scale).

Results: At baseline, response rates to the questionnaire were 65% (intervention) and 56% (control) and at follow-up 52% (intervention) and 43% (control) of the eligible youth workers. At baseline, 41% (intervention) and 40% (control) of the youth workers reported to have some or high degree of involvement in decisions regarding their work environment. At the intervention sites, 41% of the youth workers had heard of the youth health and safety committee, 39% had seen posts on Facebook, and 52% had noticed a specific intervention activity. At the time of conference, analysis of the effectiveness of the intervention conducted will be finalized and results presented.
Conclusion: We conducted a worksite intervention among a group of youth workers in the retail industry who is generally perceived as difficult to reach. With a participatory approach and use of social media, we expect the intervention to be effective in improving the youth workers’ influence on and knowledge of their work environment.
The effects of playing music during surgery on the performance of the surgical team: a systematic review on published studies

Type: Abstract Oral Presentation
Category: Healthcare
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Background:

Objectives: The present study aims to evaluate the effects of playing music during surgery on the performance of surgical team (including surgeons, nurses and staffs) through a systematic review of published studies.

Methods: Relevant database including Medline/PubMed, Scopus, Cochrane library and Sciencedirect were searched up until the end of November 2017 to identify related articles with no time limitation.

Results: After removing duplicates and irrelevant articles, our comprehensive literature search identified 24 articles that met the inclusion criteria. Among these studies, 18 studies reported positive effects of music on the performance of the surgical team (including provided more relaxing and more pleasant environment, making them calmer, performing the task more accurate and more precision, improving their performance, decreasing mental workload and time to task completion, increasing situation awareness, improving memory consolidation, and reduction of stress and anxiety). In contrast, 4 studies reported negative effects of music during surgery (including negative impact on time until task completion, poorer auditory performance and more likely repeated requests to occur). 2 remaining articles didn't see any significance differences between comparison groups. Because of the different scales used in the studies were conducted meta-analysis on the data was not possible.

Conclusion: Most studies have shown the positive effects of music on the surgical team during operation, although it should not be neglected for its destructive effects. Therefore, it is possible to improve the performance of the surgical team during operation by playing controlled music.

Keywords: Music, operating room technicians, operating room personnel, surgical team and staff.
Can musculoskeletal pain and psychosocial factors predict car crash involvement?

Type: Abstract Oral Presentation
Category: Transport
Navah Ratzon¹; Rachel Shichrur¹
¹Tel-Aviv University, Ramat-Gan, Israel

**Background:** Professional drivers have been found to be at high risk for developing musculoskeletal disorders (MSD) due to prolonged sitting, vehicle vibration or problematic body postures. The association between work-related ergonomic and psychosocial stressing factors and MSD is well established in the literature. However, the association between MSD and work related psychosocial stressing factors to the risk of higher car crash involvement, is not yet clear. The aim of this study is to examine the relationship between musculoskeletal pain, psychosocial off road assessments and on road driving performance to car crash involvement, using a multiple linear regression model.

**Method:** The study examined 77 healthy professional bus drivers, from a large bus company. Drivers were 27-69 years old (mean= 52.3, SD= ±9.3). Mean time for owning a driver’s license was 32.3 years (12-50, SD= ±9.7), and for working as a bus driver was 20.9 years (1-45, SD= ±12.7). The drivers drove mainly in an urban area. Inclusion criteria were: male gender, and having a valid bus driver’s license. The assessment battery included off road diagnostics, on road evaluation and a driving simulator. Drivers filled out bio-demographic details and a driving history questionnaire, Standardized Nordic Questionnaire for analysis of musculoskeletal symptoms (SNQ) to examine the degree of musculoskeletal pain, and the Demand Control Support Questionnaire (DCSQ) to examine psychosocial characteristics. In-Vehicle Data Recorders (IVDR's) were installed inside the driver’s vehicles and were used to evaluate real time on-road driving behavior. Crash records (number of crashes recorded in the last year before participating in the study) was based on the claims submitted by the bus company to the insurance, including damage to the vehicle and injury to people as a result of the accident. A multiple linear regression was conducted to assess if a set of on and off road variables predict the dependent variable—car crash involvement.

**Results:** The linear regression model was statistically significant (p<0.001) and explained 40% (R-square) of the variance in participants’ car crash involvement.
The significant predictors of car crash involvement were number of painful joints ($\beta=0.54$), lumbar pain severity ($\beta=-0.43$), number of self-reported at-fault crashes (with car damage only) ($\beta=0.35$), DCSQ score ($\beta=-0.22$) and IVDR risk score ($\beta=0.21$). The number of collisions in the driving simulator was the only variable not found to be significant.

**Conclusions:** Musculoskeletal pain, psychosocial characteristics, self report number of at-fault crashes and on road characteristics collectively predicts car crash involvement. Understanding the contribution of work related psychosocial factors and MSD to the risk of higher car crash involvement and to predicting safe driving, may be a useful recommendation for bus companies, in the stages of selection, recruitment and training of drivers or when assessing safety intervention effectiveness.
Assessment of various Risk Factors causing Pressure Ulceration in people with Spinal Cord Injury – A Retrospective Study

Type: Abstract Oral Presentation
Category: Healthcare

Priyanka Rawal1; Gaur. G. Ray1

1IDC, School of Design, Indian Institute of Technology, Bombay, Mumbai, India

Pressure Ulcer (PrU) is a leading cause of morbidity and even mortality in people with Spinal Cord Injury (SCI). It is a major cause of re-hospitalization and subsequent mental and financial agony among the people with SCI. Development of PrU in the initial phases of SCI reduces the chances of recovery as the person is required to be bedridden and thus, misses out on the important period of physiotherapy and exercise. Moreover, this extended state of inactivity, in turn, mostly results in more PrUs due to prolonged exposure to pressure.

Elements and circumstances which expose skin to surfeit and prolonged periods of pressure or deplete its pressure bearing ability are risk factors for the development of PrUs. A substantial amount of literature in the domain of PrU generation and its effects on the body is available, with numerous risk factors enlisted and briefly described. But, independent studies are not reported covering the variety of causes and means for developing PrUs, especially studies from developing countries. In most of the studies, the broader picture is shown but the details regarding the same are either absent or inadequately elaborated. Especially, the risk factors related to the usage of equipment and products meant for people with SCI are not extensively studied and reported.

This study was carried out on a sample strength of 33 in which, the male to female ratio is 7:3. 20% are Quadriplegic and 80% are paraplegic. The reasons for SCI among the participants of the study fell from height (54%), road accidents (29%), sports injury (6%), swimming and gunshot (1%), and Non-Traumatic Injury (10%).

This work intends to assess various risk factors responsible for developing PrUs and conclusively delineate them based on evidence produced through direct data and experience extraction from the people with SCI, medical experts and caregivers through semi-structured interviews and medical reports (used for cross-verification). The information collected then was analyzed for frequency and severity of PrUs and subsequent re-hospitalization cycles due to them. The study was conducted in India, a developing country, to understand the aforementioned aspects in the context of the people with SCI in developing countries.

The intention is to help the medical community concerned with SCI to dissipate information at an early and critical stage, regarding these risk factors to the stakeholders in an effort to reduce instances of re-hospitalizations and improve their chances of recovery. Also, this study can provide knowledge about the risk factors associated with the equipment used by the people with SCI, which can assist designers and manufacturers to improve the usability and safety of their products.
Applying Human Factors methods to explore ‘Work as Imagined’ and ‘Work as Done’ in the Emergency Department’s response to Chemical, Biological, Radiological, and Nuclear events

Type: Abstract Oral Presentation
Category: Healthcare

Saydia Razak1; Hignett Sue1; Barnes Jo1; Hancox Graham1

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The Emergency Department (ED) is a complex, hectic, and high-pressured environment. Chemical, Biological, Radiological, and Nuclear (CBRN) events are multi-faceted emergencies. CBRN events present numerous challenges to ED staff (first receivers), such as overwhelming the ED with large-scale trauma, consequently requiring a combination of complex responses. Human Factors and Ergonomics (HF/E) methods such as Hierarchical Task Analysis (HTA) have been used in healthcare research. The HF/E theory Work as Imagined (WAI) and Work as Done (WAD) has been applied in the ED. However, HF/E methods and theory have not been combined to understand how the ED responds to CBRN events.

This study aimed to compare WAI and WAD in the ED CBRN response in a UK based hospital. WAI was established by carrying out document analyses on CBRN plans and WAD was represented by presenting first receivers with CBRN scenario cards. The analyses and responses were converted to HTAs and compared.

In the WAI stage of the study, two types of HTAs were formed. The first HTA established the general organisational responsibilities of the hospital during a CBRN event. The second HTA individually analysed 19 first receiver role action cards. Both types of HTAs were verified by the hospital CBRN lead and were later reviewed by Ergonomists. During the WAD stage, scenario cards were presented to 29 first receivers in the ED. Field notes were made, converted to HTAs, and verified with a representative sample of first receivers through interviews.

The first WAI HTA showed that the general organisational responsibilities during a CBRN event were: 1) understand roles and responsibilities 2) take notification of casualties 3) establish command and control 4) activate CBRN plan 5) manage scene 6) decontaminate 7) initiate recovery and 8) debrief. The second WAI HTAs represented the actions required from first receivers during a CBRN event which were: 1) prepare to respond to CBRN incident 2) respond to CBRN incident 3) initiate recovery from CBRN incident and 4) document CBRN incident. A comparison of WAI and WAD HTAs highlighted common actions such as isolating the patient, escalating the patient presentation to a senior first receiver, and activating the CBRN plan as being crucial. Two key differences between WAI and WAD were the importance placed on treating the patient and diagnosing the presenting complaint.

This study used HF/E methods and theory to understand the ED response to CBRN events. Combining document analyses (WAI) and qualitative scenario card presentations (WAD) provides an evidence-based source of knowledge, which can be used to inform future clinical policy and practice in the ED CBRN response.
Modeling people wearing body armor and protective equipment: applications to vehicle design

Type: Abstract Oral Presentation
Category: Automotive
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Vehicle interiors are complex human-machine interfaces, posing substantial design challenges, particularly when the vehicle is also a workplace. These challenges are compounded by the wide variability in human size, shape, and preference. For law-enforcement officers (LEO), firefighters, soldiers, and other workers, specialized clothing or body borne gear can affect their accommodation, comfort, safety, and ability to perform. Digital human modeling has the potential to provide designers with accurate tools to represent human variability, but current software generally lacks the ability to represent accurate seated body shapes for occupants with body borne protective equipment. This paper presents an overview of research to develop body shape modeling tools for vehicles that incorporate body armor representations. Laser scan data drawn from a large-scale study of men in seated postures was used to develop a predictive model that generates body shape as a function of standard anthropometric dimensions and seat and workspace variables. The model is postured using a data-based approach that incorporates the effects of body armor and gear on posture. Importantly, the space claim for the body armor and body borne gear is validated by reference to laser scan data.
Safety training parks - Cooperative initiatives to improve future workforce safety skills and knowledge

Type: Abstract Oral Presentation
Category: Building and Construction

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Construction is one of the most unsafe industries worldwide. Various different adverse health effects and risks for accidents and injuries are associated to construction work (Ringen et al. 2010). In addition to adversely affecting at individual level to human health and well-being, they usually affect at the company, family and society levels. Construction sites are shared workplaces where different personnel groups act together. The backgrounds for the personnel might vary, but some common characteristics can be identified. Work contains manual elements and the employees tend to be less educated and male-dominated. In addition, employees at the work sites might have different cultural and language backgrounds (Demirkesen and Arditi, 2015). This poses challenges to the safety management processes. Safety training is one essential element of safety management. A wide variety of different safety training methods have been introduced, and a need for more engaging training methods have been recognized (Burke et al., 2011).

An unique approach for safety training – a Safety Training Park (STP) concept – has been introduced in Finland (Reiman et al. in press; STPNF). In this study we focus on the STP (later STPNF) in Northern Finland. STPNF trainings are based on dialogic learning at simulated training points, representing real life work environments. Dummies representing good and bad practices are utilized to facilitate dialogue and support different learning approaches. STPNF was jointly created in 2012-2014 by various stakeholder organizations from construction companies to service providers and employee and employer associations. Currently 86 stakeholder organizations belong to the STPNF consortium. Cooperation is based on a shared vision and funding by the consortium members. Each organization have provided something to the common purpose of constructing and developing the STPNF. Mutually, the consortium members get the rights to use the STPNF premises for their own training purposes. A sustainable decision made by the consortium – supporting social impacts and long-lasting learning – is related to the common agreement that all schools and universities in the Northern Finland are allowed – without any fee – to use STPNF for their educational purposes. Student groups from pre-school to university level have been trained in the STP.

In this article we present the STPNF concept which has risen interest broadly from different consortiums seeking for possibilities to import it to other Nordic countries. We further discuss potentials and prerequisites for the transferability of the STP methodology to other contexts (target groups and regions) more generally. Therefore, the concept will be characterized due to different ergonomic perspectives: Microergonomics concerning the safety improvements at workplace level, macroergonomics concerning the change management training method and community ergonomics focusing on the stakeholder consortium model for funding and vision building.
The aim of this article is to propose a systematic for the integration of ergonomics into product design, based on the user-centered design approach, which, although initially applied in the design of computer systems, has gradually infiltrated other design disciplines (Kelly, 2014).

The UCD was formalized through ISO 13407 - Human Centred Design Processes for Interactive Systems (1999), later updated by ISO 9241-210 (2010), which guides the incorporation of user-centered activities to obtain quality of use throughout the lifecycle of interactive systems. The standard describes user-centered design as a multidisciplinary activity that incorporates ergonomic knowledge and techniques with the aim of increasing efficiency and productivity and improving human working conditions, as well as being complementary to existing design methodologies and providing a human-centered perspective that can be integrated into different design and development processes (ISO 9241-210, 2010).

In this context, starting from the assumptions that ergonomics is little considered in the design engineering practice (Reinert and Gontijo, 2017), and that engineering design methodologies do not adequately present the use of ergonomics (Reinert and Gontijo, 2017), it is believed that a formalized and standardized approach such as the user-centered design (ISO 9241-210, 2010) associated with a well-structured engineering methodology can help engineering students better understand and apply ergonomics in the product development process.

Therefore, a system was developed to integrate ergonomics into product design, based on the product design methodology of Back et al (2008), because it is the most used by the engineering students of the Federal University of Santa Catarina (Reinert and Gontijo, 2017), University in which the research was developed. The integration of ergonomics, through the user-centered design, was done in this methodology, so its use will be facilitated by the prior knowledge of the students in the process.

In order to verify the applicability of the systematics in the engineering education, an experiment was carried out in two classes of the product design course in 2016. One class was chosen as a study group and used the systematic proposal during the course, and the other group was chosen as a control group and used the standard methodology proposed by Back et al (2008), as was already done by the Professor of the discipline. At the end of the course, a questionnaire was applied with the students of both classes, on the understanding and use of ergonomics in the product design, showing that presenting this content of ergonomics in an appropriate way and together with the design process allows students to be more likely to use it, to understand it better and know how to use it.
Up to our Elbows in Ergonomics: Quantifying the risks of bovine rectal palpations

Type: Abstract Oral Presentation
Category: Agriculture

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Background

International literature has shown that musculoskeletal disorders (MSD) are common among bovine (beef and dairy) veterinarians. One of the most hazardous tasks for these practitioners has been hypothesized to be rectal palpations (Cattell, 2000; Ailsby, 1996; Zeng et al., 2018), which are primarily performed to assess presence/stage of pregnancy. However, little research has been done to quantify exposure to specific risk factors associated with this procedure. The research objective for this study was to identify potential risk factors related to bovine rectal palpations.

Methods

A mixed-mode survey targeting 262 members of the Western Canadian Association of Bovine Practitioners reported on personal and work characteristics and musculoskeletal symptoms. Multivariate analysis was performed on this data to identify work conditions, task characteristics, and veterinarian characteristics that could have an association with MSD symptoms. To complement the data, an exploratory pilot observation study was conducted with four bovine practitioners (two practicing veterinarians and two veterinary students). Practitioners were video recorded while performing bovine rectal palpations in their workplace. The assessment of the pilot data was conducted using existing ergonomic assessment tools, including Rapid Upper Limb Assessment (RULA) (Middlesworth, 2015) and Quick Exposure Check (QEC) (University of Surrey, 2009).

Results

Survey responses and preliminary field observations of rectal palpations indicated that this task is highly repetitive and physically demanding; the average number of palpations performed per year was over 4,000 and the highly seasonal nature of the task means practitioners are not able to spread the work out over time. Physical attributes (height and overall health status) were found to be individual-level risk factors for MSD. A high frequency of awkward postures was observed in the field assessments during manual and ultrasound-assisted palpations. The combined data suggests that for shorter statured practitioners, rectal palpations often involve reaching above shoulder height, while taller practitioners or those working with smaller cows might have to flex forward. Practitioners
were observed using a high level of physical force to insert their arm into the rectum. Using both RULA and QEC, repeated rectal palpations were calculated to be a task with high MSD risk.

Conclusions

Our assessment suggests that rectal palpations are a highly hazardous task performed routinely by bovine practitioners. The next stage of this research will involve expanding the pilot assessment to include more practitioners, locations, and more advanced biomechanical modeling.
Sedentary behaviour of office workers with long-term access to sit-stand workstations

Type: Abstract Oral Presentation
Category: Banking and insurance

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Introduction: Prolonged sitting has been associated with detrimental health outcomes such as an increased risk for premature death, heart disease and diabetes. Especially office workers show high accumulated sitting hours at work, indicating that for this group interventions to reduce sitting time are relevant. Recent research in this respect has mainly been focussed on the introduction of sit-stand workstations and evaluating its short term effects. Little is known about the actual use of sit-stand desks and accompanying sedentary behaviour in office workers who have had long-term access to sit-stand workstations. The main objective of this study was to determine how frequently office workers with long-term access to a sit-stand workstation use the standing option of their desks. Additionally, we investigated whether different user groups differed with respect to their self-reported sitting, standing and walking times.

Method: A European company has been offering sit-stand workstations to their employees since 1999 without additional intervention to stimulate its use. In total 3533 office workers were invited by email to fill out an online questionnaire, asking about the frequency of using their sit-stand workstation and the time spent sitting, standing or walking at work (assessed using the Occupational Sitting and Physical Activity Questionnaire; OSPAQ).

Results: In total 1115 employees (31.6%) completed the questionnaire. Participants were mainly male (64.9%) and had a mean age of 46.7 years (SD = 7.8 years). Three user groups were distinguished based on their self-reported frequency of using their sit-stand workstations: non-users: 33.4% using the standing option not at all or less than once per month; monthly/weekly users: 36.8% using the standing option at least once per month to three to four times per week; and daily users: 29.9% using the standing option at least once per day. Daily users reported fewer sitting hours at work (mean = 28.7 (SD = 10.9) h/w) than moderate users (mean = 34.2 (SD = 10.2) h/w; p=0.057) and non-users (mean = 35.6 (SD = 10.0) h/w; p<0.05). Furthermore, daily users reported more occupational standing time and walking time than moderate users and non-users.

Discussion: Office workers with long-term access to sit-stand workstations differed considerably in their self-reported frequency of use. Thus, providing workers with a sit-stand workstation does not necessarily guarantee its (frequent) use for the majority of office workers. As expected, daily users seemed to report fewer hours of sitting and more hours of standing and walking during a working week than non-users. However, self-reported sitting time was not different between weekly/monthly users and non-users. Therefore, additional intervention efforts are recommended to stimulate the use of...
sit-stand workstations, especially in moderate and non-users, in order to make workers sit less and stand and move more.
An Ergonomic Investigation Of Medical Device Design In Aortic Valve Resection And Implantation

Type: Abstract Oral Presentation
Category: Healthcare

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Ergonomics and Human Factors criteria for medical devices design are an essential part of new product development. These principles have gained in significant, mainly due to the increased realization that unsafe events and medical errors are attributable to human behaviors and device design. Indeed at present, human factors standards are mainly associated to human device interface, physical environment and cognitive aspects of device users. In this way, ergonomics provides useful guidance on how to sketch and incorporate human centred design principles into medical devices and equipment so users spontaneously feel comfortable with the system.

Within the scope of a research project, the purpose of which was to define the ergonomics of a new system for the replacement of a stenosed and calcified aortic valve without opening the heart and without resorting to external blood circulation, i.e., on the beating heart and using a transcatheater transapical procedure, we analyzed the processes of fibrillation during which many technical, human and organizational factors combine to ensure high efficiency of the Transapical Aortic Valve Implantation (TAVI) operating mode.

Aortic stenosis is one of the most important acquired heart diseases, with a prevalence of 4.8% in patients aged more than 75 years and represent more than 60% of the indications for cardiac surgery in elderly patients. In this perspective, the concept of endovascular resection of the aortic valve before TAVI was developed. The method habitually used for transapical valve implantation requires rapid ventricular pacing at 180-220 beats per minute, which lowers the systolic blood pressure to ≤ 60 mmHg. The heart then beats so fast that it “freezes” and the blood no longer circulates, which also blocks blood circulation in the brain. As a result, such blockage can only be very limited in time – to one minute – and that the surgeon is working within a highly restricted time frame. The chief difficulty of replacing the valve is that it requires that the heart be stopped by fibrillation for a maximum of one minute during the positioning and expansion of the endovalve.

The purpose of this research is to perform remote resection of the diseased valve by catheter and remove it while implanting the new valve. Observations, interviews and data analysis led to several models, mock-up, 3D printed parts, and lastly, a demonstrator based on the ergonomics principles and task analysis. Ergonomic specifications have been concretely translated by the development of mock-ups and finally, a usable demonstrator, which we will present in the complete oral communication.
Most of the time, workplaces are designed according to the design process that starts with the macro dimension and consequently proceeds to specific points of the project. Therefore, this approach initially deals with the building, then it focuses on the workspaces where the infrastructure will be established, and finally the workstations are defined. Normally, decisions concerning macro points are prematurely made in an early phase when it is still difficult for designers to anticipate future users, necessities, and deal with space management. Hence, designers decisions are made based on spaces previously defined by the program that guides the project in a macro way.

Once the project is executed, the building and spaces represent some restrictions for the micro dimensions. The structural design, the positions of the walls, the windows, the isolation, the access to the building, the natural ventilation, all of them are already set. Complementary projects like electrical installations, artificial lighting, and ventilation are already oriented by a basic layout, which are many times discussed in the initial phases of project. However, it is in the micro dimensions of the project that workstation conformity is effectively perceived by the user in a positive or in a negative way. This perception is easily observed when the workstation is being used to reach the production system aims and management decisions.

This paper aims at showing that understanding how a workstation is used can reveal essential information to the project of the workspaces as well as the building where they are located. In order to accomplish that, we present a case study of a control room project (spaces and workstations) in a thermoelectric power plant.

Work analysis shows dynamic of relations involving the control process system, the workspaces and workstations, and that experience with the control system is fundamental to define macro project requirements to fit workstations to the workers necessities in order to keep the production system in a stable and efficient way. Nevertheless, the management staff not always understand that requirements defined in the macro dimension of the project may result in difficulties to workers activities.

In conclusion, we show that the project is conceived from macro to micro dimensions. However, it is later that some mismatches caused by this traditional sequence of deployment from macro to micro lead to an invisible extension of the project development in a micro scale. It becomes necessary to adopt strategies, even in managerial level to minimize the tension involving user expectations, management goals and the effective structure to accomplish the operational work activities. Thus, it is important in this process of inverting the project sequence to learn with the use experience to avoid some mistakes that normally happen in many projects.
Introduction

Aging is a complex and natural process that has been extensively studied. Studies indicate that high biomechanical exposure and job strain in midlife are strongly associated with the severity of disability in later life (Oakman, Neupane, & Nygård, 2016). This study aims at characterizing the perception of work activity demands, according to age, and it is part of a prospective study done in a Portuguese municipality from 2015 to 2017.

Methodology

A survey based methodology was used and the questionnaire integrated the sociodemographic characteristics, as well as the variables related to the activity demands, classified through a 5 points Likert scale. The sample consisted of 885 (54.7%) workers in 2015 and 1167 (70%) in 2017.

Results

Our sample showed an average age of 46.9 years (sd= 8.3) in 2015 and 48.4 years (sd=8.7) in 2017. The mean age differences were statistically significant (p≤0.001), what corresponds to a low level of workers’ turnover and to the ageing process of the working population. In both years there were a higher percentage of female workers (65.6%; 61.8%), with the professional category of Technical Assistants (37.9%; 37.1%) followed by Operational Assistants (33.7%; 32.7%). The mean age was higher among the category of Operational Assistants (2015: 49.7 ±9.2; 2017: 51.1 ±8.9) (p≤0.001), those with basic education level (2015: 51.7 ±8.5; 2017: 53.2 ±7.7) (p≤0.001) and among workers who have not received training in the last two years (2015: 47.1 ±8.8; 2017: 49.3 ±8.9) (p≤0.001).

The results showed that postural demands and manual materials handling obtained more favourable results in 2017, with the categories never / seldom presenting higher percentages, what seemingly tends to a reduction on its frequency over the two years. However, older workers presented a higher percentage of physical demands in their work activity, in both moments of the study, such as manually handling loads between 1-4 kg (2015: 29.8%; 2017: 30.4%), working with trunk rotation (2015: 26.6%; 2017: 27.9%) and trunk flexion (2015: 19.9%; 2017: 23.9%), and performing precision tasks. In our sample, physical demands at work are still perceived as frequent, mainly among older blue collar
workers and it is known that these are the main determinants of poor work ability among the older workers (Lindberg, 2006; Savinainen, Nygård, & Arola, 2004).

Conclusion

This study showed a sample of municipal workers with a high mean age in line with the ageing trends of the Portuguese population. Municipalities must manage workers’ resources by adapting workplaces and tasks to maintain productivity and promote active and healthy aging. The results indicate that it is necessary to implement an age management policy at the municipality, so that older workers can remain active and healthy.
This study is concerned with a new method for partly automating forestry harvesting work. Work-related injuries and constant demands for a higher productivity are two of the many arguments for why forestry work must be improved. Forestry work places great mental demands on the driver because they must continuously evaluate and act on relevant parts in a heavy visual information flow. Against this background the purpose of the present study was to extend the knowledge of functional linkages between visual and mental fatigue, performance, and prefrontal cortex activity, during semi-automated and conventional forestry harvesting work. Eleven healthy participants, range 21–51 years old, with a minimum of 1-year work experience, carried out the task of loading logs along a standardized path in a machine simulator during two counterbalanced 45-min periods: (i) conventional forest harvesting, and; (ii) semi-automated forest harvesting. Equal emphasizes was put on accuracy and speed. During manual forest harvesting the driver controlled the crane arm, used to load logs into the load space of the forest vehicle (“forwarder”), by manually operating the joysticks and so guide the crane to the location of the log and then back to the load space. During semi-automatic forest harvesting the driver moved the crane with the press of a button to a pre-programmed location near the log and then, after another button press, to a pre-programmed location within the load space. The following joystick usage parameters were considered for the statistical analysis: Sequential work cycle number, work phase (1-loading in basket, 2-movement to log, 3-picking up log, 4-movement to load space), number of simultaneously used controls across samples of one phase, number of direction changes of joystick movements per phase. Mental load was assessed by quantification of oxygenated hemoglobin (HbO2) concentration changes over the right dorsolateral prefrontal cortex (dIPFC) via non-invasive functional near infrared spectrometry (fNIRS: PortaLite mini, Artinis Medical Systems, Zetten, the Netherlands). The frequency and duration of horizontal amplitudes of eye/head/neck angles was assessed continuously with 8 SmartEye cameras and used as a measure of visual load. NASA-TLX and Borg CRS was used to assess perceived mental and physical fatigue. Linear Mixed Model will be used to test and to analyze the effect of the duration of work, joystick usage, work type (manual or semi-automated) and perceived mental and physical effort on the outcome of oxygenated hemoglobin concentration. This study contributes with new knowledge of the consequences of the current increase in automation. The 4th industrial revolution can have tremendous implications on how we
perceive and organize work in the future, but little is still known about the impact on human body and brain.
Needs and use of the information in the environment by people with visual impairment

Type: Abstract Oral Presentation
Category: Building and Construction

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Most of the information we use in our daily commutes is presented in a visual way, however, this volume of information is useless for people with visual impairment. With this purpose, exists some resources such as tactile flooring or braille information points that constitute the main guiding tools in public spaces; although little information of the extent of the real utility of these elements is available. Furthermore, it has been detected a gap of information regarding the characteristics of the commutes and needs of people with visual impairment.

This study aimed to identify the needs of information of people with visual impairment through the identification of the following points: 1. Daily life activities. 2. Orientation strategies and wayfinding in complex built environments, with consideration of the climatological conditions. 3. Frequency and way of use of the signals provided in the environment by people with complete blindness or severe visual impairment. 4. Types of discrepancies, errors and omissions in the characteristics of the environment, which reduce the usability of the space and might put the user in danger. 5. Safety perception.

The data was obtained through a semi-structured questionnaire applied to 25 adults with complete blindness and severe visual impairment to assess the five previously mentioned aspects. At the same time, five accompanied commutes were made, in order to identify the efficacy of the existing information in the environment and the possible obstacles during their journey. It was found that 100\% of the participants leave home at least once a day to attend to school or work and remain outside home an average of 8 hours. As references for orientation, the most mentioned aspects where textures or level changes on the floor, as well as ambiance elements like noise and smell. On the other hand, the information presented in braille was reported as little used, due to the difficulty to find the information in the first place. In regard to safety, participants reported not feeling unsafe although most of them mentioned street crossing as a major risk point.

The use of auditory, tactile or even olfactory signals can provide important information while commuting, making paramount the design of signals that consider these senses to take advantage of them. It is required as well, to assess the characteristics of the existent tactile signals and their location to identify opportunities for improvement to ensure the safety and independence of people with visual impairment.
Development of edema and its reduction by compression stockings during prolonged standing – a laboratory study

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Introduction: Prolonged standing is a widespread physical strain for workers in the industrial and service sector. It is known to be a cause for lower leg swelling and a risk factor of venous disorders. The use of compression stockings is assumed to be effective in reducing lower leg swelling. Little is known about the effect of different compression intensities and the time course of the swelling. The aim of this study was to investigate the influence of two different compression intensities throughout a 2-hour standing exposure on lower leg swelling, complaints, and wearing comfort. An additional aim was to analyse the progress of edema development during this period.

Methods: 40 healthy subjects participated in this randomized cross-over experiment. Spread over three days in a randomized order, each subject was exposed to a 2-hour standing period wearing compression stockings medical class I (18-21 mmHg) or class II (23-32 mmHg) or not wearing stockings. Lower leg swelling was quantified by changes of lower leg volume using water plethysmography before and after each standing exposure. The time course of arising edema was analyzed by using low frequency bioelectrical impedance measurement. Level of discomfort was assessed every 30 min (11-point Likert-Scale) and wearing comfort was measured at the end of the exposure using a custom-made standardized questionnaire.

Result: Wearing compression stockings reduced lower leg swelling significantly compared to wearing no stockings, but there was very little difference in leg swelling between the two compression classes. The low frequency impedance measures confirmed these results and its time course showed an exponential behavior. The levels of discomfort were rather low and did not significantly differ across conditions. Higher levels of wearing comfort were found for the class I compared to the class II stockings.

Discussion: Results showed that the lower compression intensity might be almost as effective as the higher compression intensity in reducing lower leg swelling. This is an important finding since compliance of wearing compression stockings increases with lower compression intensities, which is supported by the increased wearing comfort for the lower compression class in this study. The fast arising edema leads to the conclusion that the use of compression stockings maybe more useful in short standing periods than previously assumed.
Attention and vigilance: A large scale workplace study

Type: Abstract Oral Presentation
Category: Others

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Many previous studies have examined the effect of working environment on job performance. However, these are usually site-specific experiments examining office workers, concentrating on self-report measures and peer assessments. An area of particular interest is whether computerised tests could be used to identify deficits in performance and associate these with specific environmental problems.

We recruited over four hundred participants from several companies in Singapore, spanning a range of job types requiring different levels of visual attention, broadly grouped as technical workshop staff, administrative staff, management, and operational control room workers. Where possible, job types were matched across companies. Participants were given a series of psychological, environmental, and health-related questionnaires and computerised tests examining various aspects of visual attention (psychomotor vigilance task, go-no-go task and global-local change detection) as analogues of work performance. Environmental measurements, such as light quality and accessibility of windows was recorded for each participant's personal work area.

Hierarchical logistic regression multivariate models were used to examine the workers' performance, taking into account work-related, environmental, and health related factors. Results indicate variability across companies within job types and divergent effects for vigilant and selective visual attention.

We discuss these results in the context of the environmental aspects of each workplace, and offer potential architectural improvements to improve the visual environment.
Designing an Organizational Readiness Survey for Total Worker Health® Workplace Initiatives

Type: Abstract Oral Presentation

Category: Others

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Total Worker Health® (TWH) initiatives integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being (NIOSH 2017). However, few methods have been published to date for specifically assessing "organizational readiness" to implement or participate in TWH policies, programs, and practices.

Organizational readiness is defined as, “The extent to which individuals are cognitively and emotionally inclined to accept, embrace, and adopt a particular plan to purposefully alter the status quo, and the organization’s capacity to successfully undertake those changes” (Armenakis et al., 1993). The proposed TWH organizational readiness instrument is well grounded in the change management literature, can be used to identify actionable steps to be taken in employer organizations, and has been partially validated through field work. We first identified indicators of organizational readiness for change in the extant literature. Readiness for change also depends, in part, on context-specific change. Everyday functioning in the workplace will affect change efforts, even though this may seem unrelated it is the combination of initiative content and workplace context that influences individuals’ motivation to change, attitudes toward change, and behaviors to change.

In our conceptual model of organizational readiness (Figure 1), the first layer is context; the organization’s current functioning and how it operates day to day. The practices and processes that are currently in place can affect the level of readiness for future change efforts. The second layer is content; the change effort of choice. Included in the content layer is visionary communication that clearly explains the change, why it is needed, and what can be expected. Communication quality and its consistency is very important, and alignment of actions with the message. The third layer is individual motivation; support for the change, acceptance of the change when it occurs, a belief that one’s behaviors can be adapted to accommodate this change, and being able to work together to make this happen. All levels of an organization, including the organization itself, groups/teams, and individuals, together have impact within and across these three layers.
The systematic literature review, and conceptual model, led to the development of a 43-question assessment tool. As an organizational diagnostic, the tool can be used to assess the level of readiness for organizations to initiate, manage and sustain integrated wellness and safety initiatives. The tool is also designed to help organizations with low scores improve their readiness for change by identifying their specific resource and training needs. Initial validation efforts and use of this organizational readiness tool in a TWH initiative will be presented.


Over the years, healthcare workers have suffered debilitating musculoskeletal disorders when lifting, transferring and repositioning patients manually. Hence this study focuses on risk-related issues experienced by healthcare workers as well as their patients due to manual patient handling. Issues regarding patient handling activities were analyzed by conducting a survey on healthcare workers and patients that includes ergonomic assessment tools like Rapid Upper Limb Assessment (RULA), NIOSH Lifting Equation, and Nordic Musculoskeletal Questionnaire (NMQ) etc. After which, one-way ANOVA and Tukey’s HSD Test were conducted to determine a significant difference between the risk factors on patient handling activities. As a result, healthcare workers tend to experience discomfort mostly on their upper limbs due to equipment’s dimensions and capacity to lift. To address the problem, this study suggested an intervention for the most critical patient handling activity by proposing a patient handling device. The design of the device was based on healthcare workers and patients’ needs and requirements which were translated using Quality Function Deployment (QFD) and Detail Design. For validation of the product, Design Failure Mode and Effect Analysis (DFMEA) and survey regarding user’s perspective of the product were conducted. To test the effectiveness of the proposed design, RULA and NIOSH Lifting Equation were again utilized and the results were compared to the ones obtained before the intervention. Through this, it was confirmed that the proposed design captures critical patient handling activities and offers more functions and features than the available lifting equipment with a lower cost.
New types of wearable products with electronics and intelligent components are rapidly entering the global consumer marketplace. These new wearable technologies have greater need for fit precision to function properly with broad demographics. However, traditional anthropometric averages and human 3D models alone are proving to be insufficient for achieving the fit required. Effective product development requires iterative use of human subjects starting early in the design process. The fit testing must be continued throughout the process with close communication with industrial design and various engineering teams. This process is particularly important for products that are the first of their kind and thus have no precedents to follow.

This paper will review the effective fit study process developed at various institutions to ensure correct fit and comfort on highly technological products. The process was applied and proven at a new technology startup in Florida, Magic Leap Inc. The result was not only an effective fit for their target market, but also an elegant design which is comfortable to wear for a long duration of time and intuitive for consumer to interact.
Ergonomics and architectural programming: a possible articulation?

Type: Abstract Oral Presentation

Category: Building and Construction

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Throughout history, the practice of architectural design for industrial buildings generally considered the criterion of square footage established by the number of occupants or machines of a specific environment as a design parameter. Large sheds are often built for the distribution of industry sectors in space, prioritizing the manufacturing sequences and sizes of equipment. Nevertheless, space needs to be considered as an important resource in the management process.

One of the problems faced by architects in their professional practice is the difficulty in integrating the expected functional quality into an architectural program with their architectural designs. In order to achieve an adequate level of support for the use of the construction, it is positive that the project should be preceded by the expected functional understanding of the construction and the results of the built environment. In fact, it has been mainly considered what is prescribed, that is, the task, disregarding the activity and its resulting problems.

The hypothesis of this study sustains that, when integrating the Ergonomic Work Analysis (EWA) as an auxiliary tool in the architectural programming, it is possible to promote functional quality for the use of the building. In this sense, work activity can be considered one of the fundamental pillars of industrial construction projects, not only as an adjustment variable to be treated, when practically everything is already defined, and it would be necessary to fit the right workers into their work spaces.

The lack of knowledge about the activities, carried out in a space destined to a predefined task in the architectural programming process, negatively affects the health and quality of workers' lives, but also the economy in general. Significant investment costs of construction are inevitable, with unavoidable interventions in a short post-occupation period in such
environments, as well as the unfavourable effects of such remodelling on production systems.

In this perspective, this study compares the methods used in EWA and architectural programming to enrich different design processes used by architects in their daily work. The research, carried out empirically in a Brazilian food industry, whose activities, inherent to the prescribed tasks, were analysed in a systematic way, has the purpose of adding contributions to the usual methodology of architectural design.

The results indicate that the lack of activity analysis generates problems in the production flow and a layout without flexible spaces for the integration of new machines in the implementation of new products.
Development of an interactive system that censes the air quality in parking lots, indicating situations of health risks

Type: Abstract Oral Presentation
Category: Education and Training

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The detection of various pollutants in the environment is an important tool for decision making related to the health of the population. Inappropriate concentrations of various gases or volatile particles can cause various levels of health risks to people in the respiratory tract, as well as skin and eye conditions. There are systems in the market for detection of these pollutants that, when used properly, make it possible to accurately quantify the presence of any of these contaminants; however, the development of such systems has been directed primarily to be used by specialized professionals, who require to use them, a certain level of training and qualification both in the daily use of the equipment and in its configuration, maintenance and interpretation of data; Moreover, determining what actions should be taken after the detection of a specific level of contamination, usually falls on various actors who are not usually part of the population exposed to such risks.

The objective of the project under development called "interactive system that censes the air quality in parking lots, indicating situations of health risks", will promote the detection of gases in closed spaces that, through the generation of interactive interfaces aimed at the general population, will give them real-time access to the air quality conditions in said spaces, and with this, their active participation in the preventive or corrective measures leading to mitigate said risk situation will be viable, without requiring specialized knowledge. The main sensors that will be implemented are for detecting CO, CO₂, VOCs and O₂ gases, which have been widely related to the combustion process in motor vehicles and respiratory health. It is of paramount importance to know such concentrations in real time because, although there are indexes that measure at the metropolitan level the general concentrations of said gases and particles (in CDMX the Metropolitan Index of Air Quality IMECA), the conditions of the Closed spaces such as large parking lots can vary significantly, due to factors such as peak hours of use, configuration of the property, presence of forced ventilation systems in the property, as well as the environmental conditions of the area in which it is located. be restrictors of good ventilation and dissipation of gas concentrations in the study space. Through the DCU as the main characteristic of the system that is developed, we seek to know the variability of profiles of individuals that inhabit such spaces; time of permanence, organizational relationship, attitudinal and other factors that allow directing the user interface of the system so that they can interact through different interfaces, according to their needs and attitudes, to act or provide information in a timely manner to decision makers, looking for the elimination of such health risk conditions.
ERIN: A Practical Tool for Assessing Exposure to Risks Factors for Work-Related Musculoskeletal Disorders

Type: Abstract Oral Presentation
Category: Education and Training

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Work-Related Musculoskeletal Disorders (WMSDs) prevention has become one of the main concerns to ergonomics practitioners and health professionals in both, developing and industrially developing countries. An important step in the prevention of WMSDs is the exposure assessment of risks factors at workplace. However, ergonomic methods available to assess the exposure to WMSDs risk factors have been mostly developed for specialized personnel, which has made the massive evaluation of workspace/tasks very difficult in many industrially developing countries, since the existence of this personnel is limited.

This paper presents the Individual Risk Assessment (ERIN) ergonomic tool, developed for assessing exposure to risks factors for work-related musculoskeletal disorders by non-experts. It is also presented a procedure on how this tool can be used during the ergonomic evaluation and intervention process at workplaces.

ERIN involves the measurement or assessment of the following seven variables: posture and frequency of movement of the trunk, shoulder/arm, hand/wrist, and neck; the rhythm resulting from the interaction of work speed and the duration of each task; intensity of effort (which includes both the intensity and frequency of the perceived effort); and the worker’s assessment of the stress required in carrying out the task. The global risk is obtained by adding the values for all the seven variables assessed in ERIN. The model used for calculating the global risk permit to easily identify the influence of each factor and to address the change needs for diminishing the global risk.

ERIN can be used by non-experts with minimal training in evaluating dynamic and static tasks, and as an instrument to determine in which cases interventions should be instituted to reduce the worker’s exposure to WMSD factors and to measure the effects of those measures. ERIN has proven to have an acceptable level of reliability and validity, as well as a great acceptance among professionals that perform ergonomic evaluations on real contexts since its use requires low training, sources and time. To date, ERIN has been applied in different workplaces in several countries (eg. Brasil, Canada, China, Cuba, Colombia, Ecuador, India, Mexico, Peru, among others). Finally, it should be stressed that ERIN is only one tool in a comprehensive effort to prevent WMSDs.
The need of practical macroergonomic methods and tools that can be used by non-experts or practitioners, easy to understand and use, non-time consuming and requiring minimal training has been recently highlighted. This paper describes a new macroergonomic tool for assessing the organization capacity to introduce, apply and integrate the ergonomics in their process.

The Ergonomic Maturity Model (EMM) was constructed in two phases: planning and design. In the planning phase a work team was conformed to develop the model. A set of maturity models, information related to system ergonomics, macroergonomic tools and sociotechnical work system theory were reviewed to identify shortcomings in the existing models and to select suitable parameters for the proposed maturity model. In the design phase, the model levels were established. Also, the aim and the name of the maturity model were defined. Finally, an evaluation matrix, questionnaires, checklists and a procedure to apply the model were developed.

The model establishes five maturity levels: Ignorance, Understanding, Experimentation, Regular use and Innovation (Figure 1). The evaluation matrix is structured by four macro parameters with its corresponding elements. (1) Integration: determined by the degree to which the structures and management policies prevailing in the company induce the introduction of Ergonomics (strategic alignment, management, commitment and resources), (2) Performers: are the people who run Ergonomics, including external and internal to the company (knowledge and skills, owner and compensation), (3) Surveillance: is the way of collecting, analyzes and interprets information regarding the ergonomics as well as feedback within the company (indicators, information systems and risk assessment) and (4) Culture: refer to the will and way of managing the company focused on Ergonomics (work team and acceptance). The procedure to apply the EMM consists of three steps: (1) preparation of the evaluation, (2) evaluation of “ergonomics maturity” using the model, and (3) improvement plan. Lastly, an example of application of the model in a Colombian company is shown.

The EMM is a tool that can be used by ergonomist for planning new strategies in order to enhance the introduction, application and integrations of ergonomics into process organizations under ergonomics systems perspective. Subsequent validation of the model should be carried out in order to refine their parameters and tools that support its application. The model has been applied in several organizations of industrially developing countries (eg. Cuba, Colombia, Ecuador).

Figure 1. Ergonomic Maturity Model.
Level 5. Innovation

Level 4. Regular use

Level 3. Experimentation

Level 2. Understanding

Level 1. Ignorance

Ergonomic culture

Ergonomic programs

Ergonomic interventions

Ergonomic understanding
The problem of misuse or non-use of digital health resources can be overcome. However, it is a fallacy to think that if you build it, they will come. Challenges are faced with lack of consistent power and internet access, availability of culturally appropriate educational material, accessible continuing education content and limited staff in rural locations. Digital health tools need to be designed in a participatory manner in order for the clinicians to not only learn how to use the new tools but also gain a sense of ownership and create their own ways of using them that work with the workflows and cultures of their communities of practice. While many projects have been started, few have proven to be sustainable or began to investigate the new modalities of work introduced by this technology.

Most notably, midwives and nurses need more health information resources to encourage best practices in their work. mHealth tools have been a useful method to efficiently give health care staff access to such information. In particular, a curated digital repository of evidence-based clinical research, the Global Library for Women's Medicine (GLOWM) has been developed by the International Federation of Gynecology and Obstetrics (FIGO), specifically as a resource for midwives and nurses in low-and middle income countries (LMIC) with high maternal mortality rates (http://www.glowm.com/). SaferMotherhood is an application for mobile devices based on GLOWM content and is currently in the beta stage of market testing to make GLOWM usable in rural areas where cellphones are the primary tool for access to the internet.

This presentation reports on part of a larger project that seeks to shift the current paradigm of piloting mHealth interventions without a plan for integration within clinical practice and understanding existing practice. We present findings from a usability evaluation of the Global Library of Women's Medicine and the accompanying SaferMotherhood mobile application. Additional results are presented from the previous socio-technical analysis of the health information infrastructure. We used the Systems Engineering Initiative for Patient Safety (SEIPS) framework to guide our approach to examine current use, create a participatory training to encourage further use, and evaluate the use of these resources to improve health outcomes. In order to ensure sustainability of the efforts, we are a partnership effort between Drexel University in the USA and Makerere University in Uganda.
Ergonomic considerations for the inclusive communication of low vision people in academic spaces

Type: Abstract Oral Presentation
Category: Education and Training

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The World Declaration on Higher Education in the 21st Century, emphasizes "the need to guarantee minimum benefits for the entire population that allows them to live with dignity, valuing diversity and respecting the rights of all people" (Unesco, 1998: 68). These global policies present great challenges and challenges for public universities in Latin America, since they must compose spaces that validate, integrate and recognize the differences of their population, within a common and transversal context, Ocampo (2011). In response to these challenges of inclusion, and in particular considering people with low vision (International Classification of Functioning IFC of the WHO), this project was proposed to explore from three Latin American universities (Universidad Pedagógica y Tecnológica de Colombia, Universidad Autónoma de Nuevo León - Mexico and the University of Buenos Aires - Argentina), the communication needs of this population group, from the three indispensable categories for achieving autonomy within the university space: Informative, guiding and directional signage. This is due to the fact that significant differences in behavior and response have been found during interaction with open spaces and closed spaces, between people with low vision and people with total blindness.

Through a process of action research, and research through design, a project that seeks to determine the ergonomic considerations necessary to design sufficient information and in the appropriate format for people with low vision within these scenarios is being developed. According to the Research-Action IA, a clear description of the problematic situation has been obtained, with the participation of the people in each of the stages proposed to gather their appreciation within the academic dynamics. The participating group is composed of forty-five (45) people with low vision, fifteen (15) of each country who have the quality of high school or university students. The information was collected using the life history technique, and the categories were related to the ability to perceive stimuli and to use the residual state of vision, as well as its main problematic barriers and reference facilitators.

The data obtained to date allow us to identify considerations that significantly differentiate the use of interior spaces and the main needs of the group, which are being verified through the process of interaction with stimulating experiences that were designed for this purpose, and from the which will be formulated the ergonomic and design considerations required to attend this activity.
Ergo-etnography….Measurement of indicators of well-being and comfort through ethnographic research techniques

Type: Abstract Oral Presentation
Category: Others
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1
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Desde el diseño, los estudios ergonómicos han centrado tradicionalmente sus reclamos en los enfoques que privilegian las variables y los indicadores cuantitativos de corte. Estos procedimientos nos han permitido obtener resultados favorables para una mejor aproximación al imperativo de los objetos espacios y sistemas que ocupan el mundo, a partir de variables objetivas relacionadas con la eficiencia y la eficiencia del diseño. Aun así, hay necesidades de igual importancia durante el uso de objetos, relacionadas con la comodidad y el bienestar de personas de igual importancia en los estudios de usabilidad, que no explican los criterios de medición dentro de los diferentes métodos.

Este documento describe un proceso de macro-investigación que tuvo el propósito de sistematizar algunas experiencias que fueron abordadas desde la intención fenomenológica y descriptiva del modelo Etnográfico, aceptándolo como un enfoque de investigación, enfoque científico y perspectiva teórica; en el sentido de su validez como un proceso de descubrimiento permanente y comprensión de la realidad. La etnografía, proporciona datos útiles dentro de modalidades descriptivas e interpretativas, como afirma Rosana Guber (2006), por ser "una metodología artesanal que permite construir conocimiento sobre situaciones sociales, a partir de la descripción e interpretación de quienes lo viven". Su interés en el campo de la ergonomía es describir hechos complejos de la vida cotidiana que pueden generalizarse,

La muestra para los estudios se estableció de acuerdo con las directrices del enfoque de representatividad, incluyendo las generalizaciones realizadas en estudios previos que aseguraron la inclusión de todas las personas y las características de interés. Los individuos fueron seleccionados de acuerdo con el criterio de oportunidad en todos los casos, y el número de evaluaciones se estableció bajo la proporción de saturación. Los estudios se llevaron a cabo con las poblaciones denominadas por la ergonomía como casos especiales:

- Personas con discapacidad en el proyecto relacionado llevado a cabo con el centro de ataque Roosevelt y en el análisis de las regulaciones del transporte automotriz accesible en la ciudad de Buenos Aires donde se aplica como una herramienta para diagnosticar y detectar necesidades ergonómicas.
- En el proyecto de procesos interactivos y de accesibilidad cognitiva con adultos mayores, así como para el diseño y evaluación del uso de Módulos de Rehabilitación realizados en el centro de rehabilitación de Colombia se utilizaron CIREC como herramientas de validación de uso.

En todos los proyectos, las propuestas técnicas se desarrollaron y evaluaron mediante métodos de observación en todas sus modalidades, acompañados de otros protocolos. La investigación probó la etnografía desde diferentes perspectivas, escenarios, temas y
contextos, que luego fueron respaldados por pruebas y equipos de laboratorio, siempre promoviendo la participación de los usuarios a lo largo del proceso de análisis.
The typographic grid in the editorial project – an essential resource to the graphic consistency and perception

Type: Abstract Oral Presentation
Category: Others
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A fundamental aspect of ergonomics in communication design is related to the typography behaviour – namely legibility and readability.

In editorial design, an aspect that contributes significantly to the readability is the consistency throughout the publication, which, despite the unique character of each page, provides coherence and uniformity to the content. This coherence generates a secure relationship between the reader and the graphic object, allowing him to know where each element is expected, focusing his attention on the content, rather than on the form, and also allowing a correct “navigation” throughout the publications. To achieve this consistency and ease of navigation, it is essential to use the grid as a fundamental resource to the graphic project development.

The grid can be defined as the geometric division of space into columns of text, space between them and distance from them to the page margins. It is, therefore, the structural element that defines the location of the elements on the page and provides the white spaces also essential to good readability.

Historically, there have been various manifestations in which Man, using mathematical thinking, has designed grids to organize and/or define his spatial reality, for example the golden section, the Fibonnacci sequence or the Modulor. In editorial design, we can observe that the use of the grid dates back to the medieval era manuscripts, having been especially important in the modernism movement and achieving its high point during the Swiss Style. Nowadays, it continues to be an extremely useful resource and its use, although due to the facilities provided by the computer is not so crucial, it continues to make perfect sense.

Within editorial design, the grid becomes even more necessary in the design of periodicals, because when conceiving a project of this nature, we create not only an object, but also a system, designed to serve variable, complex and from diverse provenance information, and destined to be used by various designers.

In other kind of projects, sometimes not following a grid becomes the option that best serves the graphic project. However, we believe that this decision must be taken consciously and not by ignorance of the potentialities of this system.

In this article we will study the importance of the grid in the editorial design, addressing some of the main authors who have studied the subject (Allen Hurlburt, Jan Tschichold, Josef Müller-Brockmann, Karl Gerstner, Antony Froshaug, Robert Bringhurst or Timothy
Samara) and reaping from their studies the fundamental aspects for the editorial design at the present times, in a didactic and useful perspective for the teaching of the discipline.
Evaluation of an adaptive assistance system to optimize physical stress in the assembly

Type: Abstract Oral Presentation
Category: Manufacturing
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In the project "Mittelstand 4.0 Competence Center Darmstadt", an assistance system was developed, which automatically adapts to the individual adjustment of working height, reach, illumination and the provision of tools and materials with the help of anthropometric employee data. The data is read in via RFID card. There is also the option of making manual readjustments of the setting on a user interface. This assistance system has now been evaluated in a study. In addition to reviewing the change in physical loads, the acceptance and usability of the system were reviewed.

For evaluation, 20 subjects performed a typical assembly activity with and without the support of the assistance system. Using motion capturing, based on the Captiv system of the company TEA, the posture was determined without and with the adjustment of the assistance system. For this purpose, the movements of selected parts of the body were analyzed and evaluated. In addition, a semi-structured interview was conducted. As well as the usability scale score and an acceptance questionnaire, individual components of the table such as lighting or the user interface were evaluated in writing by the user. Afterwards an interview was conducted to investigate how the users perceived the adjustment of the assistance system and where they saw room for improvement. The aim was to derive indications for the design of an adaptive assistance system. It was found that the height of the user is an important influencing factor when evaluating the assistance system.
The Association Between Safety Climate and Musculoskeletal Symptoms in the U.S. Logging Industry

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Introduction: The logging industry is one of the most dangerous in the world as well as in the United States accounting for the highest rates of occupational mortality. The purpose of this research was to assess the association between safety climate and musculoskeletal symptoms (MSS) in the logging industry of Montana, USA.

Methods: A questionnaire was administered to 1200 loggers participating in emergency first-aid and safety training workshops. The questionnaire consisted of three different sections: demographic data, a MSS questionnaire (Standardized Nordic Questionnaire, SNQ), and a safety climate evaluation (Nordic Safety Climate Questionnaire, NOSACQ-50). The NOSACQ-50 is a validated safety climate questionnaire which measures seven different dimensions of safety climate. In the present study, five of the seven safety climate dimensions measured by the NOSACQ-50 were assessed: management safety priority and ability, workers' safety commitment, workers' safety priority and risk non-acceptance, peer safety communication, learning, and trust in safety ability, and workers' trust in efficacy of safety systems.

Dimension scores for the NOSACQ-50 were analyzed in accordance with published guidelines. Safety climate dimension scores were analyzed separated by supervisory status (leader versus worker). Two binary variables were created based upon the results of the SNQ to identify workers who experienced MSS in any anatomical area (Yes/No) or missed work due to MSS in the past 12 months (Yes/No). T-tests were performed to determine if there was a significant difference in safety climate dimension scores and individual safety climate question responses between workers that had experienced MSS or missed work due to MSS versus workers who had not experienced MSS or missed work due to MSS.

Results: Leaders (company owners or crew supervisors in the logging industry) who reported MSS had significantly lower dimension five safety climate scores (workers' safety priority and risk non-acceptance) than leaders who did not experience MSS. Workers (non-leaders) who reported MSS had significantly lower scores on dimension one (management safety priority and ability), and dimension five, in comparison to workers who did not report MSS.

Workers who missed a day of work due to MSS had significantly lower (more negative) responses to the following questions regarding management: "My coworkers and I have confidence in management’s ability to deal with safety" and "Management ensure that safety problems discovered during safety inspections are corrected immediately". Workers who missed work due to MSS...
reported that they were less likely to learn from their experiences than workers who did not report missing work due to MSS. Workers who experienced MSS in the past year were more likely to agree with the statement “My coworkers and I accept risk-taking at work”.

**Conclusions:** The results obtained during this study provide a baseline measure of musculoskeletal symptoms and safety climate. Moving forward, injury prevention efforts and safety interventions in the logging industry should focus on sustaining the safety climate of the logging industry and targeting the association between MSS and safety climate.
The Impact of Mechanization on Musculoskeletal Symptoms in the Logging Industry

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Abstract

Introduction: Logging is one of the most dangerous industries in the United States. In the logging industry, there are different risks based on the logging used. The logging system depends on the terrain and region of the harvest, as well as the resources of the contracted logging company. There are two main logging systems for felling trees: conventional chainsaw logging and mechanical harvesting logging. In conventional logging systems, sawyers use chainsaws to cut the trees, while in mechanical logging, heavy equipment is used to fell the trees while logger operates the equipment from inside an enclosed cab. Mechanical logging systems are associated with higher rates of production and previous research on logging mechanization found a change in types and rates of injuries among professional loggers after transitioning to mechanical logging systems. In Montana, USA, the process of mechanizing the logging industry is incomplete, therefore, the industry is a mix of companies using mechanical and conventional systems. The purpose of this study was to determine the 12-month period prevalence of musculoskeletal symptoms (MSS) among professional loggers in Montana, USA and differentiate the prevalence based on logging system types while accounting for demographic and workplace covariates.

Methods: To determine the 12-month period prevalence of MSS in the logging cohort, a modification of the Standardized Nordic Questionnaire was administered. Multivariable logistic regression was performed to determine if demographic and workplace covariates, such as BMI, years of experience in logging, hours worked per week, and weeks worked per year, were associated with MSS or missed work days due to MSS.

Results: The anatomical area with the highest 12-month period prevalence of MSS for loggers using either system type was the low back (38.1%). Other body areas with the highest prevalence of MSS were the shoulders (27.6%), neck (24.8%) and the knees (24.7%). Loggers using mechanized systems and equipment had a higher prevalence of neck and upper back symptoms, while loggers who utilized chainsaws to harvest trees had a higher prevalence of MSS in every other body area which included hands, arms, shoulders, legs, etc.

Conclusions: Previous research found that mechanization of the logging industry reduces the rate of injuries and fatalities, however, in the Montana population, workers using mechanized systems are still experiencing high levels of MSS. While mechanization may change the types, rate, and severity of injuries, attention should be focused on the design of heavy equipment to minimize risks such as those due to slips, trips and falls, repetitive strain injuries, and the effects of whole-body
vibration. Current interventions are focused on investigating the design of the equipment and training newly hired workers on safe equipment use.
Injury Claims from Steep Slope Logging in the United States

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Introduction: Background: Logging is one of the most dangerous occupations in the United States. According to Bureau of Labor Statistics (BLS), in 2014, the national occupational fatality rate for all industries was 3.3 workers per 100,000 FTE. During that same period, the occupational fatality rate for forestry workers was 92 per 100,000 FTE, 28 times higher than all industries combined (United States Department of Labor, 2015). Though logging injuries within the U.S. have decreased over the last 20 years, from 8.9 per 100 FTE in 1994 (U.S. Bureau of Labor Statistics, 1995) to 5.1 per 100 FTE in 2014 (U.S. Bureau of Labor Statistics, 2015b), injuries in this sector continue to exceed the rate of total recordable cases for all industries combined (3.2 per 100 FTE) (U.S. Bureau of Labor Statistics, 2015b).

Methods: Workers’ Compensation claims were analyzed and focus groups were conducted with professional loggers in order to identify the risks that loggers associate with injuries and fatalities. Injury claim data from two workers’ compensation providers, which cover companies’ active in the logging industry of Montana and Idaho were obtained. All injury and fatality claims occurring from July 2010 to June 2014 were obtained from companies in the logging industry (NAICS 113). Injury claim data from each company contained information on demographics, variables related to the time, type and source, of injury, as well as the cost associated with each injury claim.

Results: A total of 801 workers’ compensation claims were analyzed for the time period July 2010 to June 2015. A chi-square test for equal proportions revealed significant differences in the number of claims by day, month and season. Mondays accounted for the greatest proportion of claims (21.22%). The most common nature of injury for equipment operators was sprain/strain type injuries, accounting for 41.9% of all injuries to equipment operators. The most common injury sustained by sawyers and hookers was also sprain/strain injuries, followed by contusions, and lacerations.

Conclusions: Injury prevention efforts in the logging industry within the Intermountain region should be focused on early training, engineering controls, and administrative controls; all designed to promote a culture and climate of safety, communication, and shared responsibility. The results of this project will be used as the basis and justification for the development and implementation targeted safety interventions addressing the specific safety issues associated with logging.
Digitalisation is currently one of the most important drivers associated with a number of changes in our working world as well as our economy (BMAS, 2017). A steady progress in technologies enables a growing number of new human-machine-interactions: In the field of manufacturing lightweight robots become an important technology (Acatech, 2016). Hence new socio-technical working systems evolve. These have to be evaluated and furthermore designed focusing on the human user. Within human-robot-interaction there are different aspects that need to be addressed by research activities. So far research mainly addresses traditional issues like safety and physical ergonomics. But cognitive and emotional aspects as well as task related issues are equally important and have to be considered as well. The interaction quality in human-robot scenarios can be evaluated using different human or technology related parameters. Technology related parameters e. g. refer to design principles or technology acceptance. Human related parameters include mental workload, strain or affective states during the interaction (Rosen, Robelski, Kirchhoff, & Wischniewski, 2016). This paper presents data on the interaction quality in a human-robot cooperation scenario. Forty participants completed a manual assembly task assisted by a lightweight robot. They worked for thirty minutes in a laboratory setting and the interaction quality was assessed using psychometric methods. The results presented in this work focus on affective states and mental strain during the human-robot-interaction task as well as the overall technology acceptance. The findings indicate that these parameters can be used to characterise human-robot-interaction quality. Thus the same variables will be used in a planned field scenario in order to evaluate a flexible human-robot-interaction scenario in a manufacturing context. The concept of the field study will be presented as well. Within this setting complex assembly tasks will be conducted by workers, who are assisted by mobile robot units. The mobile units navigate autonomously and allow a flexible assistance to the worker. Within these hybrid teams the workers perception of task related parameters like timing or method control are analysed in a pre/post design. Furthermore we aim for a stepwise evaluation of the system. Each system iteration will be followed by another analysis. In addition to task related parameters the aforementioned variables like affective states, mental strain, workload, physical demands and technology acceptance will be monitored. Furthermore the dialogue principles according to the ISO 9241 (ISO, 2006), which were adapted to human-robot-interaction, will be evaluated. This work presents a novel approach measuring the interaction quality in human-robot interactions. Using a broad set of parameters allows for a comprehensive evaluation of human-robot scenarios. Furthermore this data can be used in order to enable a humane work design in hybrid teams.
Walkway Safety Evaluation and Hazards Investigation for Trips and Stumbles Prevention

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Falls are a major healthcare concern especially in the older population and tripping is a primary cause [1]. Tripping is defined biomechanically as an event at which the lowest part of the foot makes unanticipated contact with either the walking surface or objects during the swing phase of the gait cycle [2]. According to the American with Disabilities Act [3], "any changes in level of ¼ inch maximum height shall be permitted to be vertical and any change in level between ¼ inch and ½ inch shall be beveled with a slope not steeper than 1:2". However, identifying an obstacle or uneven surface as a tripping hazard is a subjective assessment, particularly when considering the vulnerabilities of people with knee/hip replacement, stroke, Parkinsons disease and osteoarthritis. To one person a sidewalk with level changes smaller than ¼ inch may be unsafe and difficult to navigate but to another person that same walkway is easily traversed. There is no universally accepted measurement tool or interpretation of the hazards. Because of different factors, such as overloading, frost heave, and tree roots, walkways can pose a serious risk of tripping and falling. Currently available literature on tripping/stumbling provides few reports of detailed community-based studies which can be regarded as highly representative. Most studies investigating tripping have reported laboratory-derived data from level ground walking and obstacle passing [4]. However, there are several issues with laboratory-based testing. For instance, variances associated with the real world tripping hazards are difficult to capture in the laboratory settings, and individuals will tend to adopt cautious gait patterns in laboratory testing compared to outdoor gait. Therefore, it is required to develop a systematic method to first identify and then reduce the number of tripping hazards in the outdoor environment.

The main goal of this study is to provide a standard definition of walkway tripping hazards by extracting different features which can be correlated with the Probability of Tripping (PoT). For this purpose, we first need to understand the structure of the hazards by surveying them so that more than 500 people will have the opportunity to evaluate and rank the actual hazards through an online survey. Second, we will remotely monitor the top 20 recommended hazards to obtain their PoTs and then using a novel scanning tool.
extract the important features of the hazards. Finally, the combination of the extracted features will provide the risk level of various types of tripping hazards in different locations.

References


Global phenomena such as population aging, increased rate of disability, and growing numbers of obese people have gained intense attention within the air transportation industry since it expects increases in travel and changes in the profile of users. However, studies have indicated gaps between the needs of passengers and the services and assistance provided by airlines and airports. Therefore, the objective of this study was to understand the contradictions and discontinuities in the activity systems of passengers with disability, elderly and obese in the Brazilian air transportation originating restrictions to participation during the boarding, the flight and deplaning process of air travel. A qualitative approach was adopted based on Ergonomics and the Activity Theory. The research participants were passengers with physical, visual, and auditory disabilities and elderly and obese passengers. A combination of methods and techniques was used for data collection, including: 14 preliminary interviews in rehabilitation organizations and assistance services for the participant groups and air transportation users, with a total of 25 participants; a questionnaire survey involving 399 respondents; and observations in commercial aviation. A total of 43 non-participant observations were carried out, and other eight participant observations took place during the journey, which included two self-confrontation interviews. Data were analyzed using descriptive statistics and thematic content analysis. The results indicated passenger participation restrictions during the journey that are related to airport infrastructure, airport signs, operational factors, equipment, aircrafts, and regulatory aspects. These restrictions are related to contradictions in the interaction of the components of activity system, which include: the passenger, the artifacts, the rules, the community (passengers and workers), the airport operators, and the airlines, and the object of the activity. To promote full participation during the air journey, some changes are needed; primarily transformation in significance and representations for action of people involved in the air transportation and their work activity, seeking to achieve integration between design and use. This study was carried out focusing on the activity, which contributed to the involvement of different social actors; thus the information provided is based on the experience and interaction with the subjects and the context aiming to demonstrate the users' needs and constraints and support new air transport developments.

Key-words: air transport, ergonomics, activity, passengers with disabilities, elderly passengers, obese passengers
Hand Dimensions and Grip Strength: A Comparison of Manual and Non-Manual Workers

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Grip strength is an important indicator of upper limb function, nutritional status, surgical and treatment success and can predict mortality in both adult and elderly population. In ergonomics, user-centered designing of hand tools depends largely on data of grip strength. The purpose of this study was to examine grip strength differences between manual and non-manual workers and to investigate possible contributors.

Methods & materials: A cross-sectional study design was used. The recruitment period was between April and October 2017. The sample consisted of 1740 adult males aged between 20-64 years old including 905 manual (40.5±16.8 years) and 835 non-manual workers (48.3±18.2 years). Manual workers were involved in housekeeping such as cleaning, dusting, emptying trashes, sweeping and washing the floor of office rooms and so on in their routine daily work. Non-manual workers were office employees who spent the majority of their time behind a computer. Hand dimensions (palm width, hand length, palm length, forearm length, wrist circumference and forearm circumference) were measured by a digital Caliper (±0.1 mm) and a tape meter (±0.1 cm) with respect to the NASA standards. The values of grip strength were measured by JAMAR hydraulic dynamometer set at level II according to the American Society of Hand Therapy (ASHAT) recommendations (1,2). Student t-test was performed to compare means of grip strength between two types of workers. Pearson correlation coefficients were calculated to determine linear relationships among grip strength with hand anthropometric dimension. Statistical analyses were performed using SPSS 23 at significance level of 0.05.

Results: The mean hand grip strength of manual workers (51.6±8.7 kg) was significantly higher than that of non-manual workers (45.2±5.8 kg) (P<0.001). Concerning hand dimensions, Palm width was significantly greater in manual workers than in non-manual workers (range of difference: 0.5-1.6 cm). Other hand dimensions were not statistically different between the two groups. Among all hand-selected dimensions, palm width had the greatest relationship with grip strength (r=0.71, p<0.001 for manual workers; r=0.66, p<0.001 for non-manual workers).

Conclusions: This study revealed that Iranian manual workers are approximately 12.4% stronger than Iranian non-manual workers in hand grip. Being the most correlated factor with grip strength, palm width is the most predictor of hand grip strength of Iranian workers. It is important to take the observed differences into account in clinical as well as design settings.

Keywords: Grip strength, Anthropometric, Dynamometer, Workers.
Introduction: The world’s population is ageing. This creates a need to work for longer, both for income and to provide an adequate labour force. For those employed in predominantly physically demanding jobs this means they are prolonging their exposure to risk factors known to increase the likelihood of a musculoskeletal injury when their work capacity may be declining. The work ability of older workers has been most frequently assessed using the Work Ability Index (WAI). Several studies have reported significant associations between low WAI scores and sickness absence and early retirement. Relatively fewer studies have examined associations between WAI scores and specific workplace risk factors. The purpose of this study was to investigate the association between a range of workplace risk factors and the WAI scores in a cohort of workers employed in physically demanding jobs.

Methods: A cross-sectional survey of workers employed in physically demanding roles within a local government council was undertaken. The survey instruments included questions on demographic and employment characteristics, physical and psychosocial risk factors, pain and discomfort, and the Work Ability Index.

Results: The survey was completed by 155/245 of eligible workers – a 63% response rate. Respondents had a mean age of 44 years. They were predominantly male (86%) with an average length of employment of 12 years. Bivariate regression analyses were undertaken to examine the relationship between WAI scores and age, pain/discomfort, levels of stress, irritation, job satisfaction, work-life balance, and 49 other work environment risk factors. Significant associations with WAI scores were seen for age, pain/discomfort and physical and psychosocial risk factors. The WAI score was reduced by more than 2.5 points for those who reported higher levels of exposure to a range of physical and psychosocial risk factors compared with those who reported lower levels of exposure.

Discussion: It was found that the WAI provided a useful means to identify a range of workplace risk factors which, if addressed, could inform the development of interventions to maintain a healthy, older workforce. It is proposed that tailoring interventions using this approach should enhance their effectiveness.
Natural language dialogue is a desirable method for human-computer interaction, particularly with emerging intelligent software agents. Prompted by recent advances in deep learning, dialogue systems are now abundant (e.g., Siri, Alexa, Cortana) and development is underway to increase their capacity for natural language. Natural language dialogue is expected to increase coordination and task performance, largely through the promise of handling complex commands with none of the training that’s required by current dialogue systems and graphical interfaces. Critical to the success of dialogue is the underlying model for common ground and the grounding process that establishes, adds to, and repairs shared understanding.

The model of grounding for human-computer interaction should be informed by human-human dialogue. However, the processes involved in human-human grounding are under dispute. Three models have been proposed: 1) interactive alignment (Pickering & Garrod, 2004), a simple model based on priming mechanisms that has been influential on dialogue system development, 2) interpersonal synergy (Fusaroli, Rachaszek-Leonardi & Tylén, 2014), a dynamical systems account suggesting that coordination emerges automatically from interaction, and 3) audience design (Clark, 1996), a strategic interaction based on intentional coordination. This dispute is of theoretical importance because the different models represent different theoretical perspectives of cognition. This dispute is of practical importance because each model has dramatically different implications for dialogue systems development.

Few studies have simultaneously evaluated these three models on a single dataset as methods were only recently developed (Fusaroli & Tylén, 2016; Rothwell, Shalin & Romigh, 2017). These methods rely on recurrence quantification analysis (RQA) and cross-recurrence quantification analysis (CRQA), which characterize the relationship between utterances by measuring the amount of repetition and temporal sequences in the time series of the dialogue. Also, this modeling method accommodates multiple analysis levels of a dyad’s communication, e.g., morphemes, words, syntax. The models provide quantifications of recurrence that can serve as predictors of performance, with the rationale that the model that explains the most variance in task performance is capturing the grounding necessary for task completion. Syntax-level models are of particular interest, as syntax has been important in arguing for automatic, unconscious alignment (e.g., Brannigan et al 2000).

Here, we tested each models’ ability to account for human-human performance in a complex collaborative task that stressed the grounding process. Dyads discussed and collaboratively labeled many different street-level perspectives of buildings from a shared overhead perspective with labels. After correctly labeling all buildings, task completion time was used as the performance metric. The results were consistent across levels of analysis.
and showed strong support for the audience design model over the synergy model and the alignment model, indicating that audience design should replace interactive alignment as the foundational model for human-computer interaction through dialogue.
Prolonged standing while working is still widespread, in the industrial and service sector. According to an employment survey of 2012 about 54.4% of German employees stated that they were often affected by standing work (Hall et al. 2015). The ongoing demographic change, including the effects of increasing employees' average age, corresponds directly to physical reductions in working performance (Luczak 1998), and a decreased ability of long-lasting standing. Nevertheless, the number of employees which are often affected by standing work has barely changed compared to a survey of 2006 (56.4%). A first approach to improve this situation is to change body postures regularly (sitting, standing, moving). Current recommendations for the combination of sitting, standing and moving elements in the work process are still too vaguely defined. A research project at the Munich University of Applied Sciences and the Technical University of Munich investigates the reduction of strain due to different scenarios of changing body postures during work. The present laboratory study is based on five different scenarios with a duration of 45 minutes each. All scenarios are performed during one day with a break of ten minutes respectively (randomized order). The scenarios differ in the percentage of standing and moving elements and the cycle time. During standing work participants (males/females, 20-30 years) are doing repetitive assembly operations. The aim of the study is to quantify physiological strain due to the integration of defined moving elements in standing work. As objective parameters for strain the muscle activity and muscle fatigue (JASA method of Luttmann et al. (1996); joint analysis of spectrum and amplitude) are measured by using electromyography (EMG). The project focuses on the lower extremities, therefore the muscles tibialis anterior and gastrocnemius of both legs are examined. In addition, a survey of subjective complaints is recorded using a structured questionnaire. It includes both upper and lower extremities with a scale of 1 to 10. The heart rate is recorded as control variable. The results of the study allow a comparison of strain between different percentages of standing and moving elements during constant cycle times, but also different cycle times with constant standing and moving elements. Furthermore, the objective and subjective parameters can be compared. Using the JASA method of Luttmann et al. (1996), a comparison of the scenarios shows that fewer subjects are classified in the fatigue area in case of higher moving elements. A similar trend applied to the survey of subjective complaints. Moving elements lead to lower pain in the lower extremities. The future goal will be to find an optimized combination of standing and moving elements, because both too much and too little moving elements lead to a higher rate of subjects classified in the fatigue area.
Virtual simulation of human-robot collaboration workstations

Abstract:

The constant call in manufacturing for higher quality, efficiency, flexibility and cost effective solutions has been supported by technology developments and revised legislations in the area of collaborative robots. This allows for new types of workstations in industry where robots and humans co-operate in performing tasks. Safety has been a limitation to allow close collaboration between the operators and common industrial robots, but with the introduction of collaborative robots that include safety systems and are easily reprogrammed, there are possibilities of closer human-robot interaction within the workstations. In addition to safety, the design of such collaborative workstations needs to consider the areas of ergonomics and task allocation to ensure enhanced work conditions for the operators, while providing overall system efficiency. This calls for engineering tools where it is possible to design, simulate and assess different potential solutions of the human-robot workstation before the workstation is fully detailed and realised. The overall objectives of having such tools in the production development process is to gain quality, save time and money by supporting decision making and testing concepts before creating a physical workstation, in turn aimed to lead to better final solutions and a faster process of implementation or reconfiguration. Hence, a software that simultaneously can simulate and assess both the human and the robot tasks in the workstation is required.

The aim of this study is to illustrate the development and use of an integrated robot simulation and digital human modelling (DHM) tool, which is aimed to be a tool for engineers to create and confirm successful collaborative workstations.

An assembly scenario from the vehicle industry was selected for reconfiguration into a collaborative workstation. The existing scenario as well as potential collaborative concepts are simulated and assessed using a version of the simulation tool IPS, having functionality to simulate both the robot and the human model, here based on the DHM tool IPS IMMA.

The assembly use case will illustrate the capabilities of the tool to represent and evaluate collaborative workstations in terms of ergonomics and efficiency assessments.
Ryan (Ergonomics, in press) describes the development of a framework of behaviours that have been observed at railway stations before railway suicides. The framework includes classes of behaviour such as display of emotion, appearance, posture/movements, activities and interactions. This has been produced to improve the sensitivity of training for staff and to understand the range of visual cues that could be identified using new surveillance technologies. Understanding behaviour in this type of context is challenging and it is recognised that this initial framework needs further testing in a range of contexts, to validate the existing classes and sub-classes of behaviour.

The current paper explains how the framework has been tested in a related context, studying behaviour at the point of access to public buildings. Behaviours of people entering two University libraries have been observed. The entrances to the libraries have card access barriers and require similar activities to those that are required at entry to railway stations with electronic gate lines or other public buildings with similar entry restrictions. The study therefore provides an opportunity to understand how the structure within the framework can be used in exploring how typical behaviours can be described, as well as giving initial indications of some deviant/suspicious behaviours in approaching and passing through the entry barriers. The findings can provide valuable input to the development of better surveillance methods.

Seven hours of recordings of access behaviours were collected using a video camera over four days at the two library locations. The recordings have been analysed, using the classes from the behavioural framework to prompt the search for a range of visual cues. Findings have been summarised in descriptive text, supported by images that have been extracted from the recordings. These include the access behaviours of people entering the library alone and in groups of two or more. Attention has focused on behaviours that can be observed immediately outside the libraries, on approach to the access barrier and on passing through the access barrier or being inhibited by the access barrier.

The findings have been used to produce requirements for development of a smart camera system to monitor and react to typical and anomalous behaviours in this type of location. The requirements, which have been validated in interviews with security staff, include differentiating facial expressions, identifying interactions that forewarn of anomalous behaviours, and provision of alerts (e.g. when people are carrying unusual objects or trying to attract attention).

Commentary is provided on the strengths and weaknesses of the framework in exploring behaviours in this new context. The potential for future development and research
applications of the framework are explained, including a brief overview of on-going research to develop the content and utility of the framework.
ABSTRACT

This paper presents a novel prototype which allows the improvement of biomechanical conditions in the critical process of Jaggery production. Jaggery is a solid piece of sucrose obtained from boiling and evaporation of sugarcane juice and is considered one of the most traditional products of Colombia. The proposed design will be selected through an ergonomic evaluation of productive process of mixing, molding and packaging. As a first step an ergonomic analysis was carried out by applying REBA postural assessment and a composed version of loads lifting NIOSH methods; afterward, clinical history was analyzed. Finally, 39 surveys were conducted to the operators belonging to the mixing, molding and packaging process.

A CAD model of the prototype was developed by using the software Autodesk Inventor® and later the software Poser 8.0 was used to create a working method to link the prototype with the Colombian anthropometric data. It was found that the spatula (hand tool for mixing process) must be lengthened by 179 mm and the adjustable table should drop to 250 mm from the ground. An economic estimate was determined with a Net Present Value (NPV) of $7,047,110, an Internal Rate of Return (IRR) of 20.78% and a payback period of investment of 3 years. According to the results obtained by the NIOSH and REBA methods, the surveys developed and the historical information provided by the company it was possible to detect that mixing is the most critical process of Jaggery production, then was determined that modified the length of the spatula and scrape the pan diagonally reduce the number of moves. Finally, the project was proven to be economically feasible.

Key words: Prototype, Ergonomics, WRMSDs, Anthropometrics, Jaggery and Panela.
A tactile tag to identify color of clothes for people with visual disabilities

Type: Abstract Oral Presentation

Category: Healthcare

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Introduction

Some people with visual disabilities have strong interests in color though they can’t see it. Ladies who are totally blind, in particular, like to know color of clothes they wearing, and also like to enjoy their own color coordination in clothes. To meet this request, a tactile color tag, called “iro-pochi (“iro” means color and “pochi” a dot in Japanese), was developed which is attachable to clothes and enabled people to know the color of their clothes by touching it with a finger.

What is “iro-pochi”

The color tag “iro-pochi” consists of a total of 13 raised small tactile dots, 10 of them being placed equally on a circle of 30 mm diameter and the remaining three dots at the center of it aligned vertically. The 10 dots on a circle correspond to fundamental colors of red, orange, yellow, green-yellow, green, blue-green, blue, purple-blue, purple, red-purple respectively, to represent a color circle with red at the top. Three dots at the center mean white, grey, and black from top to bottom respectively. One of those dots is replaced by a hole and a person touching it can easily identify the location of the hole and consequently knows the color that corresponds to the location of the color circle.

An experimental study on color circle

Scientific interest is how the color is represented in blind people who have no experience of seeing color, and whether the concept of color circle is understood by them. The experiment was done on how the psychological difference of any two colors is evaluated by blind people. Any two colors were selected from 10 fundamental colors and gave them verbally to ask for the difference. Those data were analyzed by the Multi Dimensional Scaling (MDS) to seek for possible layout of the colors. The result showed that the fundamental colors were represented in almost a circle with a right color order that sighted people make.

Design of color tag “iro-pochi”

Being based on this color study and together with the results of tactile experiments, a tactile color tag was developed. A prototype was made and a practical test by 10 blind subjects was done which showed almost perfect identification of colors of T-shirts with the tag on the neck. The design based on a color circle was proved to be effective. It is also noted that blind person can enjoy a color combination of any two or more colors with this tactile color tag in such a way that near colors make harmony, and far colors show strong feeling.
When we say to someone “Don’t act like a girl”, we are saying more then a simple sentence, we are moving in the field of representations and selfperception. What are we saying about men? What are we saying about women?

In the last decades gender stereotypes, in particular the ones related to the idea of “real man” that is linked to the father “breadwinner”, constitute one of the key limits to gender equality: overcoming these conceptions and categorizations is a fundamental step.

As creative designers we feel the necessity of a smarter approach to design and the responsibility to be active protagonists in changing our society.

The European Parliament recognize a primary role to advertising and communication in creating and sharing culture: designers can’t be just passive witness of the modern medias’ running steam.

This project can be define a cognitive ergonomic science move in the fields of psychology and design concepts: an education path made to be designer friendly recognizing the relevance of the stereotypes and their connection to prejudices. The aim of the project is train creative designers in order to let them introduce and slowly educate audience to accept cultural changes and new models.

What we suggest is not replacing the “real man” with a new one, but we wish to deconstruct this model improving the emerging of new models and consequently promoting ideas of ‘diversity’ and ‘authenticity’.

Then we focus on a series of case studies of communication products containing male stereotypes, related to the fields of childhood, physical health, aggressiveness, sex, authority and emotion. We analyze them to understand which creative solutions are most likely to be used to promote the idea of “real man”: medias, targets, colors, fonts, narrative plots. The emerging of characteristic of “real man” - ambitious, successful, dominant, heterosexual, sexually ferocious - show us a portrait of a man without weakness and never allowed to fail and that can be considered very far from what the real man is.

Here the necessity of a rethinking appears essential more than ever.

What we suggest and did is the creation of guidelines which include psychological and designer sensibility. The opportunity to share what we did with other designers could be part of a milestone to overcome stereotypes, spreading the importance of different models of maleness, in example an image of men more respectful of themselves and of women around them and, last but not least, a real man that can choose who to be with the all the difficulty of this freedom.
Displaying digital contents in space is becoming increasingly common, driven by advances in projection mapping, LED light sources, and other technologies. Such displays are often used for advertising or entertainment, but we also see many instances of signage to warn people in emergencies, or to guide the way. Animated signs and signs that changed according to the situation, can be expected to improve the convenience of facilities and improve safety and security concerning traffic.

This technology is already being developed in multiple countries, and some practical applications have already been realized. Most of these consist of projection lighting systems for presenting information in building spaces and roadways. In this paper, this technology will be referred to as "Dynamic sign."

However, the significance, necessity and feasibility of "Dynamic sign" has been recognized, there are currently no international standards that describe the ergonomic requirements for designing "Dynamic sign." To spread this new technology of "Dynamic sign" through the marketplace quickly and appropriately, it is important to avoid situations with competing specifications that do not take into account the cognitive characteristics of the information recipient. Accordingly, this paper discuss the first step of the human ergonomics principles for the application of "Dynamic sign."

As part of the standardization process for "Dynamic sign" is visibility that takes into account the characteristics of "Dynamic sign" themselves. Visibility considerations for "Dynamic sign" differ from those for static signs, because "Dynamic sign" change temporally and can therefore have wider ranges of functional meaning. The advantage of "Dynamic sign" is that they can use components that move either spatially or temporally (indications of direction, intention, or changes in content) to clearly convey messages related to the environment in which the signs are presented. By making use of these advantages, "Dynamic sign" can deliver alerts and warnings to improve safety in road traffic environments and indoor and outdoor public spaces, or providing prompt and reliable guidance directions within facilities for enhanced convenience. Moreover, "Dynamic sign" unlike static sign, can serve as a context-dependent information presentation system, because both the timing and content of information presentation can be managed as needed based on changes in the environment. From this perspective, the ergonomic requirements to be developed can be categorized into conspicuity, discriminability, and legibility.
To establish the standardization of “Dynamic sign”, we have already started ergonomic basic experiments for collecting data that will contribute to them. In this paper, we also introduce the preliminary results.
A novel morphometric measurement of endplate degradation was compared with qualitative ratings of intervertebral disc degeneration (Pfirrmann Grading) in a double-blinded study to investigate a novel, quantitative method for relating disc morphology and bony changes using MR imaging techniques known as the “Concavity Index” (CI). By adding a quantitative measure of vertebral endplate degeneration, the CI could provide further insight into structural changes related to disc breakdown and subsequent low back pain. The continuous nature of the CI may also allow medical professionals to more closely monitor a patient’s low back health. T2-weighted MRI scans of the sagittal profile of the lumbar endplates (L2-S1) were collected from 50 subjects (25 females and 25 males) whose ages ranged from 20-40 years. Three trained examiners independently measured the height and the concavity levels of each lumbar vertebrae (L2-S1) as well as assessed the health of the intervertebral discs using Pfirrmann’s lumbar disc degeneration grading method. Concavity Indices (CIs) were computed by dividing measured concavity level by disc height (CL/DH). A larger CI was hypothesized to be indicative of spinal degradation and subsequent low back pain. Intra- and inter-rater reliabilities were assessed for both the CI measurements and Pfirrmann’s lumbar disc degeneration grades. The categorical intra-observer agreement for Pfirrmann ratings ranged from 26 to 63%. However, the CI, which is a continuous measure, varied by only 2% among raters. The CI appears to be related to disc degeneration as observed by a modest correlation with Pfirrmann ratings (r = .25). Endplate concavity is indicative of fracturing and damage and is hypothesized to lead to subsequent disc degeneration due to impediment of nutrient flow to the discs themselves. The CI shows promise as a means for potentially quantifying low back health and identifying risk for future low back pain prior to significant disc degeneration.
Can the Revised NIOSH Lifting Equation be improved by Incorporating Personal Characteristics?

Type: Abstract Oral Presentation
Category: Others

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The impact of manual material handling such as lifting, lowering, pushing, pulling and awkward postures have been extensively studied. Many models using these external demands to predict injury have been proposed and employed by safety and health professionals. However, ergonomic models incorporating personal characteristics into a comprehensive model are lacking. This presentation explores the utility of adding personal characteristics such as the estimated L5/S1 Intervertebral Disc (IVD) cross sectional area, height, age, gender and Body Mass Index to the Revised NIOSH Lifting Equation (RNLE) with the goal to improve injury prediction. A dataset with known RNLE Cumulative Lifting Indices (CLIs) and related health outcomes was used to evaluate the impact of personal characteristics on RNLE performance. The dataset included 29 cases and 101 controls selected from a cohort of 1,022 subjects performing 667 jobs. RNLE performance was significantly improved by incorporation of personal characteristics. Adding gender and intervertebral disc size multipliers to the RNLE raised the odds ratio for a CLI of 3.0 from 6.71 (CI: 2.2 – 20.9) to 24.75 (CI: 2.8 – 215.4). Similarly, performance was either unchanged or improved when some multipliers were removed. The most promising RNLE change involved incorporation of the multiplier based on the estimated IVD cross-sectional area (CSA). This multiplier was developed by normalizing against the IVD CSA for a 50\textsuperscript{th} percentile woman. This multiplier could assume values greater than one (for subjects with larger IVD CSA than a 50\textsuperscript{th} percentile woman). Thus, CLI could both decrease and increase as a result of this multiplier. Increases in RNLE performance were achieved primarily by decreasing the number of RNLE false positives (e.g., some CLIs for uninjured subjects were reduced below 3.0). Results are promising, but confidence intervals are broad and additional, prospective research is warranted to validate findings.
When being a woman represents a major risk for commuting accidents?

Type: Abstract Oral Presentation

Category: Others

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Introduction

European Agency for Safety and Health at Work (OSHA-EU) marked commuting as one of the major risk in European countries [1][8]. In Italy, since 2000, work commuting accidents are covered by public insurance (INAIL). INAIL provides an open source statistical records containing occupational diseases and work injuries data including work commuting [2]. This paper has the purpose of analysing major disabilities and fatalities related to women commuting in Italy and how prevention could be achieved by ergonomic intervention.

Methods

INAIL Statistical Data 2011-2015 on work commuting disabilities and fatalities have been studied per gender, country of birth, vehicles involved, permanent or temporary disability, grade of disabilities (%). The recognition rate of commuting injuries has also been considered. Statistical differences and significant level have been accepted (p<0.10; 0.05).

Results

Work commuting accidents are the first cause of death among Italian women (55% vs 23% males) and immigrants women (52% vs 20% males immigrants) (p<0.001) and the second cause of disabilities (30% among both Italian and immigrant women and 16% among Italian men and 14% immigrants)(p<0.0001). Almost all commuting women deaths (97%) and a large amount of women disabilities (60%) involve vehicles mainly motor vehicles. Disabilities due to work commuting injuries without vehicles are growing only among women (+18% Italian women and +52% immigrants) while an important reduction is shown among men (–30% Italian men and – 18% immigrants). An average of 1417 Italian women and 212 immigrant women suffer of permanent disabilities due to commuting with vehicles each year and 999 Italian women and 85 immigrant women without vehicles. Grade of disabilities recognized is lower among women (27% vs 28.5% men) (p<0.001) as severity recognition (0.2% vs 0.5% men) (p<0.001).

Discussion

Italy has the highest density of motor vehicles in Europe, after Luxembourg, (621 per 1000 inhabitants) [3]. Italian and immigrant women are increasing their motor vehicles properties...
(37.6 in 2005 to 40.4/1000 inhabitants in 2012) while men are decreasing (62.4 to 59.6/1000 inhabitants in 2012) [4]. The increase in using private motor vehicles among women may be due to poor public transportation, women double burden [5][6] and the need to attend secondary job. Moreover women use small and less safe motor vehicles that can represent a major risk in adverse weather conditions [7]. Women permanent disabilities increase due to work commuting without vehicles may be caused by longer walking distance home-work due to poor public mobility, secondary job, adverse weather conditions, aging at work, poor sidewalk facilities and poor lighting, assaults, use of unsuitable walking shoes, heavy bags, etc.

**Conclusion:** being woman represents a major risk in commuting using a private vehicle or while walking. Study results show the need for gender oriented ergonomics on work commuting.
Pediatric Ergonomics: analysis of primary school children’s well being using their designs

Type: Abstract Oral Presentation
Category: Education and Training
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Introduction

A research, named “Pediatric Ergonomics”, oriented towards ergonomics content in children’s design has been applied to improve well being at school. Montessori study [1] first lesson in terms of physical (table, chairs, tools), mental (autonomy, contrast of monotony, learning by doing, self-efficacy) and social (teacher as facilitator) ergonomics has been taken into account [2,3,4].

Methods. The design of 143 children (72 females, 71 males) attending primary school in Rome have been studied taking gender and age/class differences into account. Children were asked to select and design their preferred activity at school. The following aspects have been selected: activity, cold or warm colours, self and others figures, furniture, tools, proxemics among school-mates and teacher, sitting or standing position, desks and body-desks relationship. Main difference were studied using χ² test (p<0.05; 0.10).

Results

Children represent mathematics as preferred activity (72%), girls represent more music (28% vs 24% boys) particularly girls attending the fourth class (24% vs 8% boys) (p<0.05). Boys attending fourth class design more diverse activities (history, geography) (27% boys vs 59% girls) (p<0.05). Girls use warm colours (85% vs 69% boys) (p<0.05), boys more cold colours at the fourth class (20% second class vs 41% fourth class) (p<0.10). More self-portrait among boys in second class (45% boys vs 15% girls) and fourth class (29% boys vs 15% girls). Girls design more often the teacher (68% vs 53% boys) (p<0.05) mainly in the fourth class (82% fourth class vs 55% second class) (p<0.05). The class group (self, teacher and schoolmates) is shown more among girls attending the fourth class (55% fourth class vs 39% second class) than boys (49% fourth class and 20% second class) (p<0.05). Desk, blackboard, teacher’s chair are the main furniture (girls 39% and boys 28%). Boys design less teacher’s chair (47% vs 56%). Girls design tools (85% vs 70% boys) and more books (10% vs 0% boys) (p<0.01), boys design pen and notebooks (37% boys vs 22% girls) (p<0.05) and more often hands (75% boys vs 63% girls) particularly in fourth class (71% second class vs 78% fourth class). Sitting is more represented (61.5%) while standing in both genders when attending the fourth class (49% fourth class girls vs 42% second; fourth class boys 41% vs 23% second). Desks are represented in 84% of all designs less in the fourth class for both gender (second class girls 97% vs 76% fourth class (p<0.05); second class boys 86% vs 76% fourth class). Body-desks (over waist/under waist) show poor ergonomics mainly among girls (second class 82% vs 53% fourth class (p<0.05); second
class boys 69% vs fourth class 65%). Desks are represented in lines (92%) and not in circle (8%) (p<0.01). Main Results are discussed [5,6,7].
Leading a research project on Product Design about children’s furniture, the aim is to create a better environment for children, adapting furniture to their physical and psychological needs, namely a high chair following child’s growth from 6 months up to 7 years of age. The goal is also to provide solutions, which may enable extended product life cycles, contributing to sustainability. Taking Ergonomics and Human Factors as a tool for the understanding of how children interact with furniture, this study analyses a possible relation between 3 different approaches in an ergonomic level, to children, as direct users; to parents, as indirect users; and high chairs available in the market, as case studies.

Starting with children, the project’s target, a pre-school sample of 56 children male and female, was subjected to an interview based study complemented with drawing/illustration sessions as a way of expressing their feelings towards the main high chair in the case study – the classic Tripp Trapp® chair from Stokke®, designed in 1972 by Peter Opsvik. Moving on to parents, who can give a different overview of the child’s behavior interacting with this kind of equipment, a more extensive interview based study was conducted, giving clues on how children use high chairs in a daily basis and what are the parents’ choices based on, when buying this kind of furniture. Lastly, for a better understanding of how the available evolutive high chairs are adaptable or not to the child's growth at a physical level, a study based on literary review and schematic drawing was made, revealing some surprisingly low results for the majority of the high chairs chosen and how some furniture, doesn’t seem to be so fit for the child.

When comparing results and conclusions, these studies give a glance on how children are such a difficult target, highly subjective and prone to change. However, even if a relation between the results of the different approaches is sometimes narrow, is through the use of Ergonomics and Human Factors as a main tool in this design research project, that we can start to attain a better understanding of how can furniture be adapted to the child.

Keywords: Design Project, Product Design, Children’s Furniture, Ergonomics and Human Factors.
Team adaptation to complex clinical situations: VTE prophylaxis in hospitalized patients

Type: Abstract Oral Presentation
Category: Healthcare

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When teams face complex situations such as those with varying levels of uncertainty, they adapt their communication structures. For instance, Barth et al. (2015) found that pediatric surgical teams adapted communications during phases and types of the surgery: in complex surgical procedures, team communication patterns were more decentralized and flatter. These team adaptation processes were captured with social network analysis (SNA) measures such as density, reciprocity, and centralization. In this study, we use SNA measures to assess team adaptation processes in response to different complexity levels of various stages of VTE (venous thromboembolism) prophylaxis.

VTE accounts for approximately 10% of in-hospital mortality in the US, and the American College of Physicians has recommended that all hospitalized patients be assessed for risk of VTE and provided VTE prophylaxis when appropriate (Heit et al, 2005; Qaseem et al, 2011). The VTE prophylaxis process during hospitalization involves many roles and individual and team activities, and can be characterized as occurring in the following stages: admission, interruption of VTE prophylaxis, re-initiation of VTE prophylaxis, initiation of VTE prophylaxis (when it was not started at admission) and re-evaluation during transfer (Hundt et al, 2017). The stages of admission and transfer are less complex than the other three stages as there is a clear trigger for considering VTE prophylaxis (e.g., admission order set). Therefore, we expected that SNA measures will change throughout low and high complexity stages of VTE prophylaxis.

This study was conducted as a part of a larger study with the aim of developing design requirements for a clinical decision support tool that supports the VTE prophylaxis process (https://cqpi.wisc.edu/vte-and-health-it/). Interviews were conducted with five physicians of an academic hospital’s critical care medicine service. Interview data were used to create five role networks representing the 5 stages of VTE prophylaxis (Hundt et al, 2017). Data from the role networks were used as input for the following SNA measures: number of roles, number of team interactions, number of team activities, and reciprocity, i.e. the number of two-way interactions compared to the total network interactions (Valente, 2010).

As compared to the more complex stages, the role networks for the less complex stages were smaller (4 versus 6 roles), and involved fewer team interactions (6 versus 10-11 team interactions) and team activities (7 versus 11-12 team activities). The highest level of reciprocity, 0.7, occurred during a high complexity stage, i.e. interruption, whereas the reciprocity values for the other four stages ranged from 0.4 to 0.5. Overall, complex stages of VTE prophylaxis such as interruption and re-initiation involve more roles, interactions, and team activities, and can elicit more two-way communications resulting in increased
reciprocity; therefore, demonstrating that teams adapt to complex situations through increased communication with more team members.
To help represent, understand, and forecast socio-cultural behavior differences, it is critical to examine the cross-cultural variations in cognitive processing and the influence of cross-cultural differences on situation awareness (SA) from a micro, miso and macro perspective (Samman, 2012, 2016). Toward this end, the overall goal of this research is to examine the impact of culture on the development process and content of SA from a holistic approach focusing on the individual, team, and environment. The specific objective of this study is to empirically evaluate culture-dependent individual difference factors underlying SA levels (perception, comprehension, projection) in a simulated scenario involving a complex domain (aviation). The study involves 50 participants, 25 in each group, recruited from two culturally diverse populations: United States of America (USA) and United Arab Emirates (UAE). Participants (with a private pilot license) view a pre-recorded 30-minute scenario, simulating a cross-country flight. Various trigger events are embedded into the scenario, involving both routine and non-routine operations. Participants are presented with queries immediately following the trigger events to evaluate their ability to perceive the event, comprehend the event, and project what will happen next. Various psychometric instruments are used to assess individual differences in cognitive-human information processing abilities, such as attention, perception, memory, and decision making. Findings from this study aim to design and train more effective SA cross-culturally for individuals and multicultural teams and aid to predict behaviors for decision support tools that are driven by social-cultural models.
This paper presents the intervention of risk factors related to manual materials handling in the burial works conducted in five cemeteries of Chile. The design of handcrafted tweezers that allow moving heavy loads for tombstones mobilization, the incorporation of motors to funeral carts, the paving of routes for funeral processions as well as the use of bicycle trailers for materials mobilization allowed the elimination and reduction of risks. In the initial situation, 16.7% of the tasks presented risk at an ergonomically non-tolerable level and 83.3% of the remaining tasks presented high-level risks. After the intervention, 66.7% of the tasks fell to medium level and 33.3% to low level.

Keywords: Park Cemeteries, legal frame, manual materials handling, ergonomic intervention, risk factors.

In Chile, most deceased persons are buried in park cemeteries, a concept established in our country since the 1980s and a space preferably chosen by the Chilean population for burial. The fact that these are parks with specific distances, terrain and climatic factors, together with the existing culture in the country, make up a work with with varied ergonomic risk factors. Among these, the manual handling of loads in the different stages of burial is the one that presents the greatest risk to its workers.

The present study shows the result of the intervention of the ergonomic risk factors, in 6 tasks that involve manual handling of loads, in 86 workers who perform burial tasks in 5 park cemeteries of Chile.

The methodology used for the pre and post intervention evaluation of tasks is the current 2016 technical guide, which includes the MAC method and Liberty Mutual tables, the latter with the use of dinamometer and a risk estimation formula.
The tasks intervened were: burial equipment handling, transfer of casket transport carts, transfer of flowers carts, tombstones handling, boards handling and gardening equipment handling. Of the 6 tasks considered, 5 were found at a high risk level and 1 at an ergonomically non-tolerable level.

Ergonomic interventions contemplated the reduction or elimination of risks by the: mechanization of manual transfer of casket transport carts, design of tweezers for tombstones mobilization, incorporation of bicycle trailers to mobilize materials, change to lighter weight materials and the paving of the passage route for funeral processions, in the park cemeteries whose surface has irregularities and slopes.

The intervention developed allowed the elimination and reduction of risks. In the initial situation, 16.7% of the tasks presented risks at an ergonomically non-tolerable level and 83.3% of the remaining tasks presented high-level risks. After the intervention, 66.7% of the tasks fell to medium level and 33.3% to low level.
How Designers can contribute to Education: Innovating educational systems through Design Thinking

Type: Abstract Oral Presentation
Category: Education and Training
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Many academic and governmental organisations call attention to the need for urgent changes to the educational system, including curricula and learning methods, as a response to continual social and technological transformations. Over the last decade, Design Thinking (DT) has shown itself as a useful method to be applied not only in business, but also in educational innovation processes, as demonstrated by such projects as Design Thinking for Educators (Riverdale & Ideo, 2012), the online platform TD4Ed - Teachers Design For Education (Business Innovation Factory, 2014) or the Teaching and Learning Lab (Harvard Graduate School of Education, 2017). Because of its human-centeredness and its cross-disciplinary, collaborative and experimental approach, Design Thinking can be a significant support for HEI educators to face the challenge of a new learning paradigm.

Within this context, between 2014 and 2017, the European Research Project D-Think - Design Thinking Applied to Education and Training was developed, an initiative of 7 partners from different European countries, supported by the Erasmus+ Programme of the European Commission. The goal of this project was the promotion of a wider use of DT as a transversal learning tool, by developing and making available a toolkit and a digital course for educators and professional trainers.

In this paper we want to clarify the role of DT in Education, by identifying how designers and their mind set can contribute to education. For this purpose we will introduce the D-Think Toolkit (Tschimmel et al., 2017) as a method of rethinking not only learning/teaching methods, but also pedagogical approaches, learning spaces or more specifically, the role of educators. The toolkit offers three educational contexts with two concrete scenarios from each context. In the first context, ‘Setting the Learning’, for example, one scenario is related to the Pedagogical Framework, and the other to the Revision of the Curriculum.

The conception of the Toolkit was based on the Research Report D-Think (Tschimmel et al., 2015). The methodological approach of the research process was DT itself, based on Constructive Design Research as described in Design Research Through Practice (Koskinen et al., 2011). By applying the DT model Evolution 6 (Mindshake, 2016, licensed by Creative Commons), the research team was led through the different DT phases, applying several tools of DT. Through Field Observation, Interviews and Collaborative Mind Maps (primary research) on the one hand, and Media Research and Trend Analysis (secondary research) on the other, the role of designers and educators was compared, thus identifying how the designers way of working can contribute to contemporary education inside the framework of Heutagogy (Kenyon & Hase, 2001). This research shows that the designer’s creative, empathic and collaborative working approach can enrich educator’s reflection on their new role as ‘learning facilitators’.
Eco-productivity: A Useful Guide for Sustainability Decision-making

Originally written and presented to establish a direct interdisciplinary connection between the area of ergonomics and the broad field of ecology, Ergoecology aims to integrate evaluation and intervention processes generally used by ergonomics, and environmental management systems (García-Acosta, Saravia & Romero, 1997). As it is already known, Ergoecology –from a systemic focus–, "takes care of studying the human being and its relationships with the environment –through its activities (work)– to establish, analyse, reduce, prevent, control and rectify the impacts (positives and negatives) that derive from such a relationship" (García-Acosta, Saravia, Romero & Lange, 2014).

That it is why Ergoecology, looking forward to a dynamic equilibrium and an environmental balance, proposes a series of principles, postulates and axioms to achieve environmental and business sustainability (García-Acosta, Saravia-Pinilla and Riba-Romeva, 2012). Just as the anthropocentric principle is found in its initial approaches, we have also identified the need to adopt an eco-spherical vision that allows to recognize not only impacts to people, but also impacts to other living things and ecosystems. On the other hand, its postulates are eco-efficiency (systemic) and eco-productivity. However, the second one has not been sufficiently developed in a way to be applied and that is why this work put forward the concept of 'eco-productivity' and some guidelines for its application from the Ergoecology perspective.

Within Ergoecology, eco-productivity is defined as "the ability of systems to transform energy, matter (resources) and information into products or services, without generating negative impacts on other systems that interact with them". This implies the rationalization of the impact variables to control the productive system and always tending to the operational equilibrium (García-Acosta, Saravia, Romero & Lange, 2014). In this sense, ‘eco-productivity’ implies the application of environmentally friendly innovative technological changes to develop environmentally acceptable products and processes. These activities should be supported by a clearly defined environmental and human conscience and by the responsibility of producers and consumers.

As the concepts of eco-efficiency and eco-productivity cover economic, social, and environmental dimensions, we may conclude that they become strategic indicators when the interdependencies between artefact–human systems or sociotechnical systems and natural systems are being evaluated. Then, ‘eco-productivity guidelines’ can contribute to decision-making in the different phases of production processes to ensure the long-term sustainability of organizations.
Having a system which operates efficiently is an essential point in order to reach success in many organizations. Reviewing the system and providing its continuity are also crucial as well as having a well-operated system. In fact, phenomenon called sustainability which has been frequently encountered in today’s globalizing world works for this aim. With sustainability point of view, organizations try for meeting society’s requirements in order to provide better perpetual conditions.

Sustainability uses several indicators while it works for the constitution of such a system. These indicators may be environmental, technological, economic and social, depending on what type of systems they are in. When related literature is reviewed in detail, it can be clearly noticed that there are many organizations in different areas and these organizations try to adapt sustainability indicators to their systems systematically. This easily adaptable structure of the sustainability indicators is the main motivation of this study. It is inferred that sustainability indicators can be also adapted to the organizations in ergonomics area.

It may be specified that the studies in ergonomics area are generally case-based, so that keeping sustainability in ergonomics area may be difficult. Starting from the beginning at every study is frequently needed, each process has its own ergonomic point of view and procedures in order to solve the problems, each real-world problem needs newly frameworks and road maps for developing solution suggestions, etc. In order to cope with this variability which is originated from natural structure of ergonomics science and provide sustainability also in ergonomics area, it is stated that a sustainable framework is needed to reach success.

Under these circumstances, firstly in this study, related ergonomic indicators are presented with sustainability indicators as well. The relationships between these indicators are identified secondly. Proposed framework in order to examine the organizations ergonomically from sustainability point of view is explained afterwards. Thus, a base framework in order to use for various ergonomic evaluations of the processes is presented within sustainability logic. As a consequence, it can be stated that this proposed framework can provide examination of the processes which are in ergonomics area within sustainability point of view. Therefore, providing the continuity of the processes and implementing timely and efficient ergonomic interventions may be possible with this proposed framework.

**Keywords:** Sustainability indicators, ergonomic indicators, integration, framework
Prototyping a learning environment model, an application of Design Science Research and Ergonomics of Built Environment techniques

Type: Abstract Oral Presentation
Category: Building and Construction

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The school and its environments are fundamental elements for the educational system. There is a concern about educational spaces, in order to establish a perfect harmony between physical and functional requirements and users’ satisfaction attendance. The purpose of this article is to describe the triangulation of three methods used to develop a conceptual model of learning environment appropriate to technological education practices. An ergonomic approach on built environment should consider constructive and psychological aspects and users’ expectations about the spaces they use and live.

The application of ergonomic methods on built environment design is an advantage strategy for obtain reparative or innovative ideas to apply at different types of environments. One of the purposes of this research was to be developed in a participatory way, it involves middle school’s students’ and teachers’ collaboration. How to motivate these people to get involved in a future perspective thinking exercise is one of the principles of Design Science (Simon, 1996), of Constructive Design Research (Koskinen et al. 2011), of Venable (2006) and Van Aken (2011) studies. The central method of this research is the Design Science Research (Dresch et al. 2015), which was supplemented with ergonomics techniques of built environment analysis and design – The Ergonomic Methodology for the Built Environment - MEAC (Villarouco, 2002, 2011) and the studies of ergonomics for built environment by Attaianese and Duca (2012).

The Design Science Research process was applied through the following main steps: Problem identification; Problem awareness and Systematic literature review; Artifacts identification and Arrangement of problems categories; Proposal, Design and Development of the artifact; Artifact evaluation; Explanation of learnings and results, and; Generalization to a class of problems and communication of final results. Prototyping techniques were used as a dialogue way to get users involved in different moments of the conceptual model development. It made possible to explore design alternatives, to build study mockups and obtain artifact’s improvement throughout the design process.

By the research process conclusion, it was obtained a conceptual model of learning environment, presented in four flexible different layouts – for Places Rotation, for Group Activities, for Laboratory Activities, and for Exhibition Activities. As additional results are presented technical specifications regarding to - Constructive elements, Comfort conditions, Environmental systems, Furniture and equipment criteria, and finally, the methodological process developed - a scientific contribution to the Design and Ergonomics for the built environment sciences.
In France and globally, musculoskeletal disorders (MSD) remain the most widespread occupational diseases. The scientific literature has established that links exist between occurrence of MSD and the professional gesture. The intervention research described in this abstract was in response to a request from a preventive medicine unit of a major French city, and relates to preventing MSD in gravediggers. This intervention was conducted within the general methodological framework of occupational psychology using activity clinical research and it has enjoyed interdisciplinary co-operation with biomechanics. The aim of this co-operation was to study in more depth the complexity of a physical action done during real work activity, while taking account of the conditions under which it is done. Thus, the challenge for biomechanics was not to achieve a precise diagnostic analysis of the work situation, but rather it was to work with the gravediggers on the variability of their and their colleague's gestures so as not just to accept as a fatality that "when you’re a gravedigger you’re condemned to hurt yourself".

In digging a grave, 1.5 m to 2 m deep, the gravedigger has to remove the soil by throwing it backwards, constraining him to carry a tool loaded with soil at arm’s length so as to chuck the soil out of the grave, with his back to the storage point. This gesture was problematic:

- for the occupational physician who saw a link between it being done repeatedly and possible occurrence of upper limb MSD;
- for the manager who wanted to ban this gesture to avoid occupational accidents and time off sick;
- for the gravediggers who would like to avoid doing it but who have to do it when circumstances do dictate.

Regarding methodology, the muscular activity of the shoulder and back muscles of 8 gravediggers was recorded (by surface electromyography) in a real work situation. Analysis of the biomechanical data identified the gestures that put the most and least strain on each gravedigger. Videos of the gestures and quantitative assessments of them were shown to the gravediggers through self-confrontation and cross-confrontation methods. The gravediggers used them to observe and compare themselves, and sometimes even to try out different strategies for doing the gestures more efficiently while also not injuring themselves. This intervention research dealt a blow to fatalistic acceptance and contributed to setting up a dual dynamic for preventing MSD:

- between gravediggers, on the ways of doing the gestures while re-thinking how they use their bodies in this activity;
between occupational risk preventers, gravediggers, and managers on setting up training in professional gestures better suited to the realities of the work done by gravediggers so as to prevent MSD in them.
Digital Human Model Simulation of fatigue-induced movement variability during a repetitive pointing task

Type: Abstract Oral Presentation
Category: Others

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Context: Movement variability is an intrinsic feature of any human movement, providing adaptability and flexibility in all kind of activities including work-place tasks. However it is almost ignored in workstation design, where expected movements are highly standardized for productivity and quality considerations. Neglecting this variability may bring designers to skip over parts of the future operator's movements, thus leading to incomplete assessment of biomechanical risk factors [1]. The aim of this study is to develop and validate, as a demonstration tool, virtual human models and commands intended to simulate the movement variability induced by muscle fatigue. The case study is a repetitive pointing task described in the literature [2].

Material et methods: Our demonstrator is built on a multibody dynamics framework [3] and a 3-compartments muscle fatigue model [4]. Muscle fatigue effects on each joint (shoulder, elbow, wrist) are driven separately, using a generic minimization control. It simulates the evolution of movement features (postures, trajectories, exertions) with the onset of fatigue. An experiment has been carried out to identify adaptation strategies and models parameters, as well as simulation validation.

Results: The virtual human controller demonstrator accounts for the decay of force production capacities as well as the dynamic transfer of exertion from fatigued joints of the upper-limb to the rest of the body. These encouraging results are currently compared to experimental data for validation.

Discussion - conclusion: The generic control of our demonstrator reproduces some of the adaptative behaviours described in the literature during the repetitive pointing task. This demonstrator may be integrated in work equipment engineering tools such as DHM software, and adapted to allow designers account for other sources of movement variability from the first stages of design, for improved workstations ergonomics.

References


**[1431] Using 3D Statistical Shape Models for designing smart clothing**

**Type:** Abstract Oral Presentation

**Category:** Military

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**INTRODUCTION**

Statistical shape modeling is a promising approach to map out the variability of body shapes, commonly used in 3D anthropometric analyses.

With statistical shape models, a wide range of body shapes can be simulated. So, a wide range of 3D smart garment can be designed on it as well.

The design of smart clothing is crucial to obtain the best results. Identifying all the steps involved in the functional design workflow can prevent a decrease in wearer’s performance ensuring a successful design [1-4].

Nowadays, smart clothing provides a methodology to monitor mechanical, environmental, and physiological parameters in real time and in an ecological, non-intrusive approach.

These parameters can be used to detect gesture or specific patterns in movement, design more efficient, specific training programs for performance optimization, and screen for a potential cause of injury. The innovative approach concerns a combination of different digital technologies and applications to create a common co-design workflow for a garment design.

Users or designers could potentially upload the statistical body shape model and get personalized prediction of cloth size as well as personalized suggestions on how different products may fit their body.

**METHOD AND RESULTS**

Preliminary activity was dedicated to the design of a smart garment for integrating sensors and optimized for military application and its validation through a laboratory activity [1,2].

First, a reference surface is registered in a marker-less way to all input surfaces to obtain a homologous point-to-point correspondence. Then, a statistical shape model is built using principal component analysis on the posture normalized corresponded surfaces [5]. We selected 57 soldier-like (man, height 1m52-2m10, age 18y-35y, BMI < 25) body shapes from the CAESAR database to build our model. A mapping matrix describing the relationship between the biometric features (such as height, weight, gender,...) and the principal component weights of every input shape was calculated. By multiplying this mapping matrix
with a given feature vector, new PC weights can be generated. From these PC weights, a new body shape can be built.

On this new body shape, a shirt is designed. This is done by removing the arms, legs and head of the body shape and scaling the surface. The shirt was uniformly resampled to 1000 points. The body mesh and the cloth were exported as object files.

Blender [6], an open source 3D creation suite, was used to parent the body mesh with the cloth and rig them with a bvh file. Because movement was incorporated in the bvh file, the body and shirt could be animated.

**DISCUSSION AND CONCLUSIONS**

This study demonstrates a co-design approach to smart clothing development using moving statistical body shape models. This methodology can be applied to apparel design ensuring a more successful design.
[1439] Moving Statistical Body Shape Models using Blender

Type: Abstract Oral Presentation

Category: Military

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Introduction

Statistical body shape modeling (SBSM) is an intuitive approach to map out body shapes variability of 3D body anthropometric database.

Dynamic shape modeling deals with shape variations due to pose changes or a subject moving during scanning.

Nowadays, an inertial motion tracking system (mocap) can capture the movement of a subject during a task, like walking, climbing, jumping…

Human activities can be replicated based on body shape and a motion data collected on a subject.

This provides a representation of a digital human model based upon anthropometry and biomechanics of the subject.

In this paper, we propose a new framework to integrate the movement acquired by the inertial motion capture system with the statistical body shape model using an open source software (Blender).

Methods

A reference surface is registered to all input surfaces in a markerless way to obtain a homologous point-to-point correspondence. A statistical shape model is built by applying principal components analysis on the corresponded surfaces, which was developed in previous work of the authors.

In this model, the average surface and the main variances are incorporated. Posture variances were filtered out, to assure only shape is analyzed. A mapping matrix describing the relationship between the biometric features (such as height, weight, gender,…) and the principal component weights of every input shape is calculated.

By multiplying this mapping matrix with a given feature vector, new PC weights can be generated. From these PC weights, a new body shape can be built.

The Mocap system can be used to acquire the subject’s movement. Motion data is stored in BVH format and the mesh is exported as OBJ, which is a simple text format.
Blender [1], as open source 3D creation suite can be used to rig the body mesh and the bvh file.

Experiments and Results

A statistical shape model was built from the CAESAR database. We selected 57 soldier-like (man, height $> +1m52$, age $18y-35y$, BMI $< 25$) body shapes to build our model. From these meshes, we removed posture variances and finally built a statistical shape model. Using this statistical shape model, a new body shape was calculated [2].

Next, we acquired the movement of a walking soldier using an inertial motion tracking system [3]. The humanoid mesh and the skeleton from the mocap system were imported in Blender. The armature from the motion tracking system was parented with the humanoid mesh. The rigging was completed, the armature (skeleton) could move and the DHM was animated accordingly.

Conclusion

We proposed a framework to rig a statistical shape model in open source software. This methodology allows user, designer, ergonomist, to simulate realistic human movement.

Keywords: Statistical Body Shape, Digital Human Modeling, Blender, Motion Capture
Increasing consumer demands and shorter product life cycles lead to complex production characteristics, especially within the automotive sector (Bänziger et al. 2017). One opportunity coping with these challenges is bringing together highly flexible manual and highly productive automated work in hybrid production systems (IFR Statistical Department 2016; Kahl et al. 2016). In order to use Human-Robot-Collaboration (HRC) in flexible production systems, Human-Robot-Interaction (HRI) arises as key technology (Forge und Blackman 2010; Michalos et al. 2014). The use of intuitive programming methods lets robot tasks be added and reconfigured very easily (Akan et al. 2010; IFR Statistical Department 2016). As the economic efficiency for dynamic small batch productions rises with the decreasing ratio between programming effort and production time (Naumann et al. 2017), success-critical factors are seen in the usability of Human-Robot-Interfaces (Pieska et al. 2012).

Besides the intuitive configuration of robots in hybrid production systems, “instructive HRI” becomes more important due to decreasing batch sizes, reaching lot-size-one characteristics. The challenges change from intuitively programming a robot to an “online instruction” of where and how to do the next production steps. Naumann et al. (2017) and Tsarouchi et al. (2016) point out the need for new interaction modalities in order to use HRC in such unstructured industrial environments. Sheridan (2016) in particular mentions the demand of human factors community participation in HRI research. This research describes the development of an instructive HRI framework for its use in dynamic automotive processes in order to successfully combine human and robot abilities in highly flexible production systems, e.g. surface finishing processes.

The framework combines HRI from different domains with the requirements of industrial HRC. Anchored within the Design Science Research paradigm and using Usability Engineering methods, the frame concept is developed and implemented into an industrial assistive surface finishing robot. Context understanding and user requirements are used to build up a HR-Interface toolbox for empirical studies dealing with the positioning and parametrization of robot tasks in dynamic industrial environments.

The article presents the development of the instructive HRI framework as well as the results of the empirical study on positioning a robot task in automotive environments. Five HR-interfaces are evaluated with respect to their usability in a laboratory (n=20) and a real industrial setting (n=35). The usability measures consist of objective, quantitative, e.g. operation time and errors, and subjective, qualitative data, e.g. System Usability Scale (Brooke 1996) and user feedback. The mixed-method design is used to enhance the interaction modalities in an iterative manner. Relevant conclusions will be discussed and help developing the instructive HRI-framework. The derived enhancements serve as the
basis for a follow-up study, additionally dealing with the parametrization of robot tasks at pre-specified positions.
Evidence based data for the design of rotary control elements for fine motor adjustment tasks with respect to the elderly user

Type: Abstract Oral Presentation
Category: Automotive

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Object and Significance:

With increasing age, the loss of sensorimotor skills plays an important role regarding the human-machine interaction. With diminishing eyesight, it becomes increasingly difficult to operate an interface. Referring to this, presenting information via the haptic channel in critical situations can relieve the elderly user. This paper describes an approach to support elderly users using physical control elements with active haptic feedback. Therefore, evidence based locking angle and operation torque values for elderly users are presented to fulfill fine motor adjustment tasks in an efficient, effective and satisfying way.

Methods:

Two experimental studies were conducted. In both experimental studies the subjects had to perform a simple adjustment task with a rotary control element. In the first test run optimal locking angle and operation torque values were detected using the usability measures of task performance, positioning time, subjective satisfaction and precision. In the second study, elderly users had to perform adjustment tasks using control elements with varying torque curves. Therefore, it was interesting which coding feature is suitable for marking a preferred value on a scale or for a menu change. The semantic preference and the user performance were used as measures. In both studies, the data were recorded by means of rating scales and then statistically evaluated. The data were examined for significant differences and relationships within.

Results:

Based on the first study, optimal locking angle and operation torque values are presented. By increasing the locking angle and increasing the torque values, a better task fulfillment can be achieved. With regard to subjective satisfaction, precision, positioning time and task performance, a torque of 0.09 Nm at a locking angle of 30° can be determined as optimal for elderly users during a fine motor adjustment task. The second study shows that elderly users prefer significant coding features to choose a preferred value or to perform a change. Low level features, such as a sole rotation angle increase or a small torque increase were hardly perceived by the subjects which is also reflected by the task performance. A strong increase in torque ultimately leads to a better task fulfillment. The combination of a rotation angle magnification and an increase in torque also leads to a better task performance. For
the indication of a menu change elderly users prefer the combination of rotation angle magnification and torque increase.

Acknowledgements:

The presented research is funded by the German Research Foundation (DFG, grant MA 4210/6-1). The goal of the 3 years research project is to derive potential design parameters for adaptive HMI and to investigate the effect on elderly users.
The co-design process of a decision support tool for airway management

Type: Abstract Oral Presentation
Category: Healthcare

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The goal of this study was to design a decision support tool to assist anaesthesia teams during challenging airway management situations. Airway management is fundamental to anaesthesia and involves the support of breathing functions of an anaesthetised patient. Major airway complications are rare, but potentially life-threatening as they can result in hypoxia, brain injury and even death. A feared crisis is ‘can’t intubate, can’t oxygenate’, where a patient cannot be intubated nor oxygenated with any rescue airway technique such as masks and tubes; requiring a surgical airway to provide a passage for oxygen as the last resort.

Airway management in anaesthesia takes place in a complex, sociotechnical environment where practitioners have to interact with other clinicians, technology, the patient and management within organizational boundaries. Due to this complex sociotechnical nature, anaesthesia teams have to perform and make decisions under time-pressure, high stakes, uncertainty, multiple goals and organizational norms. Anaesthesia is a highly protocolled discipline inheriting many guidelines and algorithms that aim to assist anaesthesia teams with the complex (cognitive and technical) work of airway management. Cognitive aids in the form of decision trees and symbolic charts have also been developed to assist teams with airway management during emergencies. The shortcoming with these decision aids is that they were designed from the ‘top down’ based on how work is imagined to be done in an optimal way, but without basing it on an understanding of how decisions are actually made in the real world.

This study addressed this gap and designed a decision support tool for airway management by following a decision-centred design process. Three methods from Cognitive Task Analysis were conducted to explore how anaesthesia teams make decisions in airway management. The core of these methods was the knowledge elicitation from airway management subject-matter-experts: Critical Decision Method interviews, focus groups and field observations. By triangulating the findings of these methods, a few potential decision support concepts were identified and consequently evaluated on a conceptual level with a small sample of anaesthetists. One decision support tool was selected to be further developed as a prototype: a dedicated airway equipment trolley for anaesthesia teams that represents airway equipment in a visible, reliable manner.

To make sure practitioners are involved at every stage of the decision-centred design process, the design of the decision support tool prototype will be performed using a co-design method similar to the cognitive walk-through. Participants will be (1) provide input for the design and (2) probed on how they would solve a prominent airway challenge using the prototype. This paper will discuss the process and outcomes of this co-design process as an example of how to apply decision-centred design in health care.
Students are carrying heavier backpacks, sitting in improper furniture, using computers and other technology, suffering greater health problems and obesity, affecting their posture and performance in educational environments. Technology has advanced along with knowledge, yet there is regressing health in our younger population. Ergonomics, children, technology, and health are inseparable. International efforts are now focusing on the design of classroom workstations for children in order to address ergonomic and anthropometric concerns. New teaching paradigms have also influenced a reliance on technological devices. However, their effectiveness for information retention and the effect on the human body from prolonged use of these devices has been questioned. Therefore, the Ergonomics Checkpoints originally focusing on children have been re-vamped to include all educational environments.

Safety and health issues can arise at any point of a student's career, and the issues present themselves in different ways at different ages. These issues can be caused by anything from improper backpack use to unhealthy food choices and lack of sleep. Poor ergonomic and lifestyle practices can lead to health risks, and there is a higher chance of developing bad habits as a student. Some of these potential health risks may include musculoskeletal disorders, obesity, type II diabetes, and cardiovascular, respiratory, and communicable diseases. Many of these health risks are considered to be preventable.

Different aspects of ergonomic and human factors issues pertaining specifically to students has been the focus of the International Ergonomics Association's (IEA’s) Committee on Ergonomics for Children in Educational Environments. The committee has been focused on the health and safety of students, both pre-college (K-12) and college age, and have presented the results of research addressing issues in educational environments. Ergonomic checkpoints (Guidelines) for addressing specific issues students are faced with have been in development over the past three years and are reaching the point of a publishable set of checkpoints. The checkpoints that are being developed are applicable worldwide and across a wide range of individual characteristics and include both formal teaching environments and home-school environments. The checkpoints were developed to address the following topics of interest: (1) Accommodation (physical and cognitive); (2) environment (heating, air conditioning, ventilation, temperature, etc.); (3) furniture (classroom and home); (4) Health (diet, exercise, general health, posture, hygiene, backpack use, etc.); (5) teaching methods; (6) technology (the use and integration of technology in teaching environments); and (7) transportation (to, from and in-and-around educational environments including way-finding).

Therefore, the focus of the checkpoints is on all educational environments at all educational levels.
The use of electronic devices has become so commonplace as the pontificate that individuals are never without these devices. Individuals may, in fact, be addicted to these devices and use them when even when environmental conditions dictate that they should not (e.g., driving, walking, cycling, etc.).

The purpose of this project was to evaluate the timing of the pedestrians crossing streets on the campus of the University of Houston while the pedestrians used handheld electronic devices and then compare these results to results obtained during past studies. During the initial study preparation phase a major observation was that at some locations pedestrians remained in the crosswalks when the red sign or "Don't Walk" sign comes on more frequently than acceptable. The theoretical walking time of 4 feet / second appears in the Texas Manual of Uniform Traffic Control Devices published by the Texas Department of Transportation. Some pedestrians tend to cross streets faster or slower depending on several factors such as age, gender, ambulatory ability, etc.

Studies like this one have been conducted in several places. This is a major problem confronting a lot educational institutions and most evidently some major cities. Information on this project was collected via the internet, published articles, The Texas Department of Transportation Manuals, and manual data collection. The Texas Department of Transportation in particular was very influential in the collection, analysis, and comparison of data in this project. The Texas Manual on Uniform Traffic Control Devices (TMUTCD) formula published by the Texas Department of Transportation was used to calculate theoretical times for each crosswalk involved in this project. Based off the information provided by this manual, the average human speed is 4 feet per second when walking along a crosswalk with no distractions. It is quite evident from sample collections that most pedestrians do not walk at this pace due to various reasons. Such reasons include age difference, disabilities, and most evidently distractions from mobile devices. Given that there are people of different backgrounds on the University of Houston on a daily basis, it is important to consider every kind of individual walking these paths and determine an appropriate time for everyone to cross. The results to be presented cover a number of years of continuous study, using the same methodology to evaluate potential longitudinal changes/adaptations to the use of commonly used technologies by individuals engaged in potentially dangerous activities.
Intra-rater and inter-rater reliability for the Rapid Entire Body Assessment (REBA) tool

Type: Abstract Oral Presentation
Category: Others

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Background: Ergonomics researchers and practitioners use many techniques to assess risk. The Rapid Entire Body Assessment (REBA) is a common tool used to facilitate the measurement and evaluation of the risks associated with working postures as a part of ergonomic workload. This is a “checklist” style assessment, used in a variety of industries by ergonomists and other occupational safety and health professionals. Strengths of the REBA include speed of use, low cost, and flexibility of tasks/industries examined. However, little work has been reported regarding the validity or reliability of REBA.

Objective: This study assesses the reliability of this commonly used tool, REBA, for research and practice, and identifies potential improvement techniques for REBA application.

Methods: The study was carried out as part of the larger Safe Workload Ergonomic Exposure Project (SWEEP), which is a University of Minnesota research initiative on custodians’ workload and injuries. For this effort, a secondary data analysis was run on a sub-sample of 720 data points collected during a study of custodians’ exposure to risk of musculoskeletal injuries. Eight observers used the REBA tool to sequentially evaluate tasks performed two times in succession by the same individual for a total of 189 pairwise comparisons. The consistency of the repeated measurements (intra-rater reliability) was assessed using an Intra Class Correlation. Inter-rater reliability was found using Fleiss's kappa for 6 observers evaluating 4 different tasks.

Results: This study reports high intra-rater reliability (ICC = 0.925) for REBA raw scores and moderate inter-rater reliability (Fleiss kappa = 0.54) for a categorical scoring of REBA. Training and accreditation in the use of REBA may affect accuracy and consistency of observations. Calibration to either an expert or electronic standard during training may increase reliability. Therefore, a standardized training and calibration protocol is proposed as a potential means to improve intra- and inter-rater reliability.

Conclusion: The REBA assessment has high to moderate reliability; techniques for improvement are suggested.
Keywords: Intra-rater; inter-rater reliability; REBA; Assessment
Background: In light of contributions such as Rasmussen’s (1997), the focal systems considered to be within the scope of ergonomics are increasing in both size and complexity. The systems approach can be applied at various levels, which include those of the individual, communities, cities, nations, and the planet as a whole. However, as the remit of ergonomics interventions increases, so too must its inter-disciplinary integration of concepts. The importance of social networks in governance and in developing community capacity has already been established within resilience literature, but has yet to appear appreciably within the ergonomics literature. At the scale of a city, social actors (individuals, groups, and communities) make use of social contacts and their social capital to maintain normal performance as well as to cope with shocks and pressures. As a result, in Rasmussen’s (1997) words, social networks increase actors’ degrees of freedom within the context of their constraints and affordances. In light of this, understanding social networks at city–level can assist ergonomists in four ways. First, understanding networks and their effects on stakeholders assists ergonomists in understanding the perceptions and resultant behaviours of social actors that influence their local city system. Second, understanding the social fabric of a city allows ergonomists to model and analyse how social structures could be influencing the flow of other resources, either helping or hindering a city’s ability to cope within its constraints. For example, through studies involving multiplex relations the influence of trust on scarce resource flows, such as financial assistance, can be studied, helping to explain the functioning of systemic subcomponents. Third, knowledge regarding social networks can help ergonomists understand the contextual functioning of a city. This information could then be used to suggest possible system design decisions that support the emergent adaptability of social actors. Finally, knowledge surrounding social networks in conjunction with social network and stakeholder methods can also be used to understand social actors’ contextualised experience. This would help ergonomists anticipate possible emergent results of interventions that affect social actors within a city.

Aims: This paper aims to introduce the importance of including social network concepts during city-level ergonomics interventions, both for understanding normal performance and for coping with uncertainty. It also aims to present some analysis techniques from the social network literature that couple well with ergonomics concepts and methods to allow for practical application of the theory. Finally, the presentation will argue that the introduction of such tools to ergonomics toolkits would contribute meaningfully to building adaptive, resilient cities.

Keywords: Social networks, socio-technical systems, resilience, cities.
How to assess mental workload quick and easy at work: A method comparison.

Type: Abstract Oral Presentation
Category: Manufacturing

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In context of Industry 4.0 and the ongoing digitalization as well as advancing interconnection of the production process, the industrial worker will still maintain a key role. Within the research project "Factory2Fit" (funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 723277) automation solutions will be developed for the factory of the future by placing the worker in the centre of the development process. Thereby, the needs and preferences of the workers shall be considered in real-time and the production process should adapt to the worker. Therefore, a suitable interface between human and automation is needed to allow the worker to easily give feedback regarding his/her status. Using a smartwatch with implemented surveys for data assessment seems a promising solution as it can forward the collected information to the production system. However, some studies found a significant difference between varying questioning methods. For instance, when presenting the NASA-TLX on a monitor screen, the results were lower than in the paper version of the NASA-TLX. Consequently, the first step would be to examine whether questionnaires presented on a smartwatch have the same outcome as presented on paper.

In an experiment, we compared those two different kinds of methods to assess the magnitude of mental workload during a continuous mental arithmetic task with three different difficulties. After each arithmetic task, 29 participants (13 male, 16 female, mean age 23.7, mostly university students) filled in the NASA-TLX via paper or via smartwatch by using the bezel or the touchscreen.

The results show that the workload score in the paper version was significantly lower than the workload score in the smartwatch version (bezel as well as touch). Nevertheless, the relative differences between the altered levels of difficulty of the arithmetic tasks could be identified equally well with the smartwatch version compared to the paper version.

In conclusion, the assessment via smartwatch can differentiate between different levels of mental workload and therefore qualifies for the application in the field. Especially for an industrial environment, the implementation of a smartwatch seems to have great potential.
Analysis in the scholastic environment of a classroom setting geared to primary and middle school age students (6-12 years) according to a Human-Centered Design approach. The case study concerns the Scuola-Città Pestalozzi of Florence

Type: Abstract Oral Presentation
Category: Education and Training
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The PAPER is a commentary on the value of the classroom setting in the construction of an educational program and didactic project in the Italian school system for students of primary and middle school age.

The case study concerns the Pestalozzi School-City, an experimental primary and middle school established in 1945, which puts great energy into methodological and didactic experimentation and renewal of the curricula, through what is prevalently a learning-by-doing method of instruction.

The classroom setting is viewed here in the broadest physical and virtual terms as an organized but also affective and relational space within which cultural universes are represented and cognitive processes are built.

The paper explores and portrays the interaction between the individuals and the environmental factors that come into play, highlighting the context of use and the user-user and user-context interaction: a) the learning environment; b) the teacher and the students; c) the cultural, technical and symbolic tools that accompany this process, offering new ideas for the consideration of developers and designers engaged in this specific sector.

The ethnographic documentation gathered (documentary videos of different activities relative to different classroom situations) echoes a Human-Centered Design approach and focuses on factors linked to the physical-dimensional, physiological and sensory-perceptive compatibility of the context; the usability, effectiveness/efficiency of the tools that participate in the interaction and, lastly, on the aspects that contribute to the pleasure and wellbeing of the experience described, providing useful documentation for the transfer of good practices.
We are surrounded by graphic and text messages in public places, all serving various functions and having vastly different scopes: systems of urban signage, business signs, tourist panels, billboards, public interest messages, rules of conduct, etc. The messages may be quite complex, often not communicating with one another, and are produced through the combination of a graphic component and a textual component, whose effect on the definition of the final message changes depending on the category to which they belong. We can divide them into elements for Orientation (a), elements for Identification (b) and elements for Information (c).

This paper focuses, in particular, on the variables involved in decoding the messages communicated to the user through urban signage. This can be divided into directional signs, whose function is to indicate the route to take to reach a certain place; identification signs, whose purpose is to identify places, buildings, their functions, etc.; and information signs, serving to direct the user within the public place and its services, and to provide specific information. These supports are essential in order for people to be able to get around safely in public places and use their services effectively and knowledgeably.

A description of the main features of these three types and their purposes will be provided, while a separate paragraph will examine the technical and design aspects used to render the morphological and semantic elements, their composition and positioning.

The paper is introduced by a description of the physiological, sensorial and motor aspects that profile the user in this context and specific activity.
Low back pain (LBP) is a common occupational health complaint and an important public health concern. However, only a few cases of acute LBP are work-related and very few of these will progress to chronic LBP. Analysing the association between physical demands at work and occupational outcomes can be useful for improving LBP prevention and management.

In this study, data was captured at baseline (phase 1), and absenteeism and the number of LBP episodes during that period were identified 18 months later (phase 2).

At baseline, workers filled out a questionnaire gathering data on socio-demographic and work-related characteristics, general health, LBP (LBP episodes in the last 12 months, pain severity, disability, fear-avoidance beliefs, catastrophizing), psychosocial variables (CoPsoQ) and other occupational factors (DMQ).

Main results at phase 1: 735 workers answered the questionnaire (male n=359; female n=376). They worked in different sectors; healthcare (n=112); administrative tasks in private companies (n=97); private industry (n=370); and public services (n=156).

Among these 735 workers, 507 (69%) reported LBP in the last year (healthcare 78.4%; administrative tasks in private companies 60%; private industry 67%; public services 77%).

LBP-related absenteeism and the proportion of subjects with <6 episodes of LBP per year varied across sectors (p=0.001). The highest prevalence of absenteeism was found among workers in public services (13.3%) and the lowest in workers in healthcare (8.4%). The highest proportion of subjects with >6 episodes of LBP per year was found among subjects working in public services (31.8%) and the lowest among administratives working in offices (10.3%).

Most workers reported having sedentary-type work (39%), 34% a low/moderate physical intensity one, and 27% a highly physically demanding one. The higher proportion of workers facing highly physically demanding tasks at work were reported at healthcare and public services (42% and 41.7%).

Multinomial logistic regression models were developed to assess the association between "number of episodes of LBP" and "work characteristics". Results showed that, after adjusting for age, gender and sector:
• low/moderate work intensity (vs. sedentary work) was associated with a higher likelihood of having 3 to 6 LBP episodes per year (OR=2.22; 95%CI 1.23-4.00) and >6 LBP episodes per year (OR=1.89; 95%CI 1.08-3.30);
• high work intensity (vs. sedentary work) was associated with a higher likelihood of having 3 to 6 LBP episodes per year (OR=1.98; 95%CI 1.10-3.57), and >6 LBP episodes per year (OR=1.78; 95%CI 1.02-3.12).

Findings suggest that low/moderate and high physical demands at work, as compared to sedentary work, are associated with a higher likelihood of presenting LBP episodes. Results also suggest that factors other than physical demands at work are likely to influence absenteeism and workers for reporting LBP episodes. For Occupational Health Services, these results may contribute to design and assess better LBP prevention programs.
The effect of prototype in the perception of apparent usability and affective quality of mobile phones

Type: Abstract Oral Presentation
Category: Education and Training

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In this study, a design framework that integrates functional and aesthetic attribute with apparent usability and affective quality was validated for different age groups and for different representations of design (pictures and prototypes) prior to usage. The framework was validated using a high involvement product such as a mobile phone. The product’s attributes that affected visual evaluation prior to usage were selected and categorized into functional and aesthetic attributes. Nine design alternatives were generated out of varied functional and aesthetic attribute designs. A survey was used to evaluate each design alternative in terms of the pre-purchase dimensions of affective quality, apparent usability, and desirability. Structural equations modeling (SEM) was used to validate the design framework using a post-evaluation survey. A comparative analysis was performed on the SEM results for all age groups of consumers and for both representations of design.

The results indicate whether functional attribute design has a greater effect on the framework than aesthetic attribute design, and whether apparent usability has a greater effect than affective quality on desirability, for older consumers rather than younger consumers and for visually evaluating prototypes rather than pictures of alternative product designs.

After the experimentation stage, it was concluded with regards to the model validation that the model has a good fit and that the relationships were significant. Also, it was found that affective quality has the greatest direct effect on desirability, on the other hand, apparent usability has the greatest total effect on desirability. Also, it was discovered that functional attributes have significant total effects on apparent quality and desirability as well. For the comparative analysis, the hypothesis of the study were all validated and it was conversely found that older people’s perception on functional attributes have a greater effect on apparent usability, affective quality and desirability. Finally, it can be said that apparent usability evokes more emotions for people having greater usability needs (older people).
Factors Affecting Consumers' Attention when Scanning Menu of Quick Service Restaurants

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The menu board is considered as silent salesperson of a quick-service restaurant and most customers rely on the menu board when deciding what to buy at the point of purchase. Previous researches have not investigated to determine the significant menu design factors that affect customers' attention when scanning quick-service restaurant menu boards. These significant factors are important in order to help menu designers identify what to prioritize when designing menu boards. Hence, this study aimed to determine the effect of size of picture, size of text, type of text, location of picture and location of text on consumers' attention. In this research, the dependent variable considered is attention which is measured by mean fixation.

Data collected were validated through conducting a laboratory experiment wherein two menu board prototypes were used. In the experiment, a briefing session, a personal profile, a visual condition questionnaire and a consent form were given in order to know if subjects comply with the participant profile. In the experiment, the Dikablis Wireless Eye Tracking device was used to capture the participant's point of gaze and eye movements while they scan the menu board. This eye tracking device must be calibrated first with the pupil of the participant. Given such, menu boards were covered at first during the process of calibration. A total of 17 participants were considered wherein participants were asked to imagine themselves inside a newly opened fast food restaurant and instructed them to scanning for as long as they want. The wireless eye tracker recorded all eye movements to determine fixations on each menu item to measure attention. Lastly, a debriefing session was conducted to capture qualitative data and to know the reasons behind their fixations while scanning the menu board and allow the subjects to explain their experiences during the experiment. At the end, a reward was given for each participant.

Multiple Linear Regression analysis was used to analyze the results of the experiment. The result of the study revealed the significant effects of size of picture, type of text and the horizontal location of picture on menu design. It was found that the bigger the size of the picture the higher the attention would be given by customers. Subsequently, the type of text that customers prefer is sans serif fonts like Arial. Lastly, given that participants in the experiment usually scan the menu board from left to right, the horizontal location of picture was found to have a significant effect with attention in which the closer the menu item is placed at the leftmost panel of the menu board, the higher attention would be given. In addition, based from the result, a set of menu design guidelines were constructed.
Co-morbidities of Myofascial Low Back Pain among Information Technology professionals

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Human Factors and Ergonomics Domain: Musculoskeletal Disorders

Productive Sectors and Services: Building and Construction

Introduction:
Work related musculoskeletal disorders (WRMSD) are highly prevalent among Information Technology (IT) professionals. Various risk factors have been proposed for WRMSD, but its etiology is still being debated. A newer and different approach to determine the etiology of WRMSD is the consideration of co-morbidity. Co-morbidity can be defined as the presence of one or more disorders (or diseases) in addition to a primary disease or disorder, or the effect of such additional disorders or diseases. The underlying basis for such studies is that if there is a presence of two or more diseases simultaneously, they may have a common origin. Co-morbidity of several WRMSD leads to increment in the work absenteeism. Earlier studies have revealed that co-morbidity of neck and low back pain affects healthcare utilisation and absenteeism. Myofascial Pain Syndrome (MPS) of the lower back or Myofascial Low Back Pain (MLBP) is one of the commonest WRMSD noted among IT professionals. The aim of this study was to identify the prevalence of MLBP as a WRMSD and its co-morbidities among IT professionals.

Methods
The data was collected from 8500 IT professionals from a single IT company who visited the on-site clinics situated at their office campuses in 8 cities in an Industrially Developing Country. All the reports from the year 2005 to 2017 were reviewed. Demographic data were collected from the participants including age, gender, computer usage per day, and the type of use (Laptop/Desktop). Data regarding type and intensity of the musculoskeletal problems were collected from the medical records of an Occupational Health/Rehabilitation Physician and a Physical Therapist. Employee’s feedbacks were also used for evaluating the status of musculoskeletal health of the IT professional. The physician’s diagnosis revealed type and severity of the clinical features. Descriptive statistics were used to describe the age, gender, body area affected and distribution of video display users. Chi square test was used to find the association between the various musculoskeletal discomfort co morbidities and MLBP.

Results
The study participants were predominantly males (78%). The mean age of the male and female subjects were 33.30 ± 5.99 years and 27.38 ± 5.59 years respectively. 44% of the population used laptops, 42% desktops and 14% both. 48.5% of the participants had MLBP. MLBP was the third common WRMSD, following MPS of neck and Thoracic Outlet Syndrome. Analysis revealed that there was a significant association between the presence of MLBP and MPS of neck (p<0.001), MLBP and Thoracic Outlet Syndrome (p<0.001), MLBP and Fibromyalgia Syndrome (p<0.001), and between MLBP and Patellofemoral Pain Syndrome (p<0.001).
Conclusion
The present study revealed that MPS of neck, Thoracic Outlet Syndrome, Fibromyalgia Syndrome and Patellofemoral Pain Syndrome were found to be co morbid among IT professionals wit
Adverse Workstyle and its correlation with other ergonomic risk factors in Work Related Musculoskeletal Disorders

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Introduction

Workstyle has been reported as a mediating factor in the relation between job demands and Work Related Musculoskeletal Disorders (WRMSD). The concept “Workstyle” is defined as a psychosocial, physiological, and behavioural response that occurs in an individual due to high work demands (Feuerstein & Nicholas, 2006). These modifying responses generated by self (e.g. fear of losing a job, work ethic) or environment (e.g. expectation of supervisor, work culture) further exacerbate the demands placed on workers. The aim of this study was to identify workstyle related and other ergonomic risk factors that may be associated with the onset or exacerbation of WRMSD among Information Technology (IT) professionals and to look for the correlation between the two.

Method

A retrospective report analysis of 9500 IT professionals in an Industrially Developing Country was conducted. The participants' data was extracted from the database from 2006 to 2017. Ergonomic workplace analysis and demographic data (age, gender etc.), workstation information, working posture information, perceived pain and discomfort, and workstyle questionnaire addressing psychosocial factors (Feuerstein & Nicholas, 2006) were analysed.

Result

The average age of participants was 32.4 ± 9.2 years and 78% of respondents were males. 68% of participants worked between 8 to 12 hours on a computer and 55% used a desktop computer. Neck and upper back pain were the more prevalent, followed by wrist, lower back and shoulder pain. 28% of participants were reported to have a high risk of an adverse workstyle (score ≥ 28). 72% of participants reported pain symptoms during or shortly after they finish work on the computer. 38% of participants experienced numbness/tingling sensation in their fingers after working on the computer. Loss of strength in hands was reported by 24% of participants. 42% of participants indicated a loss in productivity.
due to the symptoms of pain and discomfort. 12% of participants indicated that days were taken off work due to the pain symptoms. Lack of breaks, deadlines/pressure and social reactivity subscales of workstyle questionnaire were the highest predictors of pain and loss of productivity. Regression analyses revealed that workstyle factors and duration of computer use per day were significant predictors of pain. Correlation coefficient analyses indicated a significant positive correlation between workstyle score and pain, and posture and regional pain.

Conclusion
Correlations were observed between ergonomic risk factors, psychosocial risk factors and musculoskeletal pain symptoms. Adverse workstyle appears to be a mediating factor for musculoskeletal pain, discomfort, and loss of productivity. It is recommended that intervention efforts directed towards prevention of WRMSD should address psychosocial work factors such as adverse workstyle in addition to biomechanical and environmental risk factors.
Keeping the Driver in the Loop. The ‘Other’ Ethics of Vehicle Automation

Type: Abstract Oral Presentation
Category: Automotive
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Whilst much of the current ethical debate surrounding the implementation of automation in driving centres upon how an automated vehicle should respond to critical incidents (i.e. the ethics of the vehicle itself), there are many other ethical considerations that need to be acknowledged.

Traditionally, discussion has focused upon the classic ‘trolley dilemma’, a thought-scenario based on unavoidable harm, to determine moral right and wrong in order to inform computational algorithms (Murphy & Woods, 2009; Sütfeld et al. 2017; Skulmowski et al. 2014). However, little consideration has been given to the ethical considerations relating to partially-automated driving solutions that invariably rely upon the human driver to monitor and intervene when required. In this paper, we bring together the lesser-discussed ethics associated with the role of the human driver in partially-automated vehicles. These include the changing role of the driver, the marketing and deployment of automated vehicles, the impact of automation on the development of trust, and finally issues relating to complacency.

The expectation on the human driver to passively monitor operations and rapidly resume control in emergency situations, or when systems go beyond their parameters, is posited as the main human factors challenge facing the deployment of automated vehicles (Kyriakidis et al., 2016). Yet, the enthusiasm and push for ingenuity appears to encourage more focus on the functional capabilities and characteristics of a system rather than the impacts that such systems may have upon driver behaviour. It is argued that the designers of automated systems have a moral responsibility to consider how the operational characteristics and capabilities of the systems in which they design interact upon the human driver. Too much automation can take the human out of the loop, deskill them and lower morale (Stanton et al. 2007; Bainbridge, 1983). It can also lead to decrements in situation awareness and in some instances cause erratic changes to driver mental workload (Young & Stanton, 2002). However, we are beginning to see increasing evidence within the literature which suggests that even partially-automated driving systems can lead to similar effects (e.g. Banks et al. 2014). This is because there appears to be a lack of transparency relating to the true nature of the technological capabilities of automated systems.

The utilitarian justification for automated vehicles is that they can improve safety, comfort and delivers greater mobility for both the user and wider population (Kyriakidis et al., 2016; Brown & Laurier, 2017; Stanton & Marsden, 1996). However, there is a need to balance these justifications with the current state of the art. In reality, fully autonomous vehicles are a long way off (Norman, 2015) but partially-automated driving solutions that are already available today, can give the impression of higher level functionality.
Abstract

Keywords: Load carriage, biomechanics, stride length, double limb support, energy cost, heart rate.

Introduction: The main three functions of lower limbs of human are to bear weight, provide means for locomotion and maintain equilibrium. The rhythmic alternating movements of the two lower limbs help in the forward movement of the body and the manner in which it occurs i.e. how a person walks is what is known as gait. Biomechanics of human movement changes with modes of load as well as imposed load on the body in an industrial situation. Further, biomechanical load coupled with energy cost of work provides a significant input for design of a work system. Various modes of load carriages are used in an industrial set up and it is important to understand influence of external load on human biomechanics and stability. This would be a significant input for designing work in industries and other occupations.

Aims and Objectives: The study was carried out with following aims and objectives:

1. To study the changes of lower limb biomechanics with different modes of load carriage among industrial workers.
2. To suggest biomechanically efficient mode of load carriage

Methodology: Study was conducted on 20 workers of age range 20 to 55 years. Qualisys Motion Capture System (Sweden), Kistler Force Plate (Switzerland) and Polar S810i HR monitor, Finland were used. Heart rate was recorded at rest and during different
modes of load carriage with 40% of body weight i.e. loads on head, shoulder and hand. Movement of lumbar spine while carrying loads was recorded by using Industrial Lumbar Motion Monitor (iLMM), USA.

Results: Average age and height of the workers were 38.1±12.99 and 167.4±7.45 cm respectively. Walking speed for head load, shoulder load and hand load were 4.19±0.55 km.hr⁻¹, 4.09±0.82 km.hr⁻¹ and 3.94±0.84 km.hr⁻¹ respectively. Stride length was longer in case of head mode (1.20±0.45 meter) followed by hand (1.19±0.01 meter) and shoulder mode (1.12±0.04 meter) of load carriage. Double limb support time while carrying loads has been found lowest in case of head mode (0.65±0.46 sec) followed by hand mode (0.67±0.14 sec) and shoulder mode (0.68±0.06 sec) of load carriage. Average Twisting Velocity of lumbar spine was found lowest in case of head mode of load carriage followed by shoulder and hand mode. Heart rate cost of carrying loads on head, shoulder and hand were 50±10.54 beats/min, 52.95±10.88 beats/min and 57.45±10.04 beats/min respectively. Energy cost of carrying loads on head, shoulder and hand were 294±61.99 Joule/min, 311.346±63.97 Joule/min and 337.81±59.03 Joule/min respectively.

Conclusion: Results demonstrated a significant relationship between kinetic and kinematic parameters of workers at different load conditions. Findings would provide substantial input for designing work and work rest cycle for industrial workforce.
[2435] Effects of anti-glare film on tablet usability by elementary school students

Type: Abstract Oral Presentation
Category: ICT

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Introduction: Tablets are becoming increasingly popular in elementary school classrooms as a means for improving the educational quality. It is important to consider how to use the tablet according to the learning environment of the school. For example, school classrooms are well-lit compared with the living rooms at home, and the results of our survey indicated that 57% of the students experienced difficulty in reading from the tablet screen because of the glare [1]. The use of Anti-Glare (AG) films could be one effective solution to the glare problem (Fig. 1). The aim of this study was to examine the effects of the AG film on tablet use by elementary school students.

Method: An experiment was conducted with 123 sixth-graders at a public elementary school to examine the effects of AG films on their writing, viewing and several things related to using a tablet. An AG film (Dai Nippon Printing) was attached to only the left side of the screen. The right side of the screen had a glass surface with no film attached (Fig. 1). The same image was displayed on both the left side and the right side of the screen (Fig. 2). Students were also given a questionnaire sheet, which was used for evaluating the fourteen tasks performed on the tablet. They performed the tasks individually, and rated their responses on a 5-point Likert scale. The last question was “Which do you want to use for school learning?”, which was an overall preference for the AG film and the glass surface.

Results: About writing, it was easier to write the letters on the AG film screen than the glass surface for 75% of the participants (Fig. 3). On the other hand, it was easier to read sentences on the glass surface than the AG film screen for 79% of the participants (Fig. 4). Note that students performed the experiment without the presence of a glare on their tablet screens. As an overall result including other factors in using the tablet, 75% of the students preferred to use the AG film screen for school learning (Fig. 5).

Discussion: The screen glare could be one of the major problems in classrooms. In group activities in elementary school classes, students hold the tablet and show the screen to the surrounding students. Moreover, students tend to tilt the tablet to make the screen easier to view [1]. The use of AG films could solve the glare problem in classrooms. Our experimental results also showed that the comfort levels for pen input was also improved in addition to the glare prevention. This is another advantage of attaching an AG film to a tablet.
Voluntary safety leader at the sharp-end: From controlled safety to creative safety at an expressway maintenance site

Type: Abstract Oral Presentation
Category: No productive sector applicable

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[Background]
Now that we have identified the limits of the SAFETY-I or controlled safety model which requires following a comprehensive safety manual, our next objective is creative safety, which requires flexible and creative correspondence regarding unexpected situations and efficient requirements on site. Creative safety is not so straightforward, however, as simply requiring workers at the sharp end of a situation to make decisions flexibly and think creatively. To accumulate the information, we will need to resolve this difficulty; the authors interviewed site workers employed by an expressway maintenance company. The results indicated a need for specific safety workers who volunteer to pay attention to unexpected dangers or dangers caused by efficiency requirements. We call these workers the voluntary safety leaders and have written this study with the aim of clarifying their necessary attributes.

[Methods]
We developed the safety leader index, a 69-items questionnaire based on the developed leadership scales. We asked 440 site workers at an expressway maintenance company to complete this questionnaire, once with their safety manager in mind and a second time with their voluntary safety leader, if they had one, in mind. The safety manager is a position assigned by the company; for the voluntary safety leader, we asked workers to think of one of their colleagues who, although not assigned a safety-oriented role by the company, took particular care for workers' safety. Finally, we asked them to answer 11 questions regarding the workplace safety climate.

[Results & discussion]
We received intact data from 101 out of 440 participants. We received completed questionnaires regarding both safety leaders from 59 participants. We compared the two leader types' average scores for each item through a T test. On 16 of the 69 items, the voluntary safety leaders received higher scores than the safety managers did. We performed factor analysis on these 16 items. The results indicated two factors, which we named “troubleshooting” and “commitment to colleagues.” We then performed multiple regression analysis dependent on workplace safety attitude as assessed by means of the final 11 items. Only “commitment to colleagues” contributed to workplace safety attitude. Therefore, we concluded that the seven items associated with “commitment to colleagues” represented the necessary attributes of a voluntary safety leader.


Ergonomic Design of a Drumstick Plucker

Type: Abstract Oral Presentation

Category: Agriculture

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Abstract—India is the largest producer of Moringa tree’s pod referred to as drumsticks in the world. Harvesting of this commercially valuable farm produce is a delicate process due to constraints such as the height of plant around 10 to 12 m, visibility, and difficulty in selective plucking, damage to the drumstick during the process, long working hours and uncomfortable posture. At present, most of the farmers are using self-made non-ergonomically developed tools made-up of locally available materials. These self-made harvesting tools are an essential cause for low returns from drumstick farming due to the high percentage of wastage caused by harvesting of immature pods by non-selective plucking and thereby economic losses to producers.

Until date, several studies have conducted to develop drumstick harvesters. These drumstick harvesters have used a large shearing force of 5 to 15 N for harvesting single drumstick or cutter pipe requiring twisting force to harvest. Both these ways for the development of drumstick harvesters are not feasible to apply on the commercial basis by considering work-related musculoskeletal disorders that will develop in long run. In order to avoid the huge percentage of food waste due to non-selective plucking and health-related issues, there is a need to design suitable harvesting tools. Therefore, to address the above-mentioned issues, we have used different design approaches for the development of drumstick plucker by considering the physiology of drumstick pods. From our laboratory experiments, it is evident that if the force is applied at the junction of stem and pod the drumstick can be harvested with a force of 3.5 N which is much lesser than claimed by previous studies. Further critical physiological and biomechanical analysis of modified drumstick plucker is underway which will provide a better ergonomic design solution to resolve the existing issues.

Keywords—Design, Drumstick plucker, Ergonomic assessment.
Many of the coordination and negotiation activities that take place on the road are done in an ad-hoc way. This is because sometimes the traffic rules are unclear about the situation that needs to be resolved on the spot and there are times where strict following of traffic rule can lead to blockage, or starvation, of one or more road users (e.g., trying to enter a busy roundabout where the oncoming traffic has priority). Notwithstanding, there are situations where a road agent is out to “game” others to one’s advantage or simply violate the rule. In all cases, the ambiguity of the situation and unclarity of the communication makes it difficult to resolve the situation. Nevertheless, they are resolved, this way or another. One of the reasons why these interactions usually end up without an accident is the existence of human interrelations. Namely, humans share intrinsic values such as basic trust and deep reverence to sanctity of life that guides us in resolving these situations. Since there will not be a human driver in a highly autonomous vehicle, such strong humanistic interrelations will not exist.

The general idea is that when and if a road user will be able to view how it moves in the space (e.g. conflicted trajectory) with respect to other road users that are also functioning in the space, it will be quite easy to understand what will happen on the road. This will reduce the level of ambiguity about other road users behavior and show what are the viable and safe paths that are available. The goal here is to eventually lead to a transportation system where the likelihood of accident due to ambiguity and misunderstandings of other road behavior is reduced.

The approach we will illustrate uses the concept of Maxwell’s (1865) field theory, a well-tried theoretical concept from physics (electromagnetism) to describe the interrelations between objects in the public space. Adding each object’s field with others allows for a joint field that shows areas where locomotion is enabled, trajectories based on vehicle dynamics and environmental factors (e.g., traction), potential for collisions, as well valences (positive for intended direction of travel and negative for objects and obstacles). Gibson & Crook’s work on the concept of “safe field of travel” and the many factors that lead to its dynamic shaping is the motivation behind the computational work that underlies this representation scheme (1938). Once the field is defined and its dynamics can be computed, the next steps in the process are to define what aspects of this information should be conveyed to users and how.
Companies in different developed industries are all facing the same challenge: demographic change. This leads to a higher share of elderly workers in most workplaces. When designing workstations or evaluating risks at workplaces, it is necessary to take into account age-related changes in physical and sensory skills as well as in cognitive or mental capabilities. Although extensive data regarding age-related changes in human performance prerequisites\cite{1} is available in literature only a few methods consider the factor age, e.g. the REFA-method that refers to the factor age when calculating values for maximum forces. However, most ergonomic standards and occupational risk assessment methods used in industry do not take into account the specific needs of an ageing workforce. Therefore, there is a need for action, especially with respect to the design of age-differentiated workplaces.

The two most frequent reasons for sick leave are musculoskeletal disorders resulting from physical overload and mental illnesses caused by psychological stress.\cite{2} The identification and assessment of physical and mental stress thus takes on a high priority and allows estimating the actual risk potential at workplaces. Moreover, knowing and assessing the physical and psychological strains at work is the basis for deriving adequate measures given an average ageing population.

The aim of this paper is to introduce an age-considering work evaluation framework that has been developed based on a review of literature and practical findings from a study examining an Austrian manufacturing company and a food retailer. A four step approach was applied in the course of this research:

First, 32 semi-structured interviews were conducted throughout different departments. Additionally, the available company data was examined to get insights into the workforce’s age-structure, the extent of sick-leave and the reasons which caused employees to quit work.

Second, the physiological and mental changes which individuals experience when they get older were elaborated based on an extensive literature review. Therefrom age-critical factors that should be covered in ergonomic risk assessment methods were derived.

Third existing ergonomic assessment methods that cover physical and psychological occupational risks were collated and examined, considering their coverage of age-relevant factors.
Finally, the findings from the literature review and the collected empirical data were consolidated to develop an age-differentiated workplace screening method. This method not only allows for the identification of potentially problematic workplaces and points out the need for age-related adaptation, but also reveals existing age-appropriate workplaces.

[1] E.g. ONR CEN ISO TR 22411: Ergonomic data and guidelines for the application of ISO (IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities (ISO/TR 22411: 2008), 2011

Look with the eyes of others: accessibility in hospital environments

Type: Abstract Oral Presentation
Category: Building and Construction
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Access to health is a constitutional right guaranteed to every Brazilian citizen. Although numerous laws and norms deal with the care of people with disabilities, it is observed that there are still architectural barriers that compromise the quality of the building, hamper circulation flows, influence user behavior, and occasionally impede access to patient health with disabilities. In this sense, it is the duty of the built environment to provide possibilities of use and to promote accessibility to space and equipment. The understanding of the place is also essential to define and use routes with autonomy, safety and comfort. Considering that the users of hospitals are influenced by the environment and the disease, the accesses and external areas of the University Hospital of the Federal University of Paraíba were analyzed, aiming to know the perception of the disabled user and identify the main difficulties encountered for use. For that, the multi-methods approach was used: observation of the environment, user evaluation and analysis of the results. To obtain the users’ impressions, the Accompanied Walk technique was applied, which evaluates the conditions of use of the built environment in real situations. Three volunteers with different disabilities (blind, wheelchair and reduced mobility, with crutches) were invited to travel along the routes most frequently used by patients, employees and university students, without interference from the researcher. As they circled the routes, guests reported their experiences, highlighting critical and potential points, while the researchers recorded photographs, audio recording, notes and sketches. In general, the guests demonstrated that, although they have different deficiencies, the difficulties faced are similar. For the blind, the sense of dependence of another person was observed in conversation during the accompanying ride and this feeling was shared by wheelchair and guest with reduced mobility, because at various points of the ride they needed help to move and orient themselves. The circulation in two of the four routes, became impractical for the guests with physical disabilities, as the level change was given exclusively through stairs. In summary, although traffic conditions are precarious (with steep ramps and uneven paving) and impair the circulation of users, the absence of signaling, with information in different formats, makes it impossible to use space with autonomy. Considering the results found, it is suggested that users participate during the design process, as an expert who has another view. Their experience can contribute to a quality project, especially in the hospital environment, where users are debilitated, promoting a sense of welcome. In addition, the information obtained indicated guidelines and proposals for improvement in the object of study, such as the insertion of adequate signage, with Braille texts, pictograms and sound communication.
As air travel grows the numbers of passengers with varying degrees of motor disability have grown too. The aim of this study is to analyze the task of pushing Passengers with Restricted Mobility (PRM) on three different wheelchairs (WhCh) currently supplied to PRM service of a Rome airport. The WhChs differed in their width, weight and wheels dimension as reported in the following Tab.

<table>
<thead>
<tr>
<th>Wheelchair</th>
<th>Posterior wheel Ø</th>
<th>Steering wheel Ø</th>
<th>Handle width</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>60 cm</td>
<td>20 cm</td>
<td>43 cm</td>
<td>18 Kg</td>
</tr>
<tr>
<td>B</td>
<td>60 cm</td>
<td>15 cm</td>
<td>53 cm</td>
<td>17 Kg</td>
</tr>
<tr>
<td>C</td>
<td>30 cm</td>
<td>20 cm</td>
<td>39 cm</td>
<td>13.5 Kg</td>
</tr>
</tbody>
</table>

We investigated initial and sustained forces, according to the Annex D of ISO 11228-2 standard, by means of a digital dynamometer. sEMG, expressed as mean percentage of the maximum voluntary contraction (MVC), was also recorded bilaterally from erector spinae (ES) and anterior deltoid (AD) only in the initial phase.

WhCh C showed highest mean values of sustained forces for both weights. WhCh B showed the lowest mean sustained force pushing 100 Kg and WhCh A showed the lowest mean sustained force pushing 55 Kg.

Concerning initial forces, WhCh A showed lowest values for both weights and in all the three different starting conditions (steering wheels at 180°, 90° and 0°). WhCh C showed highest initial force values at 180° for both weights and at 0° pushing 100 Kg. WhCh B showed highest initial forces starting at 90° for both weights and starting at 0° pushing 55 Kg.

During the initial effort WhCh A showed the lowest sEMG mean activity and WhCh the highest for all the investigated muscles in the 3 different conditions of steering wheels and for both PRM weights.

In conclusion, we can state that, despite all the initial and sustained measured forces were below the limit proposed by ISO Standard 11228-2 (ISO, 2007), we found clear differences in applied forces and muscle activities among the three investigated WhChs.

Pushing forces, together with sEMG, may help to have a better understanding of the task requirements and a more detailed risk assessment.
The use of both sEMG and applied forces values can be used also to help PRM airport services in choosing the wheelchair that best fit with the passenger to handle and in order to reduce the biomechanical load in PRM assistance workers.

Reference

Musculoskeletal discomfort (MSD) is one of the main health problems in office workers (OW). In EU these affecting millions of workers and cost companies a billion euros every year. OW-s work-related MSD-s main reasons are forced positions, repetitive motions, force of movements. MSD-s causes in OW-s work ability loss.

AIM: The aim of the present study was to evaluate working ability and musculoskeletal discomfort in office workers, who dominantly work in sitting position.

DESIGN AND METHODS: A total of 202 office workers (aged 21-68 yrs, mean age 44 ± 10.9 yrs, body mass index 25.1 ± 4.7 kg/m²) volunteered to participate in this study. All participants (76% women) worked in Estonian Government Buildings, with mean working experience 12.2 ± 10.5 yrs. OW-s work almost whole workday (7.9 hours per day, and 38 hours per week) in sitting position with computer. All participants filled modified Nordic questionnaire, which evaluates MSD in last 30 days in eight different body regions. Work ability was assessed by standardized questionnaire (Finnish Institute of Occupational Health) with calculation of work ability index (WAI).

RESULTS: In office workers, MSD in last 30 days was localized primarily in low back (69%), in neck (68%), in shoulders (57%), and in upper back (50%). Women perceived more MSD in upper back (p = 0.036), in shoulders (p = 0.028), and in neck (0.002) compared with men. Work ability is “excellent” in 17%, “good” in 48%, “moderate” in 32%, and “low” in 3% of participants. Work ability in women is lower than men. OW-s average work ability according to WAI was “good” (result ± SD: 38 ± 5), in fact result „excellent” was mainly in age group 30-39 yrs (6%). Lowest work ability index was noted in age group 40-49 a (1%). Correlation analyse showed that OW-s work ability falls when workers age rises. OW-s, who hasn’t satisfied with their workplace ergonomics, perceived more MSD (p<0.05) (in wrist, in upper back, in shoulders, and in low back). OW-s, whose hasn’t ergonomic chair, has felt more low back pain (p<0.05). Fatigued eyes were correlated with shoulder, and neck pain (p<0.05). OW-s, who have been optimistic with their future (p<0.05) enjoyed regular daily life activities more (p<0.05). Better work ability results (p<0.05) showed OW-s whose work place was ergonomically correctly designed. Tension in the eyes (p<0.05), headache (p<0.05) during the workday causes mental and physical fatigue, and loss of work ability.

CONCLUSIONS: The office workers perceived more musculoskeletal discomfort in low back, in neck, in shoulder, and in upper back. Women are more exposure to pains in neck, in upper back, and in shoulders. Unergonomic workplace causes MSD in OW. Work ability loss was noted individual office workers, started age of 40 years.
Hit-and-run cases have also saw a steep escalation in the past few years. Recent published report by ministry of road transport and highways shows that 55,942 hit-and-run cases were reported which is 11.6% of the total accidents that occurred in the nation (MoRTH,2016). In the current study, various factors associated with hit-and-run crashes were investigated for urban Chennai, a metropolitan city of India. A total of 65 variables under 20 factors were classified as driver, vehicle, crash and environmental factors. Data mining technique, classification and regression tree (CART) was used on the data related to 4818 hit-and-run crashes that occurred in Chennai urban between January 2015 and December 2016. The dataset was split in two as training and testing data with 50:50 ratio. The predictive accuracy of the model built with total of 65 variables was 92.29% for the training data and 92.19% for the testing data. The CART findings show that collision type is the most important variable associated with hit-and-run crashes. Other secondary variables associated were gender, driver age, vehicle type and light conditions. From the results of the present study, it can be concluded that CART algorithm can be a useful tool in determining and identifying potential causes of hit-and-run accidents.

Keywords: Road Traffic Accidents; Driver safety; Decision trees, Hit-and-run; Transportation Human factors.
Construction ergonomics: Construction Health and Safety Agents’ (CHSAs’) perceptions and practices

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IEA 2018 Abstract

Construction ergonomics: Construction Health and Safety Agents’ (CHSAs’) perceptions and practices

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Keywords: Construction, Ergonomics, Perceptions, Practices

Introduction:
Ergonomics hazards in construction include ergonomic stresses such as bending, lifting, and repetitive movement and vibration; environmental stresses such as heat, sun, noise, poor illumination, and wet or damp work; skin and respiratory exposure to chemicals and dust, as well as mental stress. In accordance with the South African Construction Regulations, clients may appoint CHSAs to fulfil their functions, which requires CHSAs to interface with and guide clients and designers, and conduct interventions during the construction process.

Methods:
A self-administered questionnaire survey was conducted among CHSAs registered with the South African council for the Construction and Project Management Professions (SACPCMP) to determine, inter alia, CHSAs’ perceptions and practices, potential of aspects / interventions to contribute to an improvement in construction ergonomics during the various project phases, and CHSAs’ source of knowledge.

Results:
Findings include: CHSAs are mostly appointed during Stages 1, 3, and 4, which does not enable them to effectively influence construction H&S through design; construction ergonomics is important to CHSAs, but less so than H&S, and end-user ergonomics; CHSAs were able to influence construction ergonomics, but mostly during design development, and tender documentation and procurement; CHSAs do have an understanding and appreciation of the role of design in construction ergonomics, and the impact of design related aspects on construction ergonomics, and CHSAs are ‘lacking’ the requisite competencies.

Recommendations:
Recommendations include: CHSAs should be appointed at Stage 1 ‘Project initiation and briefing’, Stage 2 ‘Concept and feasibility’, and Stage 3 ‘Design development’, in addition to the subsequent stages; CHSAs should register for and complete formal tertiary education programmes, and appropriate continuing professional development (CPD) courses should be evolved.
In 1937, Ronald Coase published ‘The Nature of the Firm,’ addressing the question of why firms exist. He concluded that firms emerge to reduce costs of transactions, leading to a conclusion that, in addition to price, supply-demand and productivity, firms also must be considered a major market force, and thus relevant to a major IEA concern, namely macroergonomics.

A ‘transaction’ is defined both as the action of conducting business, as well as an interaction between people. Both senses of the term prompt the present analysis. The most comprehensive behavioral theory of how people interact is that of social cybernetics (Smith et al., 1995, 2015), focusing upon the reciprocal feedback control interactions between two or more individuals in a group or organizational setting, a process termed social tracking. Social tracking is conceived as a dynamic linking of the social behavior of two or more people.

From the perspectives of both social cybernetics and transactional theory, the market success of a firm therefore may be equated with the degree to which social tracking fidelity of transactional participants is achieved and maintained in the service of organizational design and management.

To gain some insight into the nature of transactions, and the concomitant social cybernetic challenges, confronting a present-day firm, I interviewed the owner of a small silicon rubber-molding company located in Minnesota. I selected a small firm for analysis on the assumption that the owner should be responsible for the entire range of transactions affecting company operations.

Six types of owner-mediated transactions were identified with the interview, involving social interactions (SI) with: 1) 10-12 employees (18 face-to-face SI/hr); 2) 100 customers (once/day to once/yr SI, mostly by phone); 3) 24 suppliers (12 SI/week, by phone); 4) regulators (5 face-to-face SI/yr); 5) major equipment maintenance (1 face-to-face SI/yr); and 6) landlord (1 face-to-face/yr).

The interview findings support Coase’s conclusion that, “A firm consists of the system of relationships that comes into existence when the direction of resources is dependent on an entrepreneur.” Yet it is also clear that ‘the system of relationships,’ in even a small firm, can be highly complex, demanding refined social behavioral skills on the part of both partners in each transaction, a social tracking complexity that Coase’s broad analysis does not address. This suggests that the customary view of macroergonomics --- ‘concerned with improving productivity and the quality of work life by an integration of psychosocial, cultural, and technological factors with human-machine performance interface factors in the design of jobs, workstations, organizations, and related management systems’ --- needs to be expanded to address the broader transactional underpinnings of the firm itself. This analysis also applies a behavioral perspective --- i.e., behavioral economics --- to the domain of market forces.
New guidelines point to ergonomic inadequacy of the dental equipment design

Type: Abstract Oral Presentation

Category: -

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Non-ergonomic dental equipment imposes restrictions for dentists that lead them to adopt a poor working posture that can result in the development of Musculoskeletal Diseases (MSD). This study aimed to analyze dental equipment according to two methods of analysis of the ergonomic compliance level. It was evaluated Dental equipment used in 39 Primary Health Units in a large city of the São Paulo State-Brazil. Method 1 (M1), drawn from the requirements in ISO Standards relating to dental equipment and Method 2 (M2) grounded on ergonomic guidelines proposed by the European Society of Dental Ergonomics - ESDE. The ergonomic compliance analysis with M1 resulted in an average of 87.4% and with M2 an average of 57% (p <0.001). In the analysis with M2, compared to M1, the dentist stools presented 4 times more likely to be classified as non-conforming (OR = 2.2418, 95% CI: 1.7041 to 2.9492); Dental Unit: 2 times (OR = 2.2418, 95% CI: 1.7041 to 2.9492); Dental operating light: 11 times (OR = 11.3821, 95% CI: 7.4356 to 17.4232); and Positioning instruments for the dental assistant: 4 times (OR = 4.1127, 95% CI: 2.9611 to 5.7122). The guidelines proposed by ESDE showed that the ergonomic compliance level of dental equipment is very poor, which can increase the chance of occurrence of MSD and decreases the quality of life of the dentists.

Keywords: Ergonomics, Dental equipment, Musculoskeletal Disorders.
Designing underground workspaces: A human factors approach

Type: Abstract Oral Presentation
Category: Building and Construction

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With increasing population density in urban areas, underground space use in these urban centres is also on the rise. This can come in the form of more traditional underground facilities, such as water treatment plants and subway stations, but also more diversified uses such as underground offices and data centres. As these novel underground workplaces are constructed, we need to take a human centric approach to ensure that workers are happy and healthy.

When designing any space, it is important to consider the relationships between the environmental and architectural characteristics and behaviour and wellbeing. This is even more important in underground developments, as the initial cost of developing an underground space is significantly higher than aboveground and would have to be offset by a longer building life.

Previous studies show negative attitudes towards working underground and hint at possible psychological and health complaints. Major themes include lighting and circadian rhythms, metabolic changes and claustrophobia. However, these studies are over thirty years old and mainly concentrate on self-report measures. We have developed a systematic multi-disciplinary research programme that investigates psychological, social and health effects of underground spaces through qualitative and quantitative methodologies such as cognitive tests, psychophysiology, and interviews with long-term underground workers.

We present insights from our work, and examine the architectural and engineering choices that could impact or mitigate specific issues related to underground work.
Anthropometric database of agricultural workers was carried out for designing ergonomically tools and equipment not only to achieve performance and productivity but also providing safety and comfort. This study presents anthropometric dimensions of agricultural workers in north-eastern, Thailand. The anthropometric dimensions were carried out in 139 agricultural workers were randomly selected from Phimai district, Nakhon Ratchasima province with 15 anthropometric dimensions of standing posture (1) by using the commercial anthropometer set. Statistical analysis were analyze by frequency, percentage, mean, standard deviation (SD), and minimum and maximum. The 5th, 50th and 95th percentile values were calculated accordingly. However, the t-tests were used to compare different mean between male and female anthropometric dimensions. The agricultural workers were comprised of 71 males (age range 18-59 years, mean: 44.11, ±SD: 10.02) and 68 females (age range 18-59 years, mean: 45.87, ±SD: 10.83). In addition, there are significant different between male and female agricultural workers in stature, eye height, shoulder height, elbow height, hip height, knuckle height, fingertip height, hand length, hand breadth, foot length, foot breadth, span, elbow span, vertical grip reach and body weight (p-value<0.01). Similarly, the comparison mean of anthropometric dimensions in Thailand, Taiwanese from 1,322 male and 799 female with aged 18-65 years (2) and Chinese from 11,164 male and 11,150 female with aged 18-60 years (3) that found Thailand male and female are relatively smaller than other countries. Therefore, the finding of this study concluded that anthropometric data were evidently difference between male and female within the region and difference between Thailand, Taiwanese and Chinese which are absolutely necessary for designing of ergonomically machines/tools/equipment of the target users.

Keywords: Anthropometric, Standing posture, Agricultural, Northeastern, Thailand

Reference

The effect of creative reasoning tasks on critical care medical education for military and civilian learners delivered via an intelligent tutoring system

Type: Abstract Oral Presentation
Category: Education and Training

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This oral presentation will share the findings of an inter-institutional research project between the Army Research Laboratory, Columbia University Medical School, and the United States Military Academy, concerning whether creative reasoning tasks deployed via an intelligent tutoring system support the problem solving in critical care medical learning. Specifically, this oral presentation will discuss how the sequencing of content delivered through the Generalized Intelligent Tutoring Framework (GIFT), impacts the learning of both novice and experts in critical care medical education. The goal of the study is to provide empirical findings to Army and medical education stakeholders that will contribute to developing models to support an accelerated learning pathway, as well as explore models that support the learning processes, specifically higher-level, creative thinking and reasoning (Hoffman et al., 2010). As noted in Hoffman et al. (2010), to accelerate instruction requires not only an understanding of tasks that need be learned, but also an understanding of the learner and a delivery of instruction that optimizes the growth and development of expertise by the learner. This study will address the gap of identifying pedagogical models that can be employed in GIFT to support the transfer of skills from training to operations in individual Soldiers and medical students, nurses, and residents within the domain of critical medical care. The medical content will include topics in hemorrhage, airway compromise, and/or tension Pneumothorax, which are three leading causes of battlefield deaths (Kotwall et al., 2011), and relevant to pediatric critical care as well. The overarching goal of this work is to determine whether the tools and methodologies employed in this research can serve as a model for future medical education and workplace efficiency and success.
The importance of identifying patient and hospital characteristics that influence incidence of adverse events in acute hospitals

Adverse events in hospitals constitute a significant problem and a challenge for public health. The main purpose of this study is to analyse the variation in the rate of adverse events between acute hospitals in the Portuguese NHS and to explore the extent to which some patients and hospital characteristics influence the differences in the rates of AEs.

This work was based on a retrospective cohort study and was carried out at nine acute hospital Centres representative of the Portuguese NHS hospitals. A random sample of 4,250 charts, representative of around 180,000 hospital admissions in 2013 year was analysed. Hospitals characteristics were also considered. Binary logistic regression models were used to identify potential association of some patient and hospital characteristics. All tests were performed for a statistical significance of 0.05.

Main results: i) incidence of 12.5%; ii) 66.4% of all AEs were related to healthcare-acquired infection and surgical procedures; iii) 12.5% resulted in death; iv) Patient characteristics such sex (Female 11.1%; Male 14.4%); age (> 65y 16.4%; < 65 y 8.5%); Elective Vs Urgent (8.6% Vs 14.6%) all with p< 0.001; and medical Vs surgical (13.4% Vs 11.7%, p = .112) were associated with a large rate of AEs. Charlson Comorbidity Index seems to influence the difference in the rates of AEs, with a mean in the group with AE 3.10 Vs no AE 2.20, p<0.001; v) Use of reporting system (13.2% Vs 7.1%); Accredited Vs non accredited (13.7% Vs 11.2%); University Vs non University hospitals (15.9% Vs 10.9%); dimension of hospitals (small 12.9%; medium 9.3% large 14.3%) all with p<0.001; and electronic prescribing drug system (yes, 13.2% Vs no, 11.8%, p=0.177) were also associated with a large rate of AEs.

The incidence of adverse events in acute hospitals in Portugal was 12.5%. This is in line with other similar studies find in other countries worldwide

This study shows that some patients and hospitals characteristics are associated with the occurrence of different rates of AEs. These results give us important insights that can help to investigate areas for improvement in the Portuguese NHS acute hospitals. Based on these results we can define more adequate solutions to improve patient safety.

Authors: Paulo Sousa; Florentino Serranheira; António Sousa Uva, Carla Nunes
The knowledge and application of Human Factors/Ergonomics (HFE) principles and guidelines can help designers to develop better products and services. They can also make it easier for designers to apply human factors and ergonomics theories and concepts properly. HFE principles and guidelines serve to optimise human performance, improve safety and usability of products and services, and are therefore considered fundamental during the design process. The accurate application of HFE principles and guidelines assists multidisciplinary teams of developers to create effective, useful and enjoyable products and services.

Several researchers have investigated how the principles and guidelines of HFE should be applied to assist in the process of designing or re-designing products and services. Studies of several areas of knowledge, such as medication alerts [1,2]; traffic signs [3,4]; classrooms [5,6]; sustainable buildings [7]; musculoskeletal disorders [8]; furniture [9]; and workplaces [10,11] have found that the application of HFE principles and/or guidelines can improve the performance and usability of products and services.

Although HFE principles and guidelines are considered fundamental during the design process, several researchers have found that they are not completely followed by product and service developers [1,11,12]. This may be explained, among other reasons, by the fact that some developers either do not know or do not have access to HFE principles and guidelines. Furthermore, it can be argued that HFE principles may include many constraints on project development and therefore may be difficult to follow and/or may increase the costs of project development.

In addition, they may also include product/service design constraints that may affect designers’ creativity. Creativity in a product is related to its originality and appropriateness [13,14,15], and it plays an essential role in fulfilling the aspects of ergonomic design in terms of affectivity, functionality, safety and usability [16]. Although both HFE principles and guidelines and creativity are considered essential in the design of products and services, the link between them is little researched.

In this article a discussion is presented on the influence of HFE principles and guidelines can exert on the creativity of designers. It also presents case studies of HFE principles and guidelines and discusses how they can influence designers’ creative process. In addition, a set of recommendations is suggested to help designers apply ergonomic design principles and guidelines to stimulate creativity. It is concluded that HFE principles and guidelines can assist designers in creating safer and more efficient products and services and can also broaden their creative process and therefore the originality and the appropriateness of products and services.
The present study was accomplished in a sawmill in the interior of Minas Gerais - with the focus in the carpentry sector - and aimed to reveal the adaptations and regulations made by the employees, as well as understand the impact of the regulations on the work environment, production and health of workers. The gather of information for the study was carried out from the Ergonomic Work Analysis (Guérin et al., 2006; Falzon, 2015), whose objective is to track back, observe, evaluate and analyze the professional and his place of work, and to verify the relations between demands of diseases, accidents and productivity with the conditions of work, such as interfaces, systems and work organization. Through systematic and open observations of workers and the work environment in overall, such as with through interviews and confrontations, it was possible to reveal the differents regulations and adaptations that existing in the place of work. It’s clear the expertise of employees who saw the distance between the prescribed and the real activity, and developed ways of managing this distance with the idealization and execution of regulations. This regulations can be an adaptation of the company's machinery with implementation or removal of parts, or an organizational structuring of the work environment, all with a common goal: to allow better working conditions for the own workers. The transformations carried out by the employees were classified into three categories, according to the impact they created on health and safety, reducing the workload and improving the productivity. In relation to health and safety, workers developed tools that limited the direct contact with pieces that could bring risks, such as cuts and crushing. In addition, they created ways and adaptations that favor postural comfort during the accomplishment of the activity and minimizing the incidence of dust and particulate matter. In order to reduce the workload and avoid rework, were created a serie of adaptations, not only physical, but also organizational, such as the structuring of the productive chain, with the division of activities among the employees, as well as the planning of the external demand, in order to be supported by both of them throughout the day. Although the two previous blocks impacted directly in production, the productive efficiency was favored by adaptations in the machinery that reduced the need of several employees in the same task and helped in fluidity of the activities. The analysis presented elements that show how the applied knowledge of the workers to the work practices are determinant for their labor techniques and, as a consequence, an efficiency of the regulations in the productive context, as well as the minimization of impacts on the health and safety.
La Fabbrica si Misura: an anthropometric study of workers at FCA Italian plants

Type: Abstract Oral Presentation
Category: Automotive

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Nowadays, the use of updated and reliable anthropometric data is of fundamental importance. Anthropometric data play a key role in workstation design, safe use of machineries and protective equipment supplying. The variability of anthropometric data between populations of different ethnic groups, or even different countries or geographical areas of origin, cannot be neglected. For this reason, the ISO 7250 technical standard reports a collection of statistical data of anthropometric measurements for different nations. As far as the Italian adult population is concerned, the anthropometric survey, referred in the standard, was carried out nearly 30 years ago. No other anthropometric surveys is available on a large enough sample to be considered valid and reliable.

The ongoing project presented in the paper arises from the need to update the anthropometric data of the Italian population and seeks to provide data specifically for the working population. The project, “La Fabbrica si Misura” (The factory measures itself), is carried out in cooperation between Fiat Chrysler Automobiles (FCA), Politecnico di Torino and Istituto Nazionale Assicurazione Infortuni sul Lavoro (INAIL). The study consists in the development of a procedure for data acquisition and analysis of an anthropometric database regarding the workers of FCA plants in Italy. During the project, a minimum sample of 3000 subjects per gender to be measured was estimated. The measurements were carried out only on voluntary subjects, who have expressed their consent to the measurement and data processing. The age of subjects varied between 18 and 65 years.

A set of 12 static body dimensions plus body weight were measured for each subject by a qualified doctor. Before the collection of measurements began, training sessions were organized to standardize data collection and data storage. The measurements were carried out in 12 medical facilities of FCA plants in Italy. The selected plants are located in several Italian regions: Piemonte, Emilia-Romagna, Abruzzo, Lazio, Molise, Campania, and Basilicata.

First results showed significant differences between the measured data and the database included in the technical standard that will be illustrated in the paper. Statistical descriptors will be presented to support the analysis. A more accurate estimation of anthropometric measurements is vital to the design of human centered workstations and can allow to customize the workplace to different workers. Moreover, in an increasingly advanced industry, knowledge of anthropometric data will support the design of protective or auxiliary devices such as exoskeletons.
Trapezius Muscle Activity Variation during computer work performed by individuals with and without chronic neck shoulder pain

Type: Abstract Oral Presentation
Category: ICT

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Introduction: Although studies have postulated that individuals with chronic neck-shoulder pain will show less variation in muscle activity compared to healthy individuals when engaged in repetitive/monotonous work, this has seldom been verified in empirical studies of actual computer work. Studies have rarely addressed temporal patterns in muscle activation, even though there is a consensus that temporal activation patterns are important for understanding fatigue and maybe even MSD risks. This study applied exposure variation analysis (EVA) to study differences in temporal patterns of trapezius muscle activity as individuals with and without pain performed computer work. The aims of this study were to: Assess the reliability of EVA as a tool to measure variation in trapezius muscle activity patterns during computer work, measured using EVA.

Methods: Participants completed pre-selected computer tasks for 30 minutes at a comfortable but fast pace. Upper trapezius (UT) muscle activity was recorded using surface electromyography (EMG) during 2 repeated sessions for 8 healthy (H) and 1 session for 5 individuals with chronic neck/shoulder pain (CP). EVA with five intensity classes (0-6.67, 6.67-20, 20-46.67, 46.67-100, >100% RVC) and five duration classes (0-1, 1-3, 3-7, 7-15, >15 sec) was performed on the UT EMG data. EVA marginal distributions (along both amplitude and duration classes) for each EVA class, as well as summary measures (mean and SD) of the marginal sums along each axis were computed. Finally, “resultant” mean and SD across all EVA cells were computed. The reliability in EVA indices was estimated using intra-class correlation coefficients (ICC) computed from repeated measurements of healthy individuals (aim 1), and EVA indices were compared between groups (aim 2).

Results: ICCs from healthy individuals ranged from 0.60-0.89. There were no statistically significant differences in EVA amplitude marginal sums between groups. However, CP exhibited lower times of activation than H in the duration classes of 0-1 and 1-3 seconds (p=0.03 & 0.04 respectively), and higher time of activation in the final duration class of >15 seconds (p=0.03). CP also exhibited greater EVA duration mean and SD (p=0.03 & 0.02) and greater EVA resultant indices (p=0.003 and 0.02 for mean and SD respectively).
**Conclusion:** To our knowledge, this is the first study to report on the reliability of EVA applied specifically to computer work. Furthermore, EVA was used to assess differences in muscle activation patterns as individuals with and without pain engaged in computer work. Individuals with pain seemed to exhibit prolonged sustained activation of the trapezius muscle to a greater extent. Any amplitude differences between groups may have been too subtle for the current setup of the EVA amplitude classes to identify.
INTRODUCTION: Obesity rates in the geriatric population has emerged as serious health concern in recent decades. Yet, obesity-related differences in neuromuscular performance and motor control during fatiguing tasks, as well as how they are modified by gender, specifically among older adults, are still largely unexplored. As motor variability has recently been linked with fatigue development and may have the potential to reveal underlying mechanisms of neuromuscular control, the main goals of this study were to investigate the influence of gender and obesity on motor variability and performance in the elderly, by studying intermittent isometric tasks.

METHODS: Fifty-two older adults (Mean age: 73 (SD 6) years) were recruited into four groups: 9 obese males, 13 obese females, 15 non-obese males, and 15 non-obese females 15. The obese group consisted of those whose BMI was greater than 30 kg/m². Participants performed intermittent (15s contraction and 15s rest) isometric knee extensions at 30% MVC until exhaustion. Knee extension force and muscle activations of the Vastus Lateralis (knee extensor) muscle were collected. Performance was quantified using endurance time in the fatiguing task, and using force fluctuations. Motor variability was quantified using the coefficient of variation (CV) and sample entropy (SaEn) of the surface electromyography (EMG) signals.

RESULTS: Across all individuals, a significant positive correlation ($r=0.47$) between cycle-to-cycle variability of muscle activation at baseline (i.e. first 1/3rd of total task period) and endurance time was observed. Males exhibited longer endurance times than females, and achieved that by utilizing a motor strategy involving a more variable (higher CV) and less complex (lower SaEn) agonistic muscle activity. Since this was accompanied by lower fluctuations in the force signals (lower CV) and higher complexity of force (SaEn), this was interpreted to be a motor strategy involving more variable recruitment of synergistic and antagonistic motor units during the knee extension task to prolong endurance time, among males compared to females. No obesity-related changes in endurance time were found. However, obese individuals exhibited a greater cycle-to-cycle variability during the knee extension task, indicating a larger alteration in the recruitment of motor units across successive contractions, which contributed to comparable endurance time and performance with their non-obese counterparts.
DISCUSSION: This study was a basic investigation into changes in motor variability and how it was associated with the development of fatigue among older adults; and the potential influences of gender and obesity on the relationships. Given that obesity rates in the older population is rising continuously and becoming a substantial health and safety problem especially in the occupational environment, the results from this study are both timely and critical for practical design applications, especially by recognizing the importance of having a variable motor pattern in task performance, particularly among older adults.
The design value of the relationship between personal and urban data

Type: Abstract Oral Presentation

Category: No productive sector applicable

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Everyday life is characterized by the interaction with an ever-increasing flow of digital data; the exponential diffusion of even more miniaturized and inexpensive sensors and the ease of connection to the Internet produce a vast amount of data, originating what is called “datization” of reality. Data belong to really different typologies, but a great deal concerns the personal sphere where, in a more and more widespread context of Quantified Self, people voluntarily records and tracks such data, archiving events and daily facts in a meticulous way.

But when we talk about personal data, we have to consider the perception and the interaction between subject and three different but interconnected components: device, interface and data. In this context, design becomes a fundamental discipline, first of all trying to make the user active in the management of own data and helping him to understand them through information design tools. Secondly, data and information themselves become tools and materials for design, being a fundamental component of the project and not just its objective.

The research aims to focus on the impact of data on the person, trying to find if it is possible to use own and urban data to improve personal wellness. The paper offers a state of the art on projects that focus on the relation between personal and urban data, in order to define useful design guidelines.

New design perspectives are opened up; starting from the tools of information design, it is possible to make immediately visible and understandable behavioural patterns of individuals, but also of a community, thinking on different scales that can range from small buildings to large cities. Exploring data through these tools offers the opportunity to read data in a more complete and meaningful way, while at the same time helping to interpret the relationships between the individual, the places where people live and individuals around them, thus favouring the implementation of small-scale improvements or development policies of the sustainable city. This process could generate a virtuous circle of exchange between user and city, with effect between personal/collective data that enables to affect mutually and to provoke behavioural changes in both views.

In this way, data can become a tool to preserve and improve individual well-being and of the society, acting with a bottom-up approach that starts from true citizen and inhabitant needs.
The evaluation of existing large scale retailers’ furniture using DHM

Type: Abstract Oral Presentation

Category: Others

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Large-Scale Retail Trade presents a great number of tasks and furniture, related to the specific department and to the assortment of different goods. In order to safeguard the workers’ health and wellbeing, the employer must check all the elements related to the workplace and working conditions, such as environment, furniture, employees’ activities and tasks. According to International norms (ISO 11228-1, 2, 3) and National Standards (TUSL 81) and the evaluations carried out by the internal service, the employer should avoid all work-related risks as better as possible: supplying aids, redesigning furniture, or changing the processes at the basis of workers’ activities and tasks are the proposed solutions. Digital Human Models (DHM) represent effective tools to assess ergonomics of complex workplaces, such as those present in Large-Scale Retail Trade. Our research adopted the proactive ergonomics approach through DHM simulation of standard working tasks in this field, to evaluate the environment and the type of activities daily performed by workers. This activity supported the evaluation of existing furniture and the verification of the redesign of novel working environment and furniture. Moreover, DHM could be used in the work-related risks’ definition and analysis.

In this paper, we specifically present two working case studies: a) the check-out assistant and b) the restocking clerks. For each of these categories of workers, we analyzed their environment, existing furniture (cash recorder desk and shelves placed at different heights) and the supporting aids, through an ethnographic research phase. The DHM software solution (Santos, Santos Human Inc.) was applied to the ergonomic analysis. These ergonomic evaluations were performed considering 3 representative avatars: 5.th percentile female, 50.th percentile male and 95.th percentile male (Caucasian population). The avatars were anthropometrically differentiated by gender, somatotype and percentile, according to the Standard ISO 3411. Assessment was evaluated in terms of reaching maps and comparing them with the different percentiles.

Obtained results offered the opportunity to refine the given requirements to redesign the existing furniture, and a forecast of the ergonomic situation of employees.
Contributing to the early phase of design is an old challenge of Human Factors and Ergonomics (HF&E) experts. If HF&E contributions to Basic Design and Detailed Design is well defined at EDF, HF&E experts contributions to earlier phase of design like Conceptual Design or pre-conceptual design (PCD) are not frequent. Therefore, if participation of HF&E experts to the earliest phase of systems design is not new (e.g., Chapanis, 1996), up to our knowledge, there is no already described and validated HF&E method to contribute to a pre-conceptual design (PCD) phase.

The aim of the PCD phase is to prepare and address the scientific issues of the proposed new design. From an HF&E expert point of view, the scientific issues are related to the concept of operations envisioned for the new system. Thus, the first step of the HF&E approach is to define a concept of operations.

The paper presents the approach we are currently leading at EDF R&D during the PCD phase of the design of innovative small reactors in order to define its concept of operations. This approach is based on several methods we propose to articulate in order to contribute to fill the lack of described and validated HF&E method to contribute to PCD. The theoretical foundations of our approach are based on work analyses in reference work situations (Daniellou, 2004) and operational analysis (Chapanis, 1996). The analysis process is composed of three iterative steps:

- Defining options for the characteristics of the future system;
- Identifying systems with similar characteristics;
- Gaining knowledge on the impact of systems characteristics on human performance and activity of people working in these systems, and extrapolating these results to the system under design.

Alone, this process is not sufficient to allow an effective contribution of HF&E experts. Many interactions with other experts involved in the design (safety, systems architects, instrumentation and control, etc.) is mandatory. The paper will describe each step of the approach developed and the organisational conditions for the participation of HF&E experts into PCD.

A primary capability of submarines is being able to operate at great depths using sonar to generate a tactical picture. They also operate covertly at shallower depths using the periscope to undertake duties such as coastal protection, intelligence collection and scientific research (Stone, Caird-Daley, & Bessell, 2009; Bateman, 2011). A submarine control room relies on effective communication between multiple technological and human agents for optimal performance and is an excellent example of a complex, socio-technical, system (Shattuck, & Miller, 2006; Walker, Stanton, Salmon & Jenkins, 2009; Stanton, 2014; Stanton & Bessel, 2014). A challenge is understanding the complexities involved in the generation and development of a tactical picture using multiple sensors, from which command team decisions and submarine manoeuvres can be made (Dominguez, Long, Miller, & Wiggins, 2006). Technological developments have the potential to improve command team performance exemplifying, that despite evolving across a century of operations and representing a high state of maturity, submarine control rooms can be improved (Dominguez, Long, Miller, & Wiggins, 2006; Stanton, 2014). Whilst the work reported on this paper focuses on submarine control rooms exclusively, the approach and findings are applicable more widely to control rooms on land, at sea and in the air (Stanton et al, 2008). Stanton et al (2010), in particular, raise issues with commercial energy distribution control rooms, to show how shortcomings in design may be dealt with.

This study that compared three operational scenarios in a simulated submarine control room: Returning to Periscope Depth (RTPD), Inshore Operations (INSO) and Dived Tracking of Contact (DT). Social Network Analysis (SNA) method was used to model teamwork. 10 teams were recruited for the study. Results indicate that, across all scenarios, the Operations Officer (OPSO) and Sonar Controller (SOC) are particularly loaded, with communication between these operators being revealed as a potential bottleneck. The type of operation being performed affected the type of information used significantly, with a higher reliance on sonar information (and the sonar operators) during a RTPD and a higher reliance on visual information (and the periscope operator) during INSO.

Future research should also examine the design of interfaces and shared tactical displays that facilitate the merging of multiple information sources (e.g. visual vs. sonar). Whilst the various social network patterns described are likely to be a reasonable facsimile of operations at sea, validating those patterns at sea would be beneficial. Nevertheless, the study does provide greater insights in some of the nuances of command and control teams (Stanton et al, 2008). This is likely to be generalizable beyond submarines to other command and control domains (Stanton et al, 2010; Stanton et al, 2015a,b; Houghton et al, 2006).
Many road safety initiatives can be seen as a 'Big Brother' approach by controlling rider behaviour through overt/covert measures (e.g. law enforcement, road side stoppages, remote surveillance techniques). As a result, these initiatives are often 'set to fail' due to poor uptake and lack of user engagement. Therefore, new ways need to be explored with riders to enhance their road safety. In short, a user-centred approach is required, drawing on principles of participatory ergonomics.

It is possible to control user behaviour through subtle cues and affordances in the environment in the form of perceptual countermeasures (PCMs). This is a behaviour adaptation technique that the user is largely unaware of. Their effects have been demonstrated across a range of applications from health, urban design, information management, and road safety.

Research into motorcycle safety has provided positive results (e.g. slower speeds, better road positions, more space for other road users). However, by their very name (and nature) PCMs can still be regarded as a 'Big Brother' approach to road safety. This raises important questions about ethics and freedom of choice: Is it ethical to make subtle changes to someone's behaviour without their knowledge of what is causing that change? Where do such approaches sit in allowing users any free choice to follow them or not?

Pioneering research in New Zealand is looking to develop a new behaviour adaptation technique – by moving away from PCMs towards ‘PRIMEs’. For the motorcyclist, this is a perspective that promotes: Perceptual, Rider, Information, for Maximising, Expertise (and/or) Enjoyment (PRIME).

In this instance, ‘PRIMEs’ are painted road markings that provide vital road safety information in formats that give users a choice in their use based on their current needs. Moving away from the analogy of 'Big Brother', PRIMEs offer a 'Big Buddy' and more supportive approach.
This paper will present the development of the PRIMEs approach, specific road designs and the research programme for rider safety. Based on participatory ergonomics principles of including users in the design process and opportunities to influence the potential solutions, a particular focus of this presentation will be the outputs of a dedicated rider workshop that was held to determine the design factors that affect decision-making on approach to bends, to test various PRIME options, and to give riders an opportunity to introduce designs that may be beneficial to them.

Within this research a range of innovative road markings are currently undergoing road trials to evaluate how they support safer riding behaviour. Results from these trials will also be presented and discussed in references to wider interest from around the world and particularly from the EU (COST Action TU1407 Scientific and technical innovations for safer Powered Two Wheelers.
Europe is now an essentially urban society, with four out of five EU citizens living in towns and cities. Retaining the pleasure of city living, as cities become ever more congested, is a challenge for all. This is especially the case for persons with disabilities, older people, and those with reduced mobility or other types of temporary impairments. These groups risk becoming effectively excluded from significant parts of city life, becoming marginalised, excluded, and isolated from society.

European cities today have a steadily ageing population, as well as a growing number of persons with disabilities. These Europeans have difficulty getting around in the urban environment and making full use of the services and facilities which others take for granted.

Limiting a city's access to just a part of the population while ignoring a significant other part, is economically, socially and politically unsustainable. Making cities accessible is also an obligation under the UN Convention on the Rights of Persons with Disabilities (UNCRPD) that has been ratified by the EU itself as well as all but one of its Member States. For all persons to enjoy their human rights, allowing access to the conditions necessary to enjoy a full life is imperative.

Some awards can be powerful tools to promote accessibility in the built environment, such as the UIA Friendly and Inclusive Spaces Award of the International Union of Architects, the Accessible Airport Awards, and at urban scale, the Access City Award. This is an action through which the European Commission is trying to ensure equal access to a full city life for persons with disabilities and promoting accessibility by honouring good practice examples.

The Access City Award, e.g. recognises and celebrates a city's willingness, capability and efforts to ensure accessibility in order to guarantee equal access to fundamental rights and improve the quality of life of its population and ensure that everybody - regardless of age, mobility or ability - has equal access to all the resources and pleasures cities have to offer.

Local authorities play an important role in improving the living conditions of people in urban areas.

By sharing experiences and raising awareness of accessibility initiatives, the success of some cities can be an inspiration to others across Europe. The net result is greater accessibility for persons with disabilities, enabling them to go about their daily business
independently like the rest of the community. In this article, the main selection criteria and the procedures will be described and will be given some examples of good practices among the winner cities since the ACA inaugural edition.

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http://www.uia-architectes.org/en/participer/concours/10736#.WjJBj0ria70
In this paper, we describe a large-scale pedagogical workshop involving groups of students from two high schools (education and paramedical sciences agents; industrial construction & drafting technicians), an art college (interior architecture students), and a university (ergonomic psychology students), around the redevelopment of a waiting room for a mental health center. The aim is to mobilize, over the course of a school year, about sixty students from these various educational options towards the completion of a real-scale redevelopment project. Overall, ergonomics students are in charge of analyzing the needs and activities of users, paramedical students are expected to suggest inspiring design insights, interior architecture students to produce a layout project, and construction students to carry out the effective building phase of the project.

This communication builds on three major challenges typical of such an educational setting, namely (i) the management of the temporality of the various teams’ interventions in regard of their constrained calendars; (ii) the modes of communication and cooperation between students with different profiles, and (iii) the articulation between varying levels of expertise.

We focus mainly on the ergonomics students’ roles, which indeed faced major difficulties, including:

(1) **Intense mobilization during a short observation & analysis time frame**, in order to document the situation early enough, and in a way useful for the interior architects. Information required by the architects, requirements and preferences expressed by the project stakeholders as well as on-going design processes interlinked in close iterative loops to nurture the ergonomic intervention. This coupling was carried out in a very tight way, interior architects having been involved in the field observations.

(2) **A particularly sensitive and complex situation to observe**, i.e. patients with mental disorders awaiting in a room before a consultation with their therapist. In order to collect data useful for the design without interfering with these sensible situations, and in order to actively engage anonymous patients in a feedback activity, a data physicalization approach in tangible and located format was designed. Patients occupying the waiting room were invited to answer questions on panels displayed on the walls and to interact with physical devices in engaging formats. The results collected through this data physicalization approach are encouraging.
(3) The involvement of the project stakeholders, here health professionals, directly in the project. To this end, the ergonomists students on the one hand validated their recommendations with the actors concerned and, on the other hand, directly involved them in the design project via a co-creative workshop mobilizing tangible expression supports (models, inspiration mood boards etc.) built in collaboration with interior architectural students.

We conclude the presentation with conclusive elements for the on-going building project and the main lessons learned of this experience, for both students and teachers.
Co-creativity in architectural practice: Impact of occupant involvement during self-construction experiences

Type: Abstract Oral Presentation
Category: Building and Construction

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It is widely accepted that designers and users are inextricably related in regard of both the design process and output. Designers have major impacts on the quality of the built environment, i.e. on the quality of life of many people. Designed artifacts, on the other hand, are meaningless unless endorsed by end-users (in power of taking ownership or rejecting them)[1]. These end-users are nowadays recognized as “owning the factual problem” [2], i.e. being experts of their own personal experiences and issues. Research moreover points out that end-users are no longer willing to undergo the design process as external observers [3]: better informed, they expect to have their say all along the decision-making process, considering themselves as “part of the team” [4].

Acknowledging this evolution, disciplines such as product, service or software design progressively shifted from “usability” to “user-centered approaches” and eventually to “users-driven innovation” [5], while resources for participation such as “participatory design” or “co-design” emerged, either in an institutionalized [6] or horizontal way [7]. In the field of architectural design, though, research shows that most architects rarely go beyond early conversational interactions to reach out to users’ needs and expectations. Clients/architects’ relationships have been investigated for decades [8; 9], and the analysis of their interactions offers provoking results: communication gaps largely subsist [4; 10; 11], limiting users’ input to functional and structural recommendations.

On that basis, this research investigates how self-construction processes, where future occupants are largely involved all along the design process, impact actors’ interactions and assessment of the perceived quality (both in regard of the built artifact and of the shared design experience). Four case studies were chosen – two “traditional” design processes and two self-construction cases – and interviews were conducted. Results show that during traditional design processes, actors indeed mainly relied on conversational interactions, while during self-construction architects and client-users’ relationships evolved through mutual learning and co-creative experiences. The interviews moreover informed the drawing of Experience Maps for each case, illustrating evolution of actors’ (dis)satisfaction levels with time. We observed that these maps, in line with previous research [12; 13], show how each actor goes through some “honeymoon phase” (i.e. initial excitement and optimism, in line with Adler’s five-stage development model [14]) before experiencing some degree of “habitus shock”, a concept borrowed from Bourdieu’s sociological theory explaining why the users experience disorientation, frustration and stress as they are confronted with an unfamiliar (architectural) habitus. Moreover, in our cases the perceived quality of the output depended on the perceived quality of the shared experiences, underlining the ultimate importance of users/architects interaction. We discuss how self-construction processes, hypothesized as the utmost form of user’s involvement, constitute advantages and obstacles to end-users’ engagement and, thus, overall satisfaction.
Blue-collar worker sedentary exposure at work and non-work: systematic review of studies using objective measurement

Type: Abstract Oral Presentation

Category: Transport

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Background

Occupational exposure to sedentary behaviour is now being recognised as an emergent occupational hazard. There is compelling evidence that excessive total sedentary exposure is related to a number of chronic diseases and mortality, in particular if occurring for long uninterrupted periods. To date research and interventions on sedentary behaviours at work have mainly targeted white-collar desk-bound occupations. However, concerns have been raised that many blue-collar workers are also at risk, and that this may be contributing to the poor health outcomes commonly associated with blue-collar work. To understand the potential health implications for blue-collar workers a thorough understanding of their total sedentary exposure (work and non-work) is required. Therefore the aim of this study was to systematically review the available evidence from studies based on objective measurements of sedentary behaviour among blue-collar workers.

Method

In May 2017 a standardised search of Cinahl, Embase, Medline, PubMed and Scopus databases was conducted using terms related to sedentary behaviour, accelerometer/inclinometer, and work. Selection criteria included peer-reviewed journal article published in English and using objective measurement of sedentary behaviour.

Results

Database searching resulted in 878 papers being identified, with 17 studies reporting on 13 datasets meeting inclusion criteria. Work and non-work data were reported in 14 studies covering samples comprised of various industries combined as well as samples comprised of a single industry. Industries covered were agriculture, construction, cleaning, manufacturing, mining and transport/delivery. Studies of combined industries generally reported sedentary exposures at work of between 2.4 and 3.1 hours/day, with one report on drivers showing 7 hours/day. In combined industries, the average sedentary exposure out of work was 5 ½ hour/day. Similarly work exposures to prolonged sitting (bouts >30 minutes duration) were around ½ hour/day at work and 3 hours/day at non-work. Studies specifically on construction, cleaning, manufacturing and transport samples reported a similar trend for work exposure to be less than non-work exposure, except for one study on bus drivers.
Discussion

The evidence collected in this systematic review suggests occupational sedentary exposure to be substantial for many blue-collar workers, but their non-work sedentary exposure generally to be greater. Prior studies of white-collar workers have found approximately equal work and non-work exposures suggesting occupational sedentary exposure is of proportionally greater importance for these workers. However the poorer health and work longevity outcomes for blue-collar workers suggest occupational exposures are likely to still be important for blue-collar workers. Therefore designing blue-collar work to provide an appropriate balance between sedentary and activity exposure is likely to be important for sustainable health and productivity of blue-collar workers.

References

CEN/TR 16710 FEEDBACK METHOD a tool for gathering the creative contribution of end users to improve ergonomics of standards, design, construction and management of the machines.

Type: Abstract Oral Presentation
Category: BUSINESS CASE - No productive sector applicable

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The Technical Report CEN–TR 16710-1 "Feedback method - A method to understand how end-users perform their work with machines, was approved by CEN on November 2015 and published on December 14, 2015.

"The Feedback Method ....designed specifically to collect the contribution of machinery end-users by reconstructing and understanding how work is actually performed (i.e. the real work) ...can help to improve technical standards, as well as the design, manufacturing, and use of machinery.

...The method combines a high level of reproducibility, sensitivity, and user-friendliness with low demands in term of resources, which makes it attractive to micro, small and medium-sized enterprises.

...This Technical Report is addressed to standards writers, designers and manufacturers, employers-buyers, end users, craftsmen and workers, market surveillance and authorities

The "Feedback Method" with the support of the ETUI, Sind-Nova and POLO for the Promotion of Health, Safety and Ergonomics in MSMEs in the province of Siena has been successfully applied over the course of the last 20 years in 7 European countries (Italy, Germany, England, France, Belgium Sweden and Finland) in collaboration with the Public Authorities, Administration, Market Surveillance Bodies, Social Partners Organization and Technical Institutes in order to study 8 machines: woodworking machines (routers and circular-saw) forklifts, telehandlers, angular-grinders and recently, combine-harvester, agricultural tractors, and towed-grape-harvester.

2044 machines in 233 companies were examined and 363 skilled end-users participated in 36 workgroups as required by the Feedback Method in various European countries.

Using the "Feedback Method" it has been possible to gather the experiences and suggestions of the users of diverse machines in various European countries in order to improve the standards. For example, proposals to modify the specific technical norms EN-ISO 4254-7 and the general norm for agricultural machinery EN-ISO 4254-1, were made for combine-harvester.

One of the ergonomic improvements suggested to avoid the risks of accidents and incorrect posture concerned the point 5.9.6.1 of the EN-ISO 4254-7 relating to the
adoption of a centralized device which can be easily reached for the grassing of the combine-harvester.

The application of the Feedback Method to various machines has also given useful guidelines to designers and manufacturers (https://Ergomach.wordpress.com/; http://www.etui.org) as well as the market surveillance authorities, employers and employees.

The contribution, experience and the creativity from the people who are working represents an undeniable element in productive development, sustainable and respectful of the human and environmental resources. With the publication of CEN-TR 16701-1 the Feedback Method represents a valid instrument of referral for the systematic and reproducible collection of knowledge, experience and creativity.

The many tools and methods available for analysis of work activities have finally found a term of referral which will allow a comparison between information which has been collected in different ways.
Static postural stability on narrow platforms to prevent occupational stepladder falls

Type: Abstract Oral Presentation
Category: Building and Construction

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Falls from heights are the most common causes of occupational fatal accidents in Japan and many countries; using stepladders, which workers commonly use to move to elevated places in various situations, is one of the main causal agents. Occupational fall injuries from stepladders occur because of the loss of balance of the worker, equipment, or both. The postural equilibrium of static standing is explained based on the inverted pendulum model that postulates that the relative positional relationship of the center of mass (CoM) and the center of pressure (CoP) produce the body perturbation.

This study evaluates the postural stability of static standing on narrow platforms. Eleven male participants stood on five platforms that had anterior/posterior widths ranging from 6 to 25 cm and maintained their position for 50 s. Kinematic indices such as the position and velocity of CoM, body joint angles, as well as angular velocities were calculated based on data obtained by an optical motion capture system, and foot reaction forces and the coordinates of CoP in the horizontal plane were measured using a force plate. In addition, surface electromyograms of antigravity muscles and the subjective sense of instability were recorded.

The results showed that the relative position of CoP to the platform width and the translational velocity non-linearly increased with shortened platform width and more significantly changed than the relative position of CoM, while there was no significant difference between the 15-cm and 25-cm platforms. The regression lines of the relative position and the velocity of CoP were approximated as a function of the inverse of the platform width or the square, respectively. The slopes of the regression lines for the angular velocity of lower-limb joints were also steeper than that of upper-body joints. Therefore, body perturbations seemed to be primarily obtained by the rotation of ankle joints to maintain the CoM position at the center of the platform. The subjective sense of instability showed sensitivity to the perturbation for shorter platforms.

Shortened platforms make the postural balance of static standing non-linearly unstable, whereas platforms that are 15 cm or wider stabilize the postural perturbation comparable to that achieved on the ground. Therefore, the equipment with a platform or rungs at least 15 cm or wider should be recommended for tasks at elevated places. In particular, the rung of stepladders should be designed wider because the width of rung of commonly used stepladder in Japan is shorter than 10 cm.
Identifying the Effects of Visual Search by Railway Drivers on the Recognition of Extraordinary Events

Type: Abstract Oral Presentation
Category: Education and Training

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Railway companies often conduct vocational training sessions using a driving simulator. In focusing on the manner in which drivers recognise extraordinary events occurring in front of them, visual search is crucial. Therefore, the purpose of this study is to investigate effective visual search in recognising extraordinary events based on the eye movements of drivers.

We analysed simulator training data for actual drivers. Overall, 121 drivers participated in our study; the ages of these participants ranged from 23 to 59 years. The driving experience of the participants ranged from 1 to 33 years. Data related to driving and eye movements were recorded using a non-contact eye tracker incorporated into our driving simulator.

The given driving scenario was a multi-task scenario in which the main task was to stop the simulated train before a ground device malfunction. In this task, participants were required to focus on distance posts on their left to identify the exact location at which to stop. The important sub-task was to recognise an extraordinary event, which was a subsidence of railway track on their right. Participants were required to brake if they recognised this subsidence, and those who braked before passing the subsidence were identified as part of the Recognising Group; participants who did not brake until after passing the subsidence were identified as part of the Non-recognising Group. Next, we conducted logistic regression analysis. The objective variable was the participant group, while the explanatory variables were the mean and the standard deviation of the gaze duration, the mean and the standard deviation of the gaze x-coordinate, the mean and the standard deviation of the gaze y-coordinate, the driver’s age and duration of driving experience.

Logistic regression analysis revealed that recognition of the subsidence was significantly associated with the standard deviation of the gaze duration (odds ratio (OR) was 1.96), the mean of the gaze x-coordinate (OR = 1.38), the mean of the gaze y-coordinate (OR = 1.46), and driver age (OR = 0.92). With regard to gaze duration, drivers with larger standard deviations of gaze duration were usually able to recognise the subsidence. Mixing long and short gazes enables drivers to simultaneously recognise the subsidence far away and confirm the distance posts nearby. With regard to gaze position, drivers with a tendency to look to their left were usually unable to recognise the subsidence. More specifically, overlooking the subsidence could be attributed to excessively concentrating on the distance posts. Finally, as for the specific attributes of the participants, older drivers were usually unable to recognise the subsidence, the cause of which is a gradual weakening in visual performance. Further study is required as this study did not quantitatively measure visual performance metrics such as peripheral vision area.
Neck postures during smartphone uses in university students and office workers: A field study

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Introduction: Smartphones have become an essential everyday instrument of communication and entertainment in people’s lives worldwide. Recent reports show that most individuals spend about 4 hours per day using their smartphones. This inevitably increases the risk of adopting sustained flexed neck posture that may lead to neck-shoulder pain and disorders. Office workers and university students are more susceptible to such pain as they are frequent users of electronic devices.

The present study utilized inertial motion sensors to examine the real-time postures and movements in the cervical and thoracic spine of office workers and university students in their natural working/studying environment.

Methods:

Office workers (10 males, 10 females) and university students (11 males, 11 females) were recruited by convenience sampling. Their mean ages were significantly different (Workers: 40.8±8.5 years; Students: 21.5±2.6 years). Five inertial motion sensors (Noraxon myoMotionTM) were attached by double-side tapes onto the subject’s occipital protuberance, and the spinous processes of C6, T3, T12, and the sacrum, respectively. The relative changes in positions between motion sensors were recorded as the angular displacements of the cervical, upper thoracic, lower thoracic and lumbar segments, respectively.

In this field study, each participant wore the sensors for 3 hours during which they performed their usual work/study routine (e.g., using computers and smartphones). The kinematics signals were recorded using a data-logger worn on a waist belt. The postural angles of the cervical and thoracic spine, as well as the number of times that participants varied their postures (zero crossings per minute) were analyzed.

Results:

The mean duration of smartphone use in both groups was 0.9 hours during the 3-hour data collection. Self-reported neck pain score was higher in office workers (4.1±3.7 on a 0-10 numeric scale) than that in students (2.3±2.0, P=0.076).

Students adopted postures with significantly greater degrees of lumbar flexion [median (interquartile range) =34.6(26.9-51.2)](P<0.001) compared with office workers [9.9(6.0-17.1)](P<0.001). Conversely, office workers tended to adopt slightly larger neck postural angle [6.3(3.3-10.8)] than students [4.3 (2.5-10.9)] (P=0.093). Similarly, there was no
significant between-group difference in zero crossings for the different spinal segments (P values: Cx: 0.515; UTx: 0.619; LTx: 0.696).

Multivariate regression analyses showed that interaction of posture and duration of smartphone use were factors significantly contributing to musculoskeletal symptoms in students (P<0.001), while age and gender were significant risk factors for symptoms in office workers (Age: P=0.001; Gender: P<0.001).

**Conclusion:**

While neck-shoulder pain is common among office workers and university students, little is known regarding the relation between neck/lumbar postures and pain. The present field study utilized wearable sensors to bridge this knowledge gap and revealed important correlations. This approach opens a new horizon for ergonomic research.
From the 1980s, in the context of the phenomenon described by some authors as the neoliberal state reform, it's possible to put in evidence the development of a new way of conceiving and governing public institutions and services, called New Public Management (Clarke, 2008; Clarke, Gewirtz, & McLaughlin, 2000; Newman & Clarke, 2012). It expresses itself in a variety of ways depending on the country, region, sector and activity of the local agents. However, it has among its distinctive elements the idea of competition between public, private or third sector organizations regulated by state assessment agencies, as well as the idea of competition within each institution and between workers submitted to an individual and standardized performance evaluation. Through these evaluation mechanisms, the performance of subjects and organizations is objectified and transformed into an object of management by the State. By emulating principles of market functioning and promising greater efficiency in the use of public resources, this new form of government contrasts with the former, supposedly more ineffective and associated with the Welfare State, in which public companies and employees with high career stability were responsible for a direct action of the State in the provision of public services.

In this paper, we intend to raise reflections related to this new way of administering public services, in particular as regards how performance indicators are formulated and their potential to redefine the professions involved. How can processes, content of tasks, meaning to workers, and relationships within colleagues and the hierarchy at work be affected? Much of the recent organizational changes have affected workers' health and career perspectives in general. However, work in the public sector may contain some particularities, such as concern about equity and the right of universal access to services, and the potential of affecting public perception on the efficiency and credibility of governments and their leaders. As real examples, we will consider the case of judges, public university professors and public health workers in Brazil, taking advantage of existing studies in the literature and previous contact of the authors with these themes.
Sheet type floor materials are widely used for indoor and outdoor access aisles. Daily rain or contingent spread of machine oil in industry field must increase the risk of slip because of a formation of liquid film between the interface between the sheet and a shoe. In Japanese Industry Standard (JIS), we estimate the slipperiness from a coefficient of friction (COF) under a glycerol solution. In the present study, the aims are to measure the COFs of several types of floor sheets under a glycerol solution, and to clarify the effect of groove depth and width and surface coating of floor sheets on the COF. We used a cart-type friction measurement device which was developed by our research groups. This device was designed with several considerations in mind: portability, measurement on a slope, normal load and sliding velocity conditions comparable to actual those in walking scenarios, measurement of both static COF (SCOF) and dynamic COF (DCOF) simultaneously, and measurement with varying sliding velocity. We prepared eight sheets of floor which were designed with the combinations of two groove depths, two main groove widths, and surface coating (one is non-coating). The material of the sheets was polyvinyl chloride (PVC). The groove patterns were like radial lines; the shape of the grooves for all the eight sheets was homothetic. Generally, the surface coating is used for the aim to inhibit the adhesion of contamination. A resin type coating with the thickness of < 20 µm was used. The test shoe was a commercially available safety one. The floor sheets were affixed on a level floor and covered with a 90% glycerol solution (0.2 Pa-s at 20°C). The normal load was 514.5 N, including the test footwear, mechanical foot, and weights. From the results, both the SCOF and DCOF were influenced by the surface coating rather the groove depth or width; both of SCOF and DCOF of the sheets without the surface coating showed 1.1 – 1.5 times as high as those of sheets with the surface coating. In addition, both the SCOF and DCOF of the sheets without the surface coating exceeded 0.4, which was one of the criteria to experimentally reduce the risk of a fall. To discuss the effect of the surface coating, we calculated the spreading coefficient based on the surface free energies and interfacial energies. The relationship between the DCOF and the spread coefficient showed the strong negative correlation; that between the SCOF and the spread coefficient was almost the same. This indicated that the surfaces of the sheets without the coating were likely to repel the glycerol solution from the contact interface rather the coated sheets.
Individual differences in the contact pressure on the dorsal surface of the foot during gait

Type: Abstract Oral Presentation
Category: Others

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[Introduction and Objective]:
The main function of shoes is to protect our foot. However, poorly fitting shoes cause not only discomfort but may lead to other condition such as bunion and hallux valgus of the great toe. Contact pressure within shoe is one of main factors influence the gait performance and comfortability of people. Contact pressure on the dorsal foot contributes by multiple factors such as upper part of the shoes, shoelace and the anthropometric characteristics of the foot. Individual differences in foot shape affects not only the comfortability but also the contact pressure when wearing the shoes during gait. The main objective of this study was to identify the effect of individual differences such as foot shapes on the contact pressure on the dorsal surface of the foot during walking.

[Methods]:
Ten healthy young men with independent walking ability were recruited in this study. We measured physical anthropometric characteristics of the foot such as foot length, foot width, foot circumference, and foot height. Also, appropriate shoes size based on the foot measurement was prepared for the participant prior to the experiment. Subsequently, FlexiForce\textsuperscript{®} sensor was used to measure the contact pressure on the dorsal surface of the foot. FlexiForce\textsuperscript{®} sensors were attached to (1) the dorsal side of the first metatarsophalangeal joint, (2) the intermediate cuneiform, and (3) the pterion to measure the contact pressure from shoes to the dorsal foot during walking. In addition, foot switch sensors were used to identify the gait cycle as participants walked on the designated walkway. The analogue data of contact pressure was synchronized to gait cycle as identified by foot switch sensors so as to study the distribution of the contact pressure during walking phase.

[Results and Discussion]:
An increase in contact pressure was observed during the loading response phase and the pre-swing phase of the gait cycle. However, the characteristics of the increase in contact pressure differed among participants. For example, one participant showed no increased of contact pressure at the intermediate cuneiform during loading response phase or pre-swing phase. This observation could most probably influence by individual foot height. The contact pressure between the dorsal foot and shoe remains almost the same either in standing or walking among people with higher foot height. Therefore, there are no fluctuating changes of contact pressure in compared to people with lower foot height. In conclusion, the characteristic of the contact pressure between the foot and the shoe most
probably affect by difference foot shape. The influence of various shoes’ factors such as shoe upper part and shoelace should be further investigated to understand the contact pressure on the foot during walking.
Development of an education scheme for improving perioperative nurses' competence in ergonomics

Type: Abstract Oral Presentation
Category: Healthcare
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Introduction

Perioperative nurses have several high-risk tasks and musculoskeletal disorders are severe problems. Preventive measures are mostly insufficient. The *Ergonomic patient handling card*-education scheme was introduced in 2009 in Finland aimed at improving both caregivers’ and patient safety. Experiences of this multicomponent programme from the care units and home care are good; the physical workload and sickness absences due to MSDs are decreasing. The perioperative nurses’ work in Operating Room (OR) varies very much from the work in care units. A special education scheme for them was needed to be developed. The aim of the scheme was to define the competencies, skills, and knowledge levels required to perform perioperative work safely; to ensure compliance with legislative requirements; and to improve both, safety and quality in ORs.

Development of the Education scheme for perioperative nurses

A focus group from different ORs was convened to define the most stressful tasks in ORs in Finland. It produced identical results as the AORN guidance to seven high-risk patient handling tasks in ORs (Waters et al. 2010). For the teaching were considered what could be taught during e-learning and what by practical training?

Figure 1. The Finnish *Ergonomic patient handling card*-scheme consists of four parts.

The online platform comprises the theoretical fundamentals: exercises, tests and a discussion forum. Four tasks must be completed in two months, involving:

- studying the epidemiology of nurses’ back problems, different lifting and transferring techniques, the causes of musculoskeletal disorders, ergonomics of the work environment, analysis of risk factors in typical work tasks in ORs,
- exercises to improve body awareness, keeping a diary about one’s own body experiences to become more aware of one’s tactile senses,
- studying basic biomechanics, becoming acquainted with assistive devices, hoists, analysing the biomechanical principles to apply them in patient handling,
• reading the acts related to patient handling, discussing cases with fellow students in order to become familiar with occupational safety responsibilities and obligations.

*The practical training is lasting 12 hours* with emphases on safe working methods and safe usage of appropriated equipment in the risk tasks. The exam takes place after one month’s application time and a couple of hours lasting repetition course.

The content has been tested by two pilot-courses. The first-course was kept in one hospital to which nurses came from different ORs. The evaluation results were positive and resulted in minor content changes. In the second-pilot-course participants came from three hospitals from different parts of Finland which gave a good base to exchange experiences, its evaluation results will be ready in spring 2018 and can be presented at the conference.
Effectiveness evaluation of the conceptual framework for the International Classification Patient Safety (ICPS) in the Tuscany Region reporting and learning system

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Effectiveness evaluation of the conceptual framework for the International Classification Patient Safety (ICPS) in the Tuscany Region reporting and learning system

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RLS represents a cornerstone of safe health care practice. Successful RLS are built around four core principles: enhanced learning, protection of reporter from retaliation, meaningful analysis of collected data, extraction of learning and dissemination. This research focuses on the last two key elements related to the reporting systems: event analysis accuracy, learning and dissemination strategies to all health professionals concerning the learned lessons. Precisely, the aim of this research is to evaluate the effectiveness of the conceptual framework for the International Classification Patient Safety (ICPS) implemented on the reporting and learning system in Tuscany used to support adverse events analysis. The conceptual framework for the ICPS was designed to provide a much needed method of organizing patient safety data and information so to be aggregated and analysed for comparison of patient safety data across disciplines, between organizations, and across time and borders and to examine the roles of system and human factors in patient safety.

A working group, composed of clinical risk managers from the different healthcare trusts in Tuscany has been set up in order to verify the effectiveness of this framework supporting caregivers in classifying incident types, the contributing and mitigating factors related to all sentinel events occurred throughout 2015 and 2016. The experts group carried out a second-level analysis on filed alert reports by the clinical risk manager of the healthcare trust in which the event occurred, for a total of 57.

A quality evaluation tool related to event analysis has been designed using Google Forms to verify the accuracy of the description, adequacy of incident classification (verifying assigned priorities), attribution of main identified contributing and mitigating factors useful to provide information on the context for identifying future preventive organizational solutions. The questionnaire was also used to detect usefulness perception of the ICPS as a method of data aggregation, trying to identify its strengths and weaknesses and the improvement opportunities in order to make changes into the regional reporting system.

For each event, two different clinical risk managers filled the online questionnaire providing an assessment of the previously performed analysis and suggestions for integrating, modifying or eliminating items related to the individual thematic categories of the ICPS.

Statistical analysis was carried out on the distribution and frequency of the most used incident types, contributing and mitigating factors, the terms which have never been used, etc. This research highlighted some areas needing considerable improvement, including better definition of terms, more emphasis on assessing reliability of coding and great opportunities related to the classification results analysis focusing on facilitation and improvement strategies dissemination connected to learned lessons.
Effect of work boot characteristics on vibration transmitted to workers’ feet and subjective discomfort

Type: Abstract Oral Presentation
Category: Mining

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Vibration transmitted through the foot can lead to vibration white feet resulting in blanching of the toes and disruption of blood circulation. Controlled studies identifying industrial boot characteristics effective at attenuating foot-transmitted vibration exposures are lacking. The objective of this study was to evaluate vibration transmissibility to the foot, and subjective reports of discomfort, when randomly standing on four different outsole and three different insole materials. A constant velocity (30 mm/s) sine sweep from 10-200Hz vibration profile was generated and each trial lasted 51 seconds. Twenty-one participants randomly stood on the different materials fixed on the vibrating surface. Vibration transmissibility from the vibration platform to 10 locations on the foot was measured with a laser. After each test, participants were asked to report subjective discomfort on a scale of 1 to 10.

Overall the tested materials provided better vibration attenuation at the heel than at the toe region. In the baseline condition (barefoot) at the heel the average platform-to-heel transmissibility was 1 for vibration exposure frequencies between 10-20 Hz and 0.3 for exposures between 150-200Hz. When standing on the outsole and insole materials tested platform-to-heel transmissibility was reduced the greatest between 20-50Hz when standing on the air insole. However, the lowest reports of discomfort were associated with standing on the softest insole. Vibration transmissibility measured at the toe region of the foot was consistently above 1 indicating none of the tested materials were effective at attenuating vibration transmission to the toes.

The correlation between the vibration transmissibility from 10-200 Hz and the reported discomfort was poor. The discomfort has a good correlation with the transmissibility at the heel from 10-20 Hz and is uncorrelated with the vibration transmissibility at the toes, regardless of the vibration exposure frequency. Although clinical reports of vibration-induced white-foot are associated with distributed circulation to the toes, participants in this study appeared to base discomfort reports on how they felt vibration traveling through their whole-body and not discomfort at the toes. Previous research found workers exposed to higher magnitudes of vibration are at an increased risk of developing vibration-induced white foot; however, higher reports of discomfort were not reported for trials associated with higher vibration transmissibility. Therefore, improved exposure measures are required to document exposure characteristics as relying on subjective reports of discomfort is not sufficient to determine if a worker is exposed to vibration levels associated with elevated injury risks. To address the gap in monitoring vibration characteristics, our team is
developing a "smart shoe" sensor to evaluate the vibration transmitted under real world working conditions. Future research will attempt to identify exposure characteristics associated with increased injury risk and work boots (with improved outsole and insoles) associated with lower vibration transmissibility.
The occupational risk factors associated with work-related musculoskeletal disorders of the upper limbs can be evaluated using the Occupational Repetitive Action, (OCRA) index. The OCRA index is based on the number of actions performed by the workers in repetitive tasks, on the force required for the load handling and on the posture of the worker. The OCRA index is determined by assessing upper limb characteristic angles, evaluated by trained personnel from direct observation and from video recordings. Previously, the limitations of the camera-based systems (large number of cameras and occlusions) and inertial motion sensor (electromagnetic interferences) limited reliable posture measures in industrial environment. Recent advances in motion tracking enabled the research team to monitor in real-time working posture using two low-cost measurement systems (Microsoft Kinect V2; Notch Motion Capture). The upper limb posture was measured and the OCRA index was calculated in a tailoring workplace. The primary limitation of the Kinect is that the subject must always be visible from the camera; however, it does not require the worker to wear sensors as is the case with the Notch.

Tests were performed at Canali SPA monitoring 9 female workers performing 7 different operations (three types of steam press-ironing and four types of machine sewing). Each operation was monitored for at least 15 minutes and then divided into 5-minute sessions for analysis. Shoulder, elbow, and wrist postures were measured with the two systems. The reliability of measurements was assessed by determining the cumulative probability density function in order to assess the 10th and the 90th percentiles of the distribution.

Results demonstrated excellent performance in measuring the shoulder adduction/abduction and flexion/extension, the elbow flexion and the wrist flexion/extension. The measurement of the wrist ulnar/lateral deviation was problematic in sewing operation, where the Kinect measurements were unreliable owing to the occlusion given by the fabric and the sewing machine, and the Notch measurements were affected by the magnetic interference generated by the sewing machine frame and motor.

Data measured by the notch and the Kinect were averaged where the difference between the measures of the two systems was comparable with the measurement repeatability. Results were compatible with the subjective evaluations performed by trained ergonomists; also the number of repetitive movements, automatically computed with purposely designed cross-correlation algorithms, was in agreement with the evaluation of the subjective observation. The main advantages of the proposed method are the repeatability and the possibility of performing automatic workload evaluations.
Driving a submarine requires supervising a complex system, in what can be very short timeframes. Submariners must remain aware of the evolution of all parameters in relation to their safety and operational objectives. Such process is called Situation Awareness (SA) and can be described in three interdependent levels (Endsley, 1995, 2015): 1) perception of information; 2) comprehension of the situation; 3) projection of how the situation will evolve. In order to train submarine operators to develop their SA skills, it is first necessary to be able to evaluate the processes involved in SA elaboration.

Most methods used to evaluate SA only assess the quality of SA. To evaluate SA processes during the task under analysis, a method consists of analysing process indices such as eye-tracking data and verbal protocol (Salmon et al., 2009). Eye-tracking data make it possible to identify how the operator allocates his visual attention and is directly related to SA quality (Moore & Gugerty, 2010). Verbal exchanges allow to gain insight about reasoning processes and can highlight team SA processes (Lee et al, 2012). One of the main criticisms of this method is that the measure is indirect and therefore not always reliable. This is typical of the looked-but-failed-to-see phenomenon (Salmon et al., 2009). In verbal exchanges, it can be the divergence between what is said and what is thought.

In this paper, we propose a new method to evaluate the processes involved in the development of SA. It combines auto-confrontation interviews with eye-tracking videos. Auto-confrontation interviews consist in asking operators to watch recorded videos of their actions in order to guide their explanations of the reasoning underlying the observed behaviours (Mollo & Falzon, 2004). The purpose of the eye-tracking videos is to show operators their visual scan path. This method has been used with the aim of improving performance in various fields of activity (O’Meara et al., 2015; Omodei et al., 1998).

Based on interviews with submariners, we illustrate the advantages of this method for evaluating SA development processes:

- Assessment of level 1 of SA through the identification of visual attention allocation;
- Assessment of levels 2 and 3 through the explanation of the reasoning underlying the observed behaviours;
- A rich dataset thanks to the use of videos that helps to overcome memory deficits and which, moreover, makes it possible to recall automated and little conscious processes;
- Improved data reliability due to the supplementary explanations provided by the operator, who can explain what he/she looks at or does not look at, and what he/she thinks in relation to what he/she says;
- Access to emotional experience.

The stages of implementation of this method are described, as well as its limits.
Considering the digital advancement nowadays, technology comes closer to the population and generates concerns regarding user experience and interaction with machines. In relation to users with cognitive or motor disability, that is even more complex. In Brazil, nearly a quarter of the population declares to have a sort of disability, which makes it difficult to benefit from the full potential of technological access. Inclusive Design's role is to enable the adaptation of products, services and environments to all, regardless of their personal characteristics, age or abilities, and, consequently, to contribute to the non-discrimination and social inclusion of all people. Among the deficiencies, Cerebral palsy is the most common cause of physical disability in childhood and, overall, its rate is between 2 and 3 per 1000 live births around the world. Therefore, it is relevant to develop research regarding accessibility and technology for these people, objectifying the digital inclusion and stimulation of autonomy. Cerebral palsy lesions that mainly affect motor functions are consistent, non progressive and can be classified in scales, such as the MACS and the GMFCS. The following research aimed to identify assistive technologies that allow or facilitate computational access to people with cerebral palsy and to raise evaluation methods for these technological supports. This article intends to contribute with the improvement of studies concerning Inclusive Design focused on the audience with cerebral palsy and, indirectly, to other motor dysfunctions. Through a systematic bibliographic reviews from databases such as ProQuest, Scopus and Web of Science, classifications regarding the types of computational assistive technologies were found, as well as the relation of methods used in these articles. The methods presented here may facilitate the evaluation of existing assistive technologies and contribute with the validation of future prototypes with this purpose. As results, it was possible to observe the predominance of participative methods, in which people with deficiency test and execute tasks for the evaluation. This type of approach aims to increase acceptance, improve performance and facilitate the universal technological access. Methods such as interviews, questionnaires and focus groups were frequent, reinforcing the importance of non-invasive methodologies for people with motor dysfunctions which focuses in users satisfaction. The application of metrics was also common and valid, especially in tests related with usability, such as tasks observation and users reports. It was also noted that, though several studies have argued for the importance of considering the specificities of people with cerebral palsy, since there is great variability between cases, few characterize in detail the condition and motor dysfunction of users in the experiments. It is necessary to encourage the use of scales in experimental reports, aiming for a greater understanding of the needs and differences among individuals with cerebral palsy.
Background and Purpose

As one of driving support in automobiles, the cameras and monitors attached to automobiles have become to enable drivers to have different visions besides their own vision. While drivers currently maneuver automobiles mostly with their own vision (subjective view point), there is a possibility of having objective views of the automobile taken from behind (objective view point) in addition to the original vision of their own in the future.

Previous studies suggest that the difference between the subjective and objective viewpoints have influences on the drivers’ spatial cognition of the automobiles with its surrounding objects including traffic lanes, oncoming traffic, and pedestrians. It is, however, not revealed yet what impacts the difference of the viewpoints has on human cognitive processes of recognizing space and the quality of driving itself.

Thus, this study was designed to experimentally assess the role of the drivers’ sight from the subjective viewpoint and objective viewpoint on cognitive process of driving and level of the performance of driving. The goal is to enable the interactive system between drivers and automobiles to provide safer and smoother driving experience by suggesting the most suitable ways of drivers’ sight.

Experiment methods

Experiment participants, sitting in front of a huge screen which covers their sights entirely, were assigned to drive a car in a simulation game (Figure1).
For tasks, they were asked to drive through mazes (figure 2) aiming to reach its goals quickly at the same time as avoiding collisions with walls and obstacles. Also, I particularly required them to avoid to hit the obstacles moving on intersections which are simulated as children and bicycles.

For this task, I set two different conditions of viewpoint [subjective viewpoint, objective viewpoint] and five additional conditions [subjective viewpoint with transparent wall, object viewpoint with transparent wall, conditions of the other position (front viewpoint), two conditions for control conditions (human-sized slim car, man)] (figure3).
I recorded task logs, physiological measures and questionnaires.

**Results and Conclusion**

As a result of the experiment, the following became clear.

(1) The subjective viewpoint seems to be a viewpoint in which behavior that drives carefully increases from the result of comparing the rate of collision with dynamic obstacles.
(2) The objective viewpoint is considered to be a viewpoint that can smoothly control the own vehicle other than the front, based on the result of comparing the frequency of collision with the wall.

Therefore, it is considered effective to present an objective viewpoint when traveling in narrow alleys and crowded places. Also, in a road where drivers like monotonous roads tend to be distracted, it is considered that a method of presenting visibility that aims attention to driving with a subjective viewpoint is effective.
Railway occurrences in South Africa remain high, despite occurrence investigations conducted by the various organisations. A failure to thoroughly identify the underlying causes for incidents may be a possible reason for the number of recurrences. The primary aim of an investigation is to uncover the events at all levels of the system and to identify remedial actions to prevent a recurrence. If occurrences are being investigated, why then do the number of occurrences remain largely unchanged? A systems analysis of the South African railway industry illustrates the inherent or systemic factors within the railway system that influences the effectiveness of occurrence investigations. Systemic factors refer to challenges, pressures, frustrations or obstacles that contribute to the complexity of railway accident investigations. Rasmussen’s (1997) Risk Management Framework was operationalised for the South African railway system. A qualitative multi-method approach was adopted in this research. Methods included a print media analysis of 133 reported railway accidents, governance document analyses, 23 semi-structured interviews with railway investigators, 4 observations during actual inquiries and analyses of railway occurrence reports. The data were compared and verified against each other using triangulation. The advantages of adopting qualitative research using a multi-method design provided the researcher with an in-depth understanding of the railway system and the intricacies within a “system of systems”. An Accimap was used to graphically illustrate the complexity of railway accident investigations across the entire system. This systems analysis tool highlights that the system of accident investigations is indeed a complex system in its own right, and not just the rail accidents themselves. Decisions makers and events from all levels of the larger rail socio-technical system, of which the system of accident investigations is nested within, contributes to its complexity. System principles such as integration, feedback, demands, resources, constraints and flow of information influence the effective functioning of the entire system. The rail system in South Africa can be described as a disjointed “system of systems” contributing to the complexity of the investigation system. Deficiencies and complexities in the system of accident investigations limits the effectiveness of the entire investigation process from achieving its objectives - that is to learn from such events - offering an explanation for why railway safety trends remain unchanged in South Africa.
Communicating climate change data: what is the right format to change people’s behaviour?

Type: Abstract Oral Presentation
Category: Others

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According to Sterman (2011), the inaction of people towards climate change can be partly attributed to cognitive limitations and difficulties in understanding data and complex predictive scenarios. Harold et al. (2016) provided four areas of research that would be useful in assisting climate change communicators in designing communication strategies: how to direct visual attention, effectively utilising visual complexity, making inferences from visual information, and relationships between visual and language information. These are all aspects where ergonomics has already developed a considerable body of knowledge. This study explores the best way to present climate change information so that people understand both the severity of the climate problem and feel they have personal agency to ameliorate the problems. Three different climate data formats were compared (i.e. dynamic visualisations, pictures, and graphs/tables), each representing temperature variations in the Southern African region from 2000 to 2100. The cognitive qualities of these three formats to enhance/obscure climate data communication will be discussed in the full paper. Data were collected using an online survey platform. Participants completed the Pro-Environmental Behaviour scale to assess behaviour prior to being presented with the different formats. Participants were then randomly assigned to one of the three formats where they watched a 1 minute 45 second video presentation of the assigned format. This was followed by three self-developed outcome measures (i.e. a climate affect scale, a climate change comprehension scale, and a motivation to change behaviour scale). In total we received 364 responses after removing incomplete responses and participants with colour blindness. N=134 dynamic visualisation, N=107 graphs/tables, and N=123 pictures. Prior to the video presentation there were no statistically significant differences between the three groups on past pro-environmental behaviours (F=0.42; p=0.66). After the presentation of the video there were statistically significant differences in affect (F=205.53; p=0.00) and comprehension (F=37.50; p=0.00) of climate change. The dynamic visualisation group were significantly more anxious and concerned about climate change than the other two groups. The three groups were each statistical different from one another on the comprehension scale with the picture group having the highest comprehension level, followed by the dynamic visualisation group, and the graphs/tables group. The groups were not statistically different on the motivation to change behaviour scale (F=1.22; p=0.30), suggesting that while they understood the dangers of climate change they did not feel that this knowledge gave them agency for behaviour change. These results suggest that the dynamic visualisation and picture format provided an effective means of raising awareness of the dangers of climate change but other mechanisms are required to get people to change their behaviours. It was noted that this sample consisted mostly of highly educated individuals. These results may be different in a less educated sample.
Can computationally predicted internal loads be used to assess sitting discomfort?

Type: Abstract Oral Presentation
Category: Manufacturing

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More evidence is needed to establish whether internal body loads such as muscle forces and joint forces could be used as objective factors to assess sitting discomfort (Looze et al., 2003). Internal load measurements can be obtained only invasively and thus only a limited number of studies exist in the literature (Andersson et al., 1974; Wilke et al., 1999; Zenk et al., 2012). Therefore, computational modeling is employed to provide estimations of internal loads. Rasmussen et al. (2009) and Grujicic et al. (2010) employed a full body musculoskeletal model to assess sitting discomfort based on internal load computations, however their studies did not include experimental data and they assumed that the human body follows the seat configuration which might not be always true.

The present study aims to investigate whether muscle forces and joint reaction forces can be used to assess sitting discomfort. Experimental measurements where obtained using a recently developed multi-adjustable seat (Beurier et al., 2017). Volunteers were recruited to provide discomfort ratings on different sitting configurations resulted in by altering the seat pan angle, the back rest angle and by providing or not head support. Fourteen Vicon cameras recorded marker trajectories placed on volunteers’ anatomical landmarks, following a full body marker protocol, while force sensors recorded reaction forces between the experimental seat and volunteers’ feet, thighs, pelvis, arms, head, lower and middle back in the seat symmetric plane.

A full body musculoskeletal model was developed in AnyBody Modeling System™ v.6.1. (AnyBody Technology A/S, Aalborg, Denmark) and it was scaled to match each volunteer’s subject specific measurements, collected during a sitting reference trial. Inverse kinematics analysis was performed for each trial, using the recorded kinematic data as input to the subject specific musculoskeletal model. The computed, by the inverse kinematics, joint angles and the recorded force data served as inputs to inverse dynamics analysis that allowed the computation of joint reaction forces and muscle forces for each trial. We tested the existence of correlation between the computed internal loads and the subjective ratings provided by the volunteers for each trial to evaluate whether they can be employed as objective factors to assess sitting discomfort.

Our preliminary results revealed significant (p<0.05), but weak correlations between the subjective ratings and the predicted compressive force of L4/L5 ($R^2 = 0.4$) and the maximum force of the back spinal muscles ($R^2 = 0.4$). Since the obtained experimental measurements were limited to airplane seat configurations, only small variations of the sitting parameters were tested. In the future, experimental protocols should include larger variations of sitting parameters to ensure more discrete differences among the sitting configurations, which could possibly result in more reproducible subjective ratings and greater differences for the computed internal loads.
ERGONOMIC EVALUATION OF BION-M, FOTON-M AND RESURS-P SPACE SYSTEMS

Type: Abstract Oral Presentation
Category: Aerospace

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In execution phase of development, manufacturing and operation of space-rocket hardware and with the purpose to improve the quality and reliability of products the technical assessments are required including ergonomic evaluation (EE).

Ergonomic evaluation of BION-M, FOTON-M and RESURS-P space systems (SS) developed by SRC Progress had been performed at flight test stage in two steps:

1. Primary acquisition and execution of experimental work at Baikonur cosmodrome and flight-control center during preparations for launch and SC control.
2. Analysis, synthesis of data obtained at first step, as well as engineering report of work executed.

The main goal was the evaluation of actual ergonomic characteristics of redesigned and rebuilt SS hardware and conformance evaluation to requirements of technical enquiry and reference documents, as well as development and implementation of essential arrangements to carry-out the ergonomic requirements in order to provide high quality and efficiency of products, to retain operator's working capacity and health.

The following tasks were solving during evaluation of:
- task sharing between operators and technical facilities of SS;
- operator's activity algorithm using the hardware of engineering systems;
- human-machine interface;
- operator's activity information models;
- structure and arrangement of operators' working places, rationality of equipment layout;
- physical environmental factors in compartments and at operators' working places;
- conformity evaluation of technological and aesthetic characteristics for compartments and operators' working places to recommended values;
- conformity degree evaluation of operating documentation to ergonomic requirements.

Evaluation of SS ergonomic characteristics had been executed for redesigned and updated SC facilities:
- spacecraft and payload unit processing complex;
- spacecraft checkout equipment comprising spacecraft and payload unit processing complex, payload unit processing hardware;
- control-measuring and test and checkout equipment of onboard systems;
- working places of the staff participating in making-ready of SC at spacecraft and payload unit processing complex, space mission vehicle processing complex, fuel-and-neutralization station, launcher;
- maintenance documentation.

Upon completion of evaluation the following results had been obtained:

1. The main arrangements for SS ergonomic management had been made:
   - it had been developed ergonomic requirements in technical enquiry for SS components, ergonomic management programme and program-methodical documentation on EE;
   - EE of SS had been carried out at the flight test stage.

2. Ergonomical characteristics of SS mainly correspond to ergonomic and technical aesthetics requirements established in top level specifications for SS, regulatory guide and management directives.

3. When evaluating the ergonomical characteristics of SS it had been revealed ergonomic shortcomings and conceived the proposals to remedy them.

All revealed shortcomings had been corrected promptly, in full and within the recommended time limit.

Thus, implementation of proposals obtained as a result of EE had allowed to improve ergonomic characteristics and labour effectiveness of operators.
Is sepsis an adverse event? A proposal for an “adds-on” to Learning and Reporting Systems in healthcare

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The international classification for patient safety (ICPS) a WHO project, aims at the standardization of labels used to classify the near misses and adverse events inserted into learning and reporting system in healthcare worldwide. This in order to elicit relevant knowledge and allow for comparison and cross-fertilization of best practices.

According to AHRQ and adverse event is an “unintended physical injury resulting from or contributed to by medical care (including the absence of indicated medical treatment), that requires additional monitoring, treatment, or hospitalization, or that results in death.” Adverse events may be preventable or non-preventable; adverse events generated by errors are always preventable.

Sepsis is a medical emergency accounting for 21 million of death worldwide. It is the most common path to death following an infection. Not all the infections are deadly, of course. However, if an infection goes bad sepsis is likely to cause patient dead. Moreover, sepsis has become ubiquitous: it is not anymore limited to intensive care. Any healthcare professional also working in community medicine or in gynecology is more likely to encounter sepsis today than 10 years ago.

Unfortunately, sepsis has spread faster than the knowledge and organizational capacity needed to tackle it. Sepsis is a deadly syndrome not an adverse event nevertheless, in the current transition to safer sepsis care, death and suffering may arise in consequences of late diagnosis or inappropriate antimicrobial therapy due to lack of knowledge, skills, situational awareness and poor coordination of health care services. Healthcare system are improving, nevertheless administrative data on mortality are observing the phenomenon using a reference framework tailored to health
care organization that may need to change in order to face sepsis. In this regard, the human factor perspective may provide further contribution to the quality and safety perspective by placing the spotlight on the processes underpinning safe sepsis care.

In order to offer healthcare system additional support for becoming more resilient in this transition phase we propose to use Learning and Reporting System for acquiring more precise figure of avoidable sepsis; that is the ones originated by errors. What are the most common pattern of failure regarding sepsis care in single healthcare organization? Is it the collection of samples or the antimicrobial stewardship? We propose an adds-on to the learning and reporting system interfaces currently based on ICPS taxonomy. The sepsis adds-on we propose is a blend of already existing categories and new ones clustered into a “sepsis pathway view” in order to enhance the ability of patient safety professionals to link a specific set of incident type such as: late diagnosis or handover issue, to the main sepsis pathway. The sepsis adds-on would offer to patient safety leaders a reference framework for the estimation of organizational liabilities regarding sepsis and for leading improvement efforts.
Diagnosis of Sepsis Made Easy – Fast and Frugal heuristics for activating sepsis stewardship

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Sepsis can be the final common pathway to death from multiple organ failure in infection (Kissoon et al. 2016). It may occur in every healthcare setting: obstetrics and gynecology, internal medicine, surgical department, community medicine and emergency department, not only in intensive care units. The community of intensivists generated and prompted the evolution of knowledge for the diagnosis and treatment of sepsis which very often need access to intensive services. The extent to which such knowledge is transferred, contextualized and integrated into healthcare settings is one of the key success factor for reducing sepsis mortality. Quality Improvement program have proven to be effective in reducing the burden of sepsis mortality. Nevertheless, the success of such programs depends on how different health care services are able to activate early identification, prompt treatment and to seamlessly coordinate with each other.
In this regard human factors and ergonomics play an important role for contextualizing in non-intensive care settings the tools and methods devised by ICU professionals.

Sepsis is now defined as “life threatening organ dysfunction caused by a dysregulated host response to infection” (Singer et al. 2016). The clinical diagnosis of organ dysfunction is made using the Sequential (Sepsis-related) Organ Failure Assessment Score (SOFA). The clinical diagnosis of infection in this regard acquires relevance and needs to be reconsidered within a more complex clinical context where time may become critical. Such scenario demands for the enhancement of clinical competences in the diagnosis of organ dysfunction. Most of healthcare professionals are not confident in the use of SOFA but are more likely to encounter sepsis than ten years ago. Not every clinician is supposed to become an intensivist but every clinician is required to diagnose sepsis. We would like to offer to the healthcare professionals encountering sepsis in intermediate and normal level of care realistic tools for escorting the patients onto a safe and sound clinical path using “fast and frugal heuristics” (Gigerenzer and Selten 2001). In non-intensive setting the information, which can be used to diagnose sepsis, is often rare and scattered or redundant. Fast and frugal heuristics have been proven highly efficient in predicting situation using fewer cues than other computational model without losing accuracy. This strategy may reduce sensitivity compared to classic SOFA nevertheless, it may offer a practical tool to make early identification in all healthcare setting. The SOFA score is a 6x5 matrix composed of 6 physiological parameters and 5 levels of gravity. We propose to adopt a “Take The Best” Heuristics and consider only “slice 1 of the SOFA matrix and to simplify the assessment of the neurological and respiratory status using AVPU and SpO2% value. As a test bed scenario of the SOFA slice 1 heuristics we offer here the strategies introduced by Lombardia Region and then adopted by Tuscany region in the obstetrics area.
Safe Transitions of Care: a participatory human factors approach for improving safety in the communication of healthcare organizations

Type: Abstract Oral Presentation
Category: Healthcare

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Safe Transitions of Care: a participatory human factors approach for improving safety in the communication of healthcare organizations

Care Transitions are critical moments which may expose patients to adverse events and generate organizational failures. Ineffective care transition processes lead to higher hospital readmission rates and costs (1,2,4,6). Despite the attention given to the handoff moments - the “here and now” of communication among healthcare workers - the overarching workflows, which encompasses the singles handoffs moments and the interactions with other processes, needs to be carefully assessed in order to amplify the benefits of the standardized communication of relevant cues for patient care.

In particular, patient transitions among different settings, such as the step down from critical care to medical care or the transfer from emergency department to the medical wards, constitute critical touchpoints whose safety and effectiveness relies both on well-structured handover and on the way in which the wider workflows unfolds. We argue that the latent factors crystallized into the history of the organization needs to be elicited and considered in order to maximize the introduction of handover patient safety practice given the profound link between communication and the context in which communication occurs. This oral communication intends to present a toolbox of methods relevant to human factors approach for dwelling with the analysis of the organizational workflows in which handover communications is nested.
We involved health care workers of 10 dyads of inpatient care units (250 operators accounting for 1500 care transitions). The aim was to endow the participants with the skills necessary for evaluating the organizational context in which the handovers occur and give them support in prompting the interventions for constructing an organizational context underpinning safer communications at care transitions.

Communication at care transitions is a fundamental testbed for the resilience of complex healthcare organizations (6,7). We attempt to increase the safety of communication during care transitions in order to allow healthcare organization to sustain operations, in the presence of continuous stress. To achieve that, we endowed the healthcare workers with the methodological tools for analyzing the current situations and embrace the handover patient safety practice.

The absence of designed communication strategies at care transitions may lead to an increase in the duration of patients stays, claims, and costs. Standardized ways for constructing patient handover has revealed effective in reducing the numbers of errors and potential adverse event (3, 4). Moreover communication research has demonstrated the profound symbiotic relationship between communication and the social context in which communications occurs (5). Introducing from above constraints on communication performance disregarding the wider organizational context may lead to scarce implementation results. We focused on the way in which the handover practices are integrated and supported by the pre-existing workflows in order to enhance the capacity of the organization to retain organizational changes and improve communication safety.

The associations between mobile touch screen device use and musculoskeletal and visual symptoms: A cross-sectional study of adolescents

Type: Abstract Oral Presentation
Category: Education and Training

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Background:
The use of technology among adolescents, especially mobile touch screen devices (MTSDs), i.e. smartphones and tablet computers, has grown rapidly in the recent years. Concerns about the potential negative impact of MTSD use on musculoskeletal and visual health in adolescents have been raised. However, very little research on MTSD use and its association with such health outcomes has been reported, particularly on adolescents. Therefore, this study examined the amount of MTSD exposure in adolescents, as well as the associations of MTSD use with musculoskeletal and visual symptoms.

Methods:
Adolescents were recruited from primary, secondary and post-secondary schools in Singapore. The schools were randomly selected from a stratified sampling matrix so as to obtain a representative sample based on sociodemographic and academic streaming factors. Adolescents from four school levels were invited: primary year 5, secondary year 1 and 3, and post-secondary year 1. The online Technology Use Questionnaire (TechU-Q) was administered during class time and included questions on the weekday/weekend duration, frequency and use of multiple technology devices including MTSDs. Musculoskeletal and visual symptoms and mental health taken from other validated questionnaires were also included. Associations between MTSD use, and musculoskeletal and visual symptoms were examined using logistic regression analysis adjusted for gender, school level and mental health.

Results:
A total of 1884 adolescents (949 females(50.4%); age 13.3±2.0 years) from 13 schools agreed to participate. Overall response rate was 74.1%. Smartphone was the most common device used (95%) in the last 12 months, while 71% used a tablet. Daily
smartphone usage was high, with a mean of 263.5±243.4 minutes (4.4 hours), while daily use of a tablet was relatively lower at 52.5±123.4 minutes. Neck/shoulder was the most commonly reported area of discomfort in the last month (42.4%), followed by arms, upper back, wrist/hand and low back. The mean number of visual symptoms reported was 2.2±2.0 (out of a possible 9).

Higher daily hours of smartphone usage was significantly associated with neck/shoulder, upper back, arms and wrist/hand discomfort in the last month (OR=1.04(95%CI 1.01-1.07), 1.06(95%CI 1.03-1.09), 1.03(95%CI 1.00-1.06), 1.04(95%CI 1.01-1.07) respectively, p<.05), after adjusting for gender, school levels and mental health. Higher smartphone usage was also significantly associated with a greater number of visual symptoms (OR=1.05(95%CI 1.02-1.07),p<.001). Tablet usage was not significantly associated with musculoskeletal or visual symptoms.

Conclusion:

MTSD use was highly prevalent among adolescents. Higher smartphone use, but not tablet use, was significantly associated with musculoskeletal and visual symptoms. Our results suggest that high use of MTSDs may pose risks for musculoskeletal discomfort and poorer visual health in adolescents, and further research is warranted. There is a need to develop guidelines for wise use of MTSDs to prevent or reduce possible negative impact of MTSD use on adolescents' health.
Age-appropriate design of an input form component for the Historytelling System

Type: Abstract Oral Presentation
Category: Others

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Background

There is an increasing number of publications on designing for older users. Many of them focus on the negative consequences of aging (deficit orientation) (Coelho, Rito, Luz, & Duarte, 2015; Norval, Arnott, & Hanson, 2014). In contrast, we develop the Historytelling system focusing on the question “Where can older adults contribute to family life and to the community in general?”. The Historytelling System is an interactive website where users can contribute life stories and share them with family, friends and the wider public. The development of this complex system follows a component based approach and one important component is an input form that shall be described here in detail.

Methods

Following the human centered design approach, in a first step interviews were conducted with the potential target group to pinpoint the context of use, requirements and first design implications for the input form. These were used in combination with common design guidelines to develop a low-fidelity prototype, which was tested with six usability experts following a cognitive walkthrough approach. Usability problems in effectiveness and efficiency were qualitatively assessed and led to a clickable high-fidelity prototype. Eleven older adults between the age of 61 and 77 years (M = 69, SD = 4.6) with a positive affinity towards ICT (Sengpiel & Jochems, 2015) participated in a summative evaluation conducted in a workshop.

Results

In the summative evaluation, older adults acknowledged the prototype positively. Especially the usage of text on every control element and the consistency and scale of the interface was judged very positively. On the other hand, some elements had major negative implications for the usability of the input form:

- Explanatory elements hidden behind tooltips appearing at a mouse over resulted in ineffective and inefficient task completion (Chadwick-Dias, Tedesco, & Tullis, 2004).
- Drag and drop gestures were difficult to execute, since the participants were not aware of this interaction gesture and some of them had problems with fine motor skills (Fisk, Rogers, Charness, Czaja, & Sharit, 2009; Schorb, Hartung, & Reißmann, 2009)
- Three participants had difficulties differentiating between similar functions, such as increasing the size of the interface and the size of the text in the textbox (Fisk et al., 2009).

Further Research
In a next step, the developed input form will be compared with input forms already used in other social network sites to gain knowledge about the unique selling proposition of this component and the Historytelling System as whole. Thus, prototypes independent of the former system will be created to eliminate biases towards certain social networks, for example negative opinions that may cause unwanted influences.

**Literature**


Abstract

The present project seeks to design a sustainable energy generation system taking advantage of the piezoelectric effect that mitigates the environmental impact and the costs of current energy sources from the university in Colombia. This idea arises from the opportunity to use human movement as a source of energy due to the great flow of people on campus. The method was based in the anthropometrical and biomechanical characterization of the population in order to quantify the potential energy that could be obtained through the movement of people when they activate the piezoelectric product located and distributed in the place that will be identified as the area with the greatest possibility of energy generation. All of this making use of tools of industrial engineering like methods, Plant layout, schedule, in others. The tiles used in the design are composed of 80% recyclable materials, which indicates that it is a product friendly to the environment.

The environmental analysis was made based on the CO₂ emission factor per kWh-generated of the Colombian interconnected electricity system, which is 0.199 kg of CO₂ per kWh produced. the procedure for the selection of the piezoelectric system configuration was designed using the methodology of the hierarchical process analysis – AHP. If the piezoelectric tiles are installed as indicated by the final configuration in the main traffic path obtained in the analysis of this project, a saving of 84.478 kg of CO₂ could be achieved in the case of producing the minimum energy which is 424.517 kWh and a saving of 169.133 kg of CO₂ in the case of producing the maximum energy corresponding to 849.913 kWh. With the decrease in CO₂ emissions that result from the implementation of the tiles, the high environmental impact of the project is concluded because it contributes to the reduction of the emission of greenhouse gases caused by the energy consumption of the participating institution.
The richness of a region and its urban framework depend on the potential of innovation of own spaces, intrinsic ability of building up network and optimizing resources properly.

To date such model of innovation, apart to produce social, cultural and economic growth, it is strictly correlated to the opportunity of generating social inclusion. It is therefore needed, for the development of urban environments that are inclusive and well-designed on human scale, a reconstruction of the principle of accessibility itself, which, moving from a connotation exclusively physical toward one more social, it tends to assume broader meanings.

The idea of accessibility is transforming and has to be intended as the set of all factors able to generate well-being, promote independent mobility, guarantee safety and support socialization and collaboration among people.

Under this new vision of accessibility, the approach of inclusive design may be conceived a valid and reliable operating tool, as it is based on the assessment of actual and potential needs of people, thus allowing to address designing issues that are needed for developing inclusive urban environments.

Every design decision has the potential to include or exclude customers. Inclusive design emphasizes the contribution that understanding user diversity makes possible to inform these decisions, and thus to including as many people as possible.

In the present work, preliminary results achieved during a research project carried out at the Laboratory of Ergonomics for Design of Florence University are presented. The project is aimed at defining guidelines to promote the points listed hereafter:

- To develop a city “on a human scale”, inclusive and accessible for all, even to the weakest people (disabled, elderly and children). A city oriented to prefer solutions that support sustainability, usability and ergonomics, intended as an user-system (or user-product) interaction both of architectural-urban structures and services.
- To create services dedicated to physical activity and sport (fitness trails, wellness providers) in order to make each user, including those most vulnerable (namely disabled and elderly people), more sensitive toward an intelligent, dynamic and active lifestyle as long as possible.
- To develop services linked to systems of urban-environment intelligence, able to collect information about the city and its citizens in real time, thus allowing to improve safety, social-administrative policies and the human behaviors (way finding smart; public hearings service). Thanks to these services citizens can send to the public administration, information, requests, emergency signals, to indicate unusual situations such as potholes, disconnected sidewalks, broken street lights etc.)
Innovative scenarios and products for sport outdoor: the challenge of design for citizens’ wellness and health

Type: Abstract Oral Presentation
Category: Others
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Increasing physical activity and physical education are very important issues to overcome ageing population, but require the development of a conscious attitude of citizens towards their own health. Ergonomics for Design and methods of the Human-centered design and User Experience may allow outlining possible solutions for increasing human expectations towards active life, wellness and prevention. This paper presents the results of the "Wellness Outdoor" workshop, promoted by the Laboratory of Ergonomics and Design (LED) of the University of Florence in collaboration with Technogym, a leading-edge company that develops fitness equipment for any physical activity. Main aims of the workshop were to define and design novel scenarios and dedicated services-products for outdoor fitness systems. To achieve these goals, a first step involved the definition of user needs by focusing on the strategic aspects discouraging any user from performing outdoor physical activity.

The "Wellness Outdoor" workshop was divided in two operative phases. In the phase 1 the main project requirements (context and users needs skills) were identified by performing thematic Focus Groups (applied methodologies: Task Analysis, Personas and User Observation) and brainstorming activities, within which researchers (LED), designers and Technogym engineers took part. In detail, the main steps checked out during the phase 1 were:

1. Evaluation of user characteristics: skills, abilities, training, physical features, habits, preferences, etc. In some cases it was necessary to classify users within certain categories, for example, by considering the level of experience;
2. assess the tasks to be performed, especially those that could affect the usability of the product or system. For instance, frequency and duration. Levels of physical stress and safety issues have been also checked out;
3. Define the characteristics of the physico-social environment, habits within which users will use the product-system, including the instrumentation (e.g. technology);

Once defined the project requirements and the expected or foreseeable context of use, the following macro-areas of intervention were identified:

- Design solutions for the regeneration of the urban space
- Design solutions able to promote socialization
- Design solutions for the promotion of the relationship between well-being and nature
- Design solutions for growth / childhood (primary school sector)

Finally, the phase 2 was entirely dedicated to the development of design concepts taking into account the needs of the four points listed above.
The purpose of this study was to describe the most convenient areas for operating push- and rotary-type controls that are commonly used in various electric appliances. The participants were ten right-handed males (21.7 ± 0.5 years) with no history of trauma and no medical history of abnormal motor function. The push controls consisted of two circular buttons for increasing or decreasing functions (diameters: 21.9 mm, distance between the centers of the buttons: 58.3 mm). The rotary control was a knob (diameter: 32.3 mm, depth: 15.2 mm) that turned right (increasing) or left in the coronal plane. The controls were set on grid points with 6 conditions in the anterior direction (40%, 60%, 80%, 100%, 120%, and 140%) and 9 conditions in the left-right direction (the side of the upper limb without operation: -75%, -50%, and -25%; in the sagittal plane: 0%; the side of the upper limb with operation: 25%, 50%, 75%, 100%, and 125%) intersect. The grid points corresponding to 100% for all of the 15 aforementioned conditions were defined by the maximum reach distances achieved, with the participants in a seated position and extending the functional upper limb to the front of the acromion, or to the side at the height of the olecranon process. The participants were asked to push and rotate the controls arranged on the grid points to adjust the height of a red bar to a white target line displayed on a monitor. They were then asked to subjectively evaluate the degree of difficulty of the operations using a modified 50-point category partitioning scale. After the tasks on all grid points were completed, they indicated which of the grid points had been easiest to operate. The positional coordinates of the body motion were measured using a motion tracking system (LIBERTY240/8, Polhemus, the USA).

The participants overall reported the subjective ease of operation of the controls as follows: push control from 0 to 25% in the left-right direction, and from 60 to 80% in the anterior direction, and the rotary control to 25% in the left-right direction and 80% in the anterior direction. The participants indicated that the aforementioned conditions were subjectively easier regardless of whether they used the dominant or the non-dominant limb and the actual length of the participants' upper limbs. These grid points were located in positions where the participants could easily reach the controls using only upper limb motion, without the need for forward-stooping or horizontal rotation of the upper body. Our results indicate that the most convenient working areas for push and rotary controls could be easily calculated by the maximum reach distance of the upper limbs, using the above ratios.
Work without Man is not work but at most an automated process management. Automation of work is certainly a factor of production but will not be an element of development and innovation.

A global reading of production issues shows that development has relied in recent years on a relocation dynamic. It is a question of finding productive spaces elsewhere at a lower cost, allowing to earn performance points in the short term.

Except that the world is changing, the costs of production are inevitably associated with the societal development of producing countries. Mechanically, there will always be a place more profitable than another in a short-term logic. Major climate change tends to raise awareness of the need to think differently about the global model. The challenge of sustainable development is no longer a philosophy but an issue for everyone. Tomorrow, international summits dealing with climate issues will be fully associated with economic meetings. It is not possible that countries of mass production such as India or China continue tomorrow to become intoxicated by the effects of air pollution.

In addition, the evolution of consumption models is inviting the transformation of production models. Since 30 years, it was appropriate in countries to develop consume massively for less cost. The consumption model becomes paradoxical, it is desirable to invest in qualitative products but whose duration of use is reduced. The “re-use” is developing. As a response to waste management, the consumer wants to be able to resell its products to consume others even if it means buying used products. Reactivity in production becomes an important key to profitability, it is no longer a mass production automation but able to respond effectively and quickly to the demand of consumers become more demanding.

How do these movements translate into work? This is the questioning of this communication. In France, service production is predominant but it comes to articulate
manufacturing production. It should be possible to adapt, customize, package, ship and distribute the goods in a few hours ...

What makes innovation in these changes is the consideration of added value, it is it who is the resource in development projects. The production system must be extremely efficient, on a technical level ergonomics has significantly contributed in recent years to improving the physical conditions of production. The standards and principles of production bring a balance between performance and prevention of occupational health.

But tomorrow, it is about demonstrating the added value of human work on the whole value chain, but this objective requires to resume the foundations of a multidimensional human activity model that we will expose in this presentation.
Estimation of carrying load during manual material handling

Type: Abstract Oral Presentation
Category: Manufacturing

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Introduction: Low back injuries (LBI) and especially low back pain (LBP) are often caused by improper task execution, overuse and lack of guidance and training [1, 2]. Part of the reason for our incomplete understanding of how risk factors contribute to injuries is due to difficulties obtaining complete exposure information for individuals working complex tasks. The goal of this study was to develop a practical approach to advance continuous measurements of the risk factors of LBP as defined in the revised NIOSH lifting equation (RNLE) [3, 4]. In this paper, we focus on quantifying the weight of an object, lift frequency and lift duration during manual material handling (MMH). The proposed methodology is designed to enable continuous real-time monitoring and data collection, with the intent to set the foundation for using wearable sensor technologies in the workplace.

Methods: A healthy male participant performed lifting, lowering and side-to-side transferring of a 4.8 kg (10.5 lbs) box with proper handles. Additionally, the subject walked on a custom walkway (0.9 m × 9.6 m) with and without carrying a mass of 17.75 kg (39.1 lbs). The walkway contained a total of six force plates recorded at 1200 Hz. Kinematic data were collected with an optical motion capture system at 120 Hz. Load weight was estimated by subtracting the subject’s weight and dynamics from the ground reaction forces (GRF) and compared to the known box weight. Lifting events were detected based on GRF. The load carrying events during walking were analyzed between the heel strike on the second consecutive force plate and the toe off event of the second to last force plate.

Results: Estimations of object weight, frequency and duration of the lifting tasks were possible using only normal GRF measurements and trunk dynamics. Average estimated weight, lift duration and lifting frequency were within 0.6% (51.8±5.6 N), 4.5% (2.3±0.6 sec) and 0.1% (9.7±1.4 sec) considering whole body dynamics and within 12% (46.0±3.9 N), 13% (2.5±0.4 sec), and 0.2% (9.7±1.4 sec) considering trunk dynamics only. Weight estimation of the carried load during walking were underestimated by 1% and overestimated by 2% compared to the actual carried load (177.3±2.5 N and 182.8±2.7N) considering whole body dynamics versus trunk dynamics only.

Discussion: The importance of these results lies in the sufficient estimation of specific injury risk parameters using a reduced number of measurements. Identifying the minimum number of sensors that still provide sufficient accuracy is particularly important and desirable for practical applications of in-field risk factor monitoring in the workplace. Future work will use these results to develop a wearable system to track exposure to lifting related hazards and improve risk estimates during MMH.
The effectiveness of cardiac rehabilitation patient education through various media

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Ischemic heart disease (IHD) is one of the leading cause of death globally for the past 15 years according to the data from World Health Organization updated in January 2017. Deaths caused by IHD increased by an estimated 41.7% from 1990 to 2013. Therefore, in addition to medical procedure improvement, continuing efforts should be put in the prevention and control of heart disease by actively educating people and promoting self-health management. For patients with coronary artery disease, cardiac rehabilitation may reduce its recurrence and mortality. By practicing the cardiac rehabilitation the rates of subsequent coronary events would be decreased and the morbidity and the total mortality would be reduced as well. Patient education is also an important part of the cardiac rehabilitation, while its effectiveness through various media may be different.

Purpose: To explore and compare the effectiveness of cardiac rehabilitation patient education among three types of media, text only, text and pictures, and video.

Methods: This study was divided into two stages. The first stage was the testing of validity of “Cardiac Rehabilitation Awareness Scale (CRAS)” done by five experts. The second stage was the test of the effectiveness of various media by 90 subjects using the CRAS. The subjects were divided into three groups and each group used one type of patient education medium. The subjects carried out the tests according to five different age levels.

Results: 1. The validity of “Cardiac Rehabilitation Awareness Scale” was confirmed as a measurement tool of the effectiveness of cardiac rehabilitation patient education. 2. There was no significant difference in the effectiveness of patient education of the three media (P=0.6001).

Conclusion: It is suggested that currently for clinical application, the “text and picture” material may be used to educate the IHD patients for its convenience, low cost and preference. With the advanced information and communication technology, the “video” may be the better option in the future.

Keywords: Cardiac rehabilitation, Patient education, Media
In recent years, route guidance systems have had not only conventional static information but also dynamic information year by year and the in-vehicle displays intend to show a lot of visual contents at once during driving. On the other hand, it has been reported that elderly drivers have less cognitive and physical performance than younger drivers, especially visual performance. Therefore, it may be difficult for elderly drivers to perceive and recognize such visual contents quickly in many cases and as a result such driving situation may also increase elderly driver’s workload with driving.

The objective of this study is to investigate effective visual content or element of route guidance information based on elderly drivers’ characteristics such that they can easily reach their destinations with less workload during driving. Two experiments were conducted in this study.

The first experiment was conducted as a laboratory experiment in order to investigate how much knowledge elderly drivers have with logos of private company, which are often used as a landmark on route guidance information of navigation system in Japan. Such knowledge of elderly drivers were measured and evaluated based on their logo awareness, design feature and frequency of logo observed to be correctly recognized.

The second experiment was conducted using a driving simulator. Stores or signboards with the featured logos extracted in the first experiment were located in virtual urban area in the driving simulator, based on several types of visual angle between driver’s eye position and the shop/signboard. In the driving simulator, main task was set to the tracking operation and secondary task was set to search pre-determined shop with logo during driving. Participants were instructed to step on the brake pedal as soon as possible when they find out the shop. Participant’s performance of search task and driving task were measured and evaluated in terms of correct answer rate, visual behavior, vehicle position, etc.

The results of the two experiments showed that elderly drivers had less correct answers than younger drivers and their driving performance intended to be decreased. However, elderly drivers can easily use specific shops or signboard with logo during driving and these shops or signboards have a particular positional relationship with road, which is also relation to visual angle between driver’s eye position and their location. It is also implied that the results obtained in this study will be useful to design the visual content of route
guidance system such that not only younger drivers but also elderly can easily use such system during driving.
Traffic System Resilience: The Relationship with Driving Skills and Traffic Climate

Type: Abstract Oral Presentation
Category: No productive sector applicable

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Road traffic accidents are one of the most important public health problems in Turkey and all over the world. Traffic system resilience is crucial to enhance current traffic system and develop more sustainable and safe road traffic system. The contributory factors of road traffic accidents are identified as the human factors, vehicle factors, and environment factors; human factors that is driver behaviors and skills, were found to be the most important factors. In road traffic accidents, drivers were regarded as the most vulnerable road users, so it is crucial to investigate factors affecting the behaviors of drivers. Driving skills and traffic climate are important factors regarding road safety. The aim of the present study is investigating the relationship between driving skills, traffic climate, and traffic system resilience perception. For the first time in the literature, the traffic system resilience will be evaluated by regarding the perception of road users. The study is especially important to develop future intervention programs in urban scale. The first results of the present study will be generated by the end of January. It is expected that drivers with higher levels of perceptual-motor skills will evaluate the traffic system as less resilient than other drivers. Moreover, it is also expected that traffic climate and perceived traffic system resilience will be related to each other. The discussion of the results will be based on the current data and suggestions regarding the development of future sustainable and safe road traffic systems will be made.

Keywords: resilience, road safety, traffic system resilience, traffic climate, driving skills
In level 2 of SAE’s driving automation, it is hard for drivers to continue to monitor the driving automation system and the environment. One of the issues to be addressed is how to maintain driver’s situation awareness so as to keep them in the control loop.

In this research, we propose verbal communication between the driver and the system. We hypothesize that the driver can take part in vehicle operation cognitively even if he/she is not physically in the control loop. By using a driving simulator, we examine how verbal communication affects driver’s situation awareness.

We compared the two conditions: (1) talking with system, and (2) not talking with the system, during automated driving. Under the condition of talking with the system, the system asks the driver about peripheral situation and/or vehicle control. The driver is required to respond to the system. Two events that the driver must intervene operation during cruising occur. We measure the event response time, the number of collisions, how the driver maneuvers the vehicle, and subjective usability via questionnaire.

The results showed that the number of collisions was significantly greater under the condition of conversation than under the condition of non-conversation. The event response time was significantly longer under the condition of conversation than the other. From the above, the verbal communication did not improve driver’s situation awareness. There was no difference of questionnaire score, thus the verbal communication did not improve the usability of the automated driving system. According to the results, we could claim that drivers may overestimate how much they can get information about driving situation only through conversation. Our results provide important insights for designing systems to support driver situation awareness.
Whereas the direction which discusses the safety from the accident analysis, a new trend of analytical methods such as resilience engineering, high reliability organization, or risk literacy research, which analyze the various events by focusing on the good practices, are becoming popular.

Various good cases of resilience response were observed in individual base and also in organizational base in Fukushima-Daiichi accident as below:

- The effectiveness of insight and of the risk evaluation on accident cases, such as inundations in LeBlayais and Madras plants, and September 11 terrorism and B.5.b.order from US Nuclear Regulatory Commission to keep the plant in safe condition even natural disasters or acts of terrorism occurred,
- Decision of continuation of sea water infusion (individual base).
- Reflection of the experience on Chuetsu-Oki Earthquake,
- Improvement of seismic base isolation building equipped emergency power system and air conditioning system, which was effectively used for emergency response facility (on-site of organizational base),
- Deployment of fire engines, which was effectively used for water infusion (on-site of organizational base).
- The effectiveness of command system in ordinal time due to training (on-site of organizational base),
- Support by cooperation companies and manufacturers (designers and site workers of organizational base).

For Tsunami countermeasures in other plants, good practices were also observed in organizational base:

- Onagawa plant level was enough high to prevent Tsunami disaster due to clear understanding of the effect and sharp decision by top management,
- Tokai-Daini plant installed water stuck for sea-water pump to protect infusion due to good communication and corporation among prefecture officers and utility managers.

The many failure cases were defined under national government base and nuclear industry base which are the problems of rare event awareness and of organizational culture. The ordinal time training at on-site have also worked in emergency situation at the accident, while the bases of administration department and government didn’t work well:

- Risk misrecognition of Loss of offsite power due to damage by Tsunami (national government base, industry base).
• Confusion of command system (organization base- between on-site and the main office of Tokyo Electric Power Company),

• Confusion of command system (external correspondence base- among national government base, official residence, regulator, and the main office).

It is important to ‘establish the feedback system based on organization learning in ordinal time’, which means that it is important to establish the different order system in emergency situation from ordinal time. The decision at on-site are given priority than other ones. The representative example is the decision of sea water infusion continuation which was given priority at on-site, even though national government, official residence, and the main office had ordered to stop the infusion.
How to assess sitting (dis)comfort? - An analysis of current measurement methods and scales

Type: Abstract Oral Presentation
Category: Automotive
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Since early 1950s the human factors and ergonomics research community has evaluated and attempted to optimize sitting. To objectify the evaluation, positive and negative sensations during sitting need to be determined and correlated with objective measurements or physical effects on the human body. Regardless whether it is for aircraft, automotive or office seating, the terms and definitions of comfort and discomfort are usually used.

Several questions regarding the comparability of published sitting (dis)comfort studies arise due to the vast variety of used terms, models, measurement tools and experiment designs (Ulherr & Bengler 2017). Most of the published studies investigate similar research questions but with very different scales and methodologies. The authors, therefore, consider it critical to compare results without restriction (Ulherr & Bengler 2017).

The aim of the proposed paper is to investigate parameters of and effects on sitting (dis)comfort experiments to emphasize the need of standardization in the area of sitting research. Additionally, the extent of comparability between different published experimental results will be quantified and presented.

The core of this paper will be a meta-analysis of published (dis)comfort studies aimed at statistically comparing their results. Also the collected data of a largescale discomfort study (Ulherr, Zeller & Bengler 2018) will be analyzed to show influencing parameters on discomfort experiments. Combined with a literature research, the paper will conclude with the presentation of necessary future research goals as well as important questions to be answered and discussed within the research community of sitting comfort/discomfort.

References:

Introduction and Objective: The low vision population experiences challenges to mobile as unable to acquire sufficient visual information. Therefore, support to low vision population is in urgent need. The purpose of this study was to understand the influence of various information acquisition strategies on the foot proprioceptive and obstacles avoidance strategies among low-vision people with pigmentary retinal degeneration.

Methods: Ten male adults (41.0 ± 7.1 years) with pigmentary retinal degeneration are recruited. All participants are holding grade 2 disability certificate by the Japan Ministry of Health, Labor and Welfare (vision: 0.02-0.04, field of view: 10° and loss rate: 95%). Participants acquired obstacle information (height of obstacle: 4cm and 15cm) by three acquisition strategies, namely, front: straight view in front of the block (condition A), downward: view the obstacle by 20cm distance to toe (condition B) and tactual: identify the block by hand with no time limit (condition C). Task 1: Subsequently, participants reproduced the height of obstacles by lifting their foot on static standing (10 times each for both legs) after recognized the height of obstacles. Task 2: After acquired the obstacle information by conditions B and C, participants performed obstacle step-over from a free position where it is possible to finish by one step. For Task 1 and 2, the lower limb movement for each condition were recorded using a high-speed camera at 250 frames per second. Gait parameters, such as lift height of toe, step length, and characteristics of the foot trajectory, such the highest points of the leading and trailing feet while stepping over the obstacle, were analyzed. The coefficient of effort (the ratio of the highest point of the leading foot to the height of the obstacle) was calculated. One-way analysis of variance was used to analyze the differences between each condition.

Results: In Task 1, condition B showed significantly highest toe rise and highest coefficient of variance in toe rise (p<0.05) in compare to condition A and C. In contrast, the toe rise was similar in both conditions A and C. For Task 2, the highest points of the leading and trailing feet while stepping over the obstacle, were analyzed. The coefficient of effort in condition B was significantly larger (p<0.05) than that for the condition C.

Discussion: Inadequate visual information is one of the main reasons causes the low-vision people to indecisive and uncertain to complete their movement. These results suggest that difference of information acquisition strategies had an impact on the foot trajectory during obstacle step-over. Out of three methods used in this study, information acquisition by tactual sense may be a better feedback method to low vision person in obstacle avoidance.
Designing assistive devices and technology is not only clinically and technically demanding, it is also an intimate and emotionally sensitive task. Many of them have been developed by medical experts, for whom ergonomic and physiological considerations are paramount. Although these product need to function and fit properly, scant attention is given to emotional aspects, such as social stress, stigma and shame. Even when users of assistive devices feel perfectly at ease and self-reliant, the remarks of bystanders, fueled by culturally embedded product stereotypes, keep challenging these users (Vaes, 2014).

This paper addresses the topic of product-related stigma (PRS), social disapproval associated with the use of a particular product, and introduces a stigma-free design toolkit for development teams. The toolkit focusses on the emotional and social challenges associated with the conception of stigma-sensitive products. It contains two design tools that can be used in sequence or individually: the PAMS (Product Appraisal Model for Stigma) and the PIMS (Product Intervention Model for Stigma). The toolkit aims to inspire designers to alleviate the effects of PRS and increases user-product attachment, user empowerment and collective well-being.

The PAMS is a tool that ‘unveils’ stigma pitfalls and social conflicts between users of stigma-sensitive products and their surroundings (Figure 1). The PAMS is a user-friendly and tangible ‘checklist’ that facilitates focus and teamwork. The tool aims to displace designers into the context of the users of assistive devices. The PAMS is printed on cardboard and can be folded into two tetrahedron models. The bottom tetrahedron holds 27 questions, nine on each side. Each set of nine questions addresses a specific product-related stigma component (product perception, product in use, and reflecting on product use) and how this component is appraised by three stakeholders (product users, bystanders, and society). The top tetrahedron has specific cut-outs, allowing the team to address the questions without distractions and in a sequential order.
The PIMS targets the conception phase of the design process and can be applied to a broad range of stigma-sensitive products (Figure 2). The PIMS is a set of 17 stigma-alleviating design interventions, presented on cardboard intervention-cards. The cards aim to visually inspire designers and are conceived in a compact and consistent style, facilitating overview and comparison. The interventions challenge the designer to not only impact the product, but also empower the user or reshape societal and cultural factors. The selected design interventions are derived from the analyses of a database of 250 innovative products that managed to reduce PRS. The stigma-free design toolkit was first introduced in 2014 and has been optimized through multiple design workshops with both students and design professional.
Figure 2. The Product Intervention Model for Stigma
Guitarists interact with many elements such as music stand, chair and implements for instrument positioning in order to accomplish their artistic activity. Regarding auxiliary implements for guitar positioning, it has been recognized that in addition to provide a better accessibility and a simpler interaction with the musical instrument, it is necessary to analyze their characteristics and their relation with the postural variations in musicians to identify possible risk factors and establishing new conditions to prevent them.

The aim of this study was to describe the design process of an auxiliary implement for guitar positioning, based on the results of a postural assessment of 9 music students of the University of Guadalajara. The study took into account anthropometric aspects of Latin-American population and the analysis of other existing implements.

The first stage of the study consisted in comparing three auxiliary implements which have the same function, that is helping to position the guitar according to musician’s body, with the purpose to identify the posture of the guitarist while using this devices. The analysis in this phase comprised the estimation of several body angles, in three different moments of the performance, such as left shoulder abduction, left hip flexion, low back compression and lateral bending, axial rotation and flexion of the torso.

To carry out the postural evaluation, guitarists performed a fingering exercise specially designed for this study. They were video recorded in three different angles simultaneously. Afterwards, all videos were synchronized and divided in photograms in order to apply the Rapid Entire Body Assessment (REBA) which was useful as a diagnostic test to identify higher risk postures. Subsequently, the angles of the above mentioned body segments were estimated using the 3DSSPP software.

The data obtained in the first stage was taken as a reference to design an auxiliary implement that could contribute to improve the interaction between the guitarist and the musical instrument. The results suggested significative differences \( (p < .05) \) in hip flexion in after using one of the three evaluated auxiliary implements in the first stage. This condition could be related with an imbalanced body weight distribution and an asymmetrical effort of the spinal stability muscles.

In addition, it was recognized the importance of designing an adjustable auxiliary implement for guitar positioning, taking into consideration the anthropometric characteristics of the population that uses it. On the other hand, there are some factors that can not be solved only using auxiliary tools; For example, many guitarists develop their own postural preferences and technique when playing the instrument, sometimes
intuitively and without attending to biomechanical aspects that would improve their musical practice and reduce risky postures.
Introduction. Digital products are becoming increasingly ubiquitous. At the same time, the field of interaction design – where the interaction with such digital products is questioned and alternative interaction styles are examined – is gaining popularity. Yet, the design values and alternative interaction styles arising from this academic domain seem to be not easily translated into commercial products. Hence, good commercial examples that demonstrate the blending of digital functionality with meaningful interactions, are lacking and are mostly restricted to high-end design artefacts. For most of the digital products on the market, the graphical user interface remains dominant, making the interaction with digital products more and more similar.

Aim. The aim of this research was to investigate the potential of tangible user interfaces for the interaction with digital products. As a case study a prototype of a digital toy with a tangible user interface based on tokens was developed.

Methods. This study takes a look at the approach of token-based interaction. Token-based interaction is a field within tangible interaction, where physical objects are used to access digital data. These objects or tokens physically resemble the information they represent by their size, proportion, form, color, material and/or texture. This way tangible interaction with digital data is enabled. Within this study the potential of token-based interaction was investigated using a Research Through Design approach, wherein knowledge is gained through the process of designing, building and testing. As a case study the controls and structures of an audio/MIDI sequencer software were materialized in an embodied artefact. In total three design iterations were undertaken. With the second prototype user tests were conducted with eight children between the age of five and six. A third and final prototype was built as a demonstration model, as it directly embodies the inspirational values that tangible interaction encompasses.

Results. The result is a prototype of a digital toy with a token-based interface that allows children to build and play a musical sequence in an intuitive and playful manner. The physical design of the prototype and the interaction with it, is not computer-like. The children do not navigate through menus or press combinations of buttons, but form their own melody by taking, placing and shifting the physical objects or tokens. Unlike a graphical user interface, a token-based interface allows a more natural and rich interaction, which appeals to the children’s bodily skills.
Effectiveness of interventions for preventing injuries in the construction industry: -Results of an updated Cochrane systematic review-

Type: Abstract Oral Presentation
Category: Building and Construction

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Introduction

Various interventions to prevent occupational injuries in the construction industry have been proposed and studied. This continuing updated Cochrane review systematically summarizes the most current scientific evidence on the effectiveness of interventions to prevent injuries associated with construction work.

Method

Search terms that covered the concepts of ‘construction workers’, ‘injury’, ‘safety’ and ‘study design’ were used to identify intervention studies in five electronic databases up to April 2017. Acceptable study designs included randomized controlled trials (RCT), controlled before–after studies (CBA) and interrupted time series (ITS). We used the GRADE approach for assessing the evidence and results.

Results

In total 17 studies, 14 ITS and three CBA studies, from the US (6), UK (2), Italy (3), Denmark (1), Finland (1), Austria (1) Germany (1) Spain (1), Belgium (1) met the inclusion criteria. Most studies were at high risk of bias.

The regulatory interventions at national or branch level may not have a considerable initial effect (effect size of -0.33; 95% confidence interval (CI) -2.08 to 1.41) and no sustained effect (effect size of -0.03; 95%CI -0.30 to 0.24) on fatal and nonfatal injuries (9 ITS
studies). Inspections may not result in a considerable reduction (effect size of 0.07; 95%CI -2.83 to 2.97) of non-fatal injuries (one ITS study).

In companies that received subsidies non-fatal injuries from falls to a lower level may decrease more (risk ratio at follow-up: 0.93; 95% CI 0.30 to 2.91) than in companies that do not receive subsidies (1 CBA study). A multifaceted drug-free workplace programme at the company level may reduce non-fatal injuries in the years following implementation by -7.6 per 100 person-years (95% CI -11.2 to -4.0) and in the years thereafter by -2.0 per 100 person-years per year (95% CI -3.5 to -0.5) (one ITS study).

A safety campaign intervention may result in an initial and sustained decrease in injuries at the company level (one ITS study) but not at the regional level (one ITS study). Introduction of occupational health services may not result in a decrease of fatal or non-fatal injuries (one CBA study). Safety training interventions may not result in a significant reduction of non-fatal injuries (one ITS study and one CBA study).

**Conclusion**

There was very low quality evidence that introducing regulations as such may not result in a decrease of fatal and non-fatal injuries. There was also very low-quality evidence that regionally oriented safety campaigns, training, inspections or the introduction of occupational health services may not reduce non-fatal injuries in construction companies. There is very low-quality evidence that company-oriented safety interventions such as a multifaceted safety campaign, a multifaceted drug workplace programme and subsidies for replacement of scaffoldings may reduce non-fatal injuries among construction workers.
Evaluation of participatory strategies on the use of ergonomic measures and costs

Type: Abstract Oral Presentation
Category: Building and Construction

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1. Introduction

The implementation and use of ergonomic measures is dependent on behavioural changes of both employers and employees. Participatory strategies – guided by professional ergonomic consultants – are thought to stimulate behavioural change of the stakeholders and a better chance for starting interventions on barriers in order to increase the use of ergonomic measures. In the present study, the effect of two participatory guidance strategies – a face-to-face or an e-mail guidance strategy - on the use of ergonomic measures among construction workers and related company costs were studied.

2. Method

Twelve construction companies were randomly assigned to a structured step by step face-to-face guidance strategy (F2F; N=6) and a comparable e-mail guidance strategy (EG; N=6). The percentage of workers using ergonomic measures were assessed using questionnaires at baseline and after six months. Costs were divided into three items: the costs of the guidance strategy, purchasing the ergonomic measures, and costs of training the workers.

3. Results

Five companies – two in the F2F and three in the EG – implemented new ergonomic measures during the intervention. For the F2F, the percentage of workers using a newly-implemented ergonomic measure after the PE intervention was 23% (11 out of 48 workers) and 42% (13 out of 31 workers) for the EG. This difference was not statistically significant (p=0.271). Only the increased use of ergonomic measures to adjust working height differed significantly different (p=0.001) between F2F (+1%) and EG (+10%).

For the F2F, the total costs in the first year were between €3,294 and €5,781 per company and were mainly due to the guidance costs. The purchasing of the ergonomic measures accounted for 2% to 29% of the costs incurred. For the EG, the total costs were between €1,479 and €3,754 per company. The largest costs were guidance costs (82% of the total costs) for one company and the purchasing costs (83% to 93% of the total costs) for two other companies.
4. Discussion

Only five out of twelve companies actually implemented ergonomic measures. Within these five companies, both participatory guidance strategies are thought to be capable of improving the actual use of ergonomic measures by workers. The face-to-face guidance strategy, however, may be more suitable in a company context where lack of insight in relevant work-related risk factors exists.
Personal lighting conditions for more evidence in light effect studies

Type: Abstract Oral Presentation
Category: Building and Construction

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Research demonstrated numerously effects of light on human health. In the majority of these studies, the health effect related to illuminance was investigated; however, these illuminances were mostly measured on average (i.e., averaged over time or locations). Since human health is related to each individual separately, the environment around these individuals should be analyzed individually as well. Several environmental conditions (e.g., air pollution) were already investigated at individual level. It is recommended to measure lighting conditions per individual as well since the impact of light cannot be generalized. Light captured by the photosensitive cells on the retina (i.e., ipRGcs, rods, and cones) causes image-forming and non-image-forming effects. In order to investigate these light effects, it is essential to know the light which enters the eyes.

Health effects may be influenced, supported, or even controlled via a lighting control system which includes personal lighting conditions and personal health characteristics (either subjective or objective). In order to succeed, this lighting control system needs continuous information on the lighting and health conditions, both at individual level. This paper focuses on the personal lighting conditions.

There are various methods to determine personal lighting conditions, e.g., via:

- Measurements (i.e., person-bound (PBM) or location-bound (LBM))
- Estimations (i.e., location-bound (LBE), or computer simulations (CSE)).

Personal lighting conditions can be determined using person-bound or location-bound measurements. The advantage of the PBM is that the lighting conditions are continuously measured, at the position of the individual. Disadvantages of this method are the burden for the individual to continuously wear a device and the relatively high performance errors of the current wearables. In order to obtain personal lighting conditions, highly accurate measurement instruments can be placed at all locations of the individuals (LBM). A disadvantage of this method is that the lighting conditions are being measured at certain locations only (i.e., not dynamically) and that these measurement instruments occupy locations (e.g. desks in an office) which cannot be used by building occupants.

A new method (i.e., LBE) has been proposed which consists of estimations based on location-bound measurement. Measurements at reference locations allow estimations of lighting conditions at other locations inside the building. The LBE was developed as a principle method and various methods of the LBE were already investigated. The accuracies of these LBE methods were determined based on two validation studies in...
offices. It is expected that, considering an effect-driven lighting system (an effect can be e.g. visual performance, health, or productivity), this LBE method will be the future. The method may approach reality, is unobtrusive for the building occupants, and can easily be included in an Internet-of-Things-platform.
Electronic Voting for All: co-creating an accessible interface

Introduction

The Dutch government aims to stimulate independent voting by as many citizens as possible. Voting using an electronic interface including images and audio support, could enhance accessibility to those with disabilities, specifically the visually impaired (±1.3% of Dutch population) and those with low-literacy levels (±7.6% of Dutch population).

The study investigated the extent to which electronic voting is accessible to all voters, especially the visually impaired, those with low literacy, and the elderly.

Method

Working together with the different user groups, a series of electronic interfaces were developed. To run tests on large numbers of participants, simulations of a ‘vote printer’ were built. The interface consisted of a touchscreen and a printer. Audio support was available via a headset.

For participants with disabilities, the independent variables were visual impairment and low literacy. For elderly participants, the independent variable was age.

All participants were asked to make specific choices on the screen and to check the printed result for their choice. As a reference, they were asked to vote using the current Dutch ballot paper/red pencil system.

The criteria used to determine the accessibility of both systems were:

- does the printed ballot match the intended vote?
- can the device be used easily and without problems?

Results

In the visually impaired group, 21 of the 32 participants voted correctly when using the vote-printer; this increased to 24 with audio support. Although 14 of the participants voted correctly with the current paper ballot a majority of the visually impaired experienced the use of the vote-printer as easier than the current paper ballot.
In the low-literacy group of 30, almost similar numbers (24/25) voted correctly using both systems. Audio support only slightly enhanced (27) the use of the vote-printer. However, the majority of this group experienced the use of the vote-printer as being easier than the current paper ballot.

In the group of 285 participants aged above 65, an equal percentage (82%) voted correctly with each system. When using audio support this increased slightly to 84%. With increasing age, use of both systems was more difficult, however the majority of the elderly reported that use of the simulation vote-printer was easier than the current paper ballot.

Discussion

The vote-printer significantly increased independent voting by the visually impaired. This was not seen for the low-literacy group. The use of a vote-printer with electronic interface is expected to be at least as accessible for the elderly as the current paper ballot. All three groups reported the use of a vote-printer with electronic interface to be easier than the current paper ballot.
Exploring the relationship between materials and end-user personalities

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In industrial design, materials selection plays an important role [1], [2]. Being the interface of a product, a material does not only have to meet technical-functional requirements, but also has to include intended experiential characteristics such as user interactions, meanings, and sensorial attributes [3]–[5]. Consumers demand more from a product than simple functionality. Hence, both technical and experiential material aspects need to be integrated to design of successful products [3], [6].

Unfortunately, there is no one-to-one correspondence [7] between materials and their expressive value since a material’s perceived character is influenced by multiple contextual factors that are product-related (shape, function), user-related (gender, culture, etc.), and context-related (time, place, etc.) [8]. Recently, research started investigating how materials affect meaning creation [4], [9], however, the subjective topic remains particularly difficult to research. Hence, there is a substantial call in scientific research to explore this topic.

Our current research aims to explore possible relationships between materials, their expressive value and the link with self-expression of the end-user. It defines expressive value in terms of personality [10]–[12] and end values [13]. Considering the challenges in assessing material samples, and product-context associations. Experiments are set up as a methodology to cope with these problems.

Based on previous research [14], in a first qualitative pre-study with eight duos of Product Development students, a card sorting technique was used to validate the categorisation of 30 abstract shape renders in homogeneous groups that differ from each other. This led to four extreme differentiating shapes that are used in the main study. In a second qualitative pre-study, ten duos of Product Development students evaluated 24 different materials (3D render visualisations). The resulting twelve most clear, representative, and differentiable materials were used to materialise the previously selected shapes for the main study.

These conceived stimuli were used in the main study; an online survey with 70 non-designer respondents (consumers). In line with earlier research from Sirgy [15], [16], the main question in this research concerns the link between the expressive values of the stimuli and the user’s self-expression [17]. The questionnaire contained Likert scales and rankings related to shape and material preferences, material-shape combination preferences, and evaluated the perceived expressive values of the shape-material combinations. Furthermore, they reported their own values and personality traits.

This research reveals insight in the expressive values that twelve pre-selected materials evoke in itself and in interaction with different pre-selected shapes. Moreover, respondents are clustered in meaningful self-expressive categories, based on their value orientation [13], [18] and their personalities [12]. For each of these segments, the preferred materials and
shape-material combinations are investigated in relation to the fit between the expressive value of the material and the self-expression.
Does use of patient transfer technique in nursing homes reduce mechanical work exposure and shoulder and/or low back pain?

Type: Abstract Oral Presentation
Category: Healthcare

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Employees in nursing homes that handle patients are exposed to transfer tasks that may increase the risk for musculoskeletal disorders. In Scandinavia training of health care personal in patient transfer techniques has been introduced during the last 10-20 years. However, very little evidence exists if this training and practice reduce the risk for musculoskeletal disorders and associated sickness absence. This paper will examine the possible effects of this technique on work exposure and musculoskeletal pain in shoulders and low back.

Research question: Which aspects of mechanical exposure for nursing home employees, especially concerning the use of patient transfer technique, are associated to pain in shoulder and back.

Methods: Two hundred and five employees, one out of five male, were included at eleven nursing homes in the large Oslo region. Questionnaires were filled out at basis and every six months for two years. Questions concerning e.g. exposures at work, work load, training in patient transfer techniques, psychosocial work factors and pain in shoulder and back. The work postures were measured for a subgroup of employees by accelerometers (Actigraph GT3X+) and muscle activity in the Trapezius and the Erector Spinae muscles was obtained by electromyography (Mobi 8) during a full-shift.

Results: The mean score of subjectively assessed heaviness of the job at basis was 5.4 on a scale from 0 to 10, where 5 has the anchor word “heavy” and 7 “very heavy”. Thirty per cent report that they lift in awkward positions and 40 per cent that they work with trunk bent forward for more than 25 per cent of the working day. Thirty-nine per cent report that they manually transfer patient in bed, chair or similar more than five times daily, 15 per cent more than 10 times daily. One out of five experience insufficient training in lifting and transfer techniques.

The nursing homes have different approach to use of patient transfer techniques and it is therefore possible to answer the research question mentioned above. The analyses of the technical measures at basis as well as self-reported exposure and pain during the 2-years follow-up will be presented at the conference.
Objective

The aim of this study is to examine the validity of using a static lab-based set up to evaluate static factors in seating comfort of motorcycles.

Background

Seating comfort in automobiles has two important factors, static factors and dynamic factors (Ebe & Griffin, 2000). Static factors are influenced by pressure distribution and determine overall seating comfort when the vibration reaching the seat is low (Mansfield, 2014) as is the case when driving on flat roads. Research on seating comfort of passenger cars is often carried out using static lab-based test setups to evaluate static factors of seating comfort (Eg.; Kolich, 2000; Zenk 2006). Studies have shown (eg: Kyung, 2008) that there is no significant difference in the ratings of seating comfort between lab-based setup and actual driving in passenger cars. However, the riding posture, mass, and dynamics of a motorcycle are unlike a passenger car and warrant further research to validate that a static lab-based set up is enough to evaluate the static factors of seating comfort in motorcycles.

Method

A group of 18 male volunteers from TVS Motor Company participated in the study. The study involves subjective rating of seating comfort and objective measurement of seat interface pressure in a static lab-based set up as well as actual driving in a flat test track for two motorcycles, M1 & M2. The subjective rating of seating comfort is obtained through the Motorcycle Seating Comfort Questionnaire (MSCQ - Sai Praveen & Ray, 2017) while the seat interface pressure is measured using a piezoresistive pressure mat (manufactured by Tekscan). The results of subjective rating of comfort from MSCQ, the Peak Contact Pressure (PCP) and average Contact Pressure (CP) from seat pressure measurements are compared between static and dynamic trials statistically.

Results

The results show that the rating of comfort, as well as the seat interface pressure, are comparable between static lab-based setup and dynamic riding, both of them indicate M1 has significantly better comfort in comparison to M2. There is a statistically significant correlation between the ratings of comfort from MSCQ between static and dynamic
evaluations of seating comfort ($r = 0.77$, $p<0.01$, $n=36$). The results also show there is no significant difference between the static and dynamic measurements of both PCP and CP.

**Conclusions**

This study shows that static lab-based setups are valid to examine static factors of seating comfort in motorcycles.

**Applications**

The results of this study prove that research involving static factors of seating comfort in motorcycles can be carried out in a static lab-based setup. A lab-based setup ensures a more controlled environment, is safer and consumes less time than dynamic evaluation.
Abstract

Musculoskeletal disorders have been widely studied in the adult population, with a focus on workplaces, due to the high rates of absenteeism in the last decade (Punnett & Wegman, 2004). However, there is a limited number of studies that focus on musculoskeletal disorders and child anthropometry. Studies have shown that the lack of proper fit of children to school furniture can generate anatomical and functional changes, and negatively affect the learning process (Castellucci et al, 2014). In Ecuador, as in several Latin American countries, statural growth is influenced by socioeconomic status (Castellucci et al, 2016). For this reason, the present study focuses on the creation of anthropometric tables of school children between the ages of 5 and 7 for the urban and rural zones in Cotopaxi, Ecuador. The data is based on 10 anthropometric measures of a sample size of 260 urban and 260 rural children. The anthropometric profile is then used to analyze the differences between urban and rural children, the potential causes for these differences, and to propose a design for school desks and chairs. As a result of the study, prototypes of school desks and chairs that comply with ergonomic standards and anthropometric measures of school children were created using 3D printers.

Keywords: Ergonomics, Anthropometric Data, Latin American Children, School Furniture Design, Musculoskeletal Disorders.
Comprehensive rehabilitation for accident and occupational diseases in Colombian workers. (track Safety & Health)

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The numbers of accidents and occupational diseases in Colombia are high. In 2014, 13,918 workers received compensation for permanent partial disability and 557 were disability pensioners. Social Security provides integral rehabilitation services to workers who require it. Its objective is the social integration and recovery of productive capacity. However, information on results of the processes of vocational rehabilitation is scarce. In recent years a medical center in southwestern Colombia implements a model of ergonomic rehabilitation aimed at improving care for workers and optimize resources, achieve better results in functional recovery and employment integration in less time, positively impacting the quality of life and labor productivity in the region. The aim of the study was to determine characteristics and results of a comprehensive rehabilitation process for workers who suffered an accident or illness. descriptive retrospective research conducted by reviewing the database of a integral rehabilitation center. Predetermined variables were analyzed to characterize the population and quality of health indicators. 6336 cases were analyzed, 74% were men. 80% of the population was between 30 and 59 years, the group between 40 and 49 years was the most representative. The most frequent pathologies requiring rehabilitation were: STC (90%), lumbar disc disorders, mental disorders, Quervain tenosynovitis and epicondylitis. The behavior of disability by accidents showed a reduction in the number of days, from 96 days of incapacity average in 2013 to 50 days in 2014. Similarly behaved disabilities by occupational disease, making a difference of 126 average days lost between 2013 and 2014. The Rehabilitation times showed a downward trend from 230 days in 2013 to 43 days in 2014. The business sector with more cases is the agricultural sector with 46%, followed by the industrial sector with 30%. between 2013 and 2014, return in to the job 95% of cases.
[3415] Maximum acceptable work time for the upper and lower limbs tasks

Type: Abstract Oral Presentation
Category: Others

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Maximum acceptable work time for the upper and lower limbs tasks (track Psychophysiology in Ergonomics)

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Keywords: oxygen up take, heart rate, work load, acceptable work time, occupational health.

The physical workload is one of the major risk factors for the workers. At present the proposed methods to assess physical dynamic work load contemplate working with the whole body and not discriminate on body segments. Objective. Determine the maximum acceptable dynamic work time when the work is with the whole body, with the upper and lower limbs. Methods. Oxygen consumption was measurement by ergospirometry and heart rate was monitoring in 30 workers exposed to various loads executed with the whole body, legs and upper limbs. Anaerobic threshold was determined by respiratory quotient, this was used by calculate the acceptable dynamic work time. Results. Statistically significant differences between acceptable dynamic work time for upper limbs and lower limbs were found. Negative exponential correlation model was found between the time the work load and the oxygen consumption and heart rate, R> 0.9 in all cases. Nine regression equations were proposed to determine the acceptable dynamic work time. Conclusions. The acceptable dynamic work time for lower limbs and whole body is similar. The acceptable dynamic work time with upper limbs is significantly lower than the previous. The equation for the calculation of energy expenditure for upper limbs was

\[
LGE = CTF^* (0.65) ^{(1.1 - (0.33 \text{Logtime}))}
\]

The relative heart rate seems to be the best indicator to measure acceptable dynamic work time. The equation for the calculation of the maximum acceptable work time were, for upper limbs MAWT: 278.4E -0.05*ICCR for lower limbs MAWT: 1980.4E -0.921*ICCR
Introduction: Work-related upper extremity disorders, such as carpal tunnel syndrome (CTS) remain a troubling and costly disease for both employers and workers. Recent prospective studies have identified dose-response relationships between various measures of hand force and carpal tunnel syndrome (Harris-Adamson et al, 2015). However, exposure assessment methods used to quantify hand force are limited in accuracy and ease of measurement. The primary purpose of this study was to develop a method for estimating hand posture (pinch versus grip) and hand exertion force using inertial measurement units (IMUs) and forearm surface electromyography (sEMG).

Methods: Four sEMG electrodes were equally spaced distal to the elbow with the first sensor over the muscle belly of extensor digitorum and the next 3 forming a ring around the forearm. Three additional sensors were placed over the abductor pollicis longus (APL), extensor pollicis brevis (EPB) and flexor pollicis longus (FPL). Subjects applied 25%, 50% and 75% of their maximum power and pinch grip force (digital dynamometer and pinch meter, Biometrics Ltd, Ladysmith USA) in five different wrist postures (neutral; 50° of flexion; 50° of extension; 20° of radial deviation; 20° of ulnar deviation). Wrist posture was measured using IMUs (XSens, Culver City, USA). EMG signals were recorded at 1500Hz filtered and rectified for analysis. Synchronized IMU signals were recorded at 60 Hz. Grip and pinch force output signals were recorded at 1000 Hz.

Subjects then performed sorting tasks with varied object weights lifted via pinch (0.5kg to 2kg) or grip (1kg to 5kg), repetition rate, wrist posture and duty cycle. All tasks were videotaped at 30 frames per second and analyzed using frame-by-frame analysis (MVTA, Madison, USA) to quantify hand posture, repetition rate and duty cycle for comparison to estimated values. Five force prediction models were applied to the EMG data to assess relationships to measured force. Hand posture (pinch or grip) while applying a force was predicted using a 10 layer Neural Network.

Results: Eleven subjects of convenience participated in this laboratory study. For both pinch and grip, the neural network model showed the best correlation between sEMG signals and hand forces with values ranging from 0.92 to 0.97 depending on the wrist posture. Pinch was correctly predicted 94.3-95.5% of the time and grip was correctly predicted 96.5-97.7% of the time depending on the weight lifted. The accuracy of prediction was typically higher as the mass increased.
Discussion: Objective measures of hand posture and force are important to facilitate efficient and accurate risk assessment of hand intensive workplace tasks. Forearm muscle activity, recorded using sEMG, was found to predict hand exertion force and hand posture with good accuracy at different wrist postures.
This work results from the analysis of the health context in the productive world, related to the seated activity and the use of everyday technological objects that minimize day-to-day gestures. It discusses the consequences of excessive use of this technology, establishing predatory relationships in motor organization and body structure, which impose radical changes on human nature and health implications as a whole, highlighting the role of ergonomics and design in this issue.

The comfort related to posture, now passes through a process of analysis in the scope of corporal therapies, where the twists and postures adopted during a lifetime are capable of transformation through the alignment of the body structure to the axis of gravity. Following this line, this work brings a problematization: theoretical comparison on the understanding of what comfort means in the visions of corporal therapies X of ergonomics – a important parameter in the process of thinking design and in the definition of product form - a conceptual misconception makes the success of an entire work impossible.

The main issue addressed here is appointed to the body concepts used in ergonomic and product designs. The objective is to present new paradigms related to the ways of seeing, analyzing and treating the human body, transferring knowledge from the areas of body therapies and motor rehabilitation to the area of ergonomics. To do so, we rely on systemic concepts and constructive factors of the integrated movement, the structure and organization of complex systems, which support the understanding of the human motor system, through muscular chains of movement.

The hypothesis that feeds this work is that a closer look at the mechanical aspect of the dynamics of the psychomotor organization of the human structure, as a whole, can influence the projective reasoning of professionals who evaluate, validate, conceive and develop products. This will allow us, at last, an analysis of the seated activity, in the light of the integrated motor coordination concepts. For that, I use biomimetic models of the human body, built on biotensegrity technology, developed in my PhD research “Design for Health”.

A new paradigm of understanding the human body results in new teaching methods, goal formulation, decision processes and strategies used in the ways of diagnosing and treating it, in search of better global functionality, prophylaxis, preservation, recovery and inclusion. It is able to leverage innovative processes by contributing significantly to the transformation of the state of knowledge by establishing new mental models of cognition, which encourage innovation processes when applied in other areas of knowledge, directly
influencing ergonomics, but also in the areas of design, engineering, biomedical, in research and physiotherapeutic practices and in high performance sports.
The need for housing meeting user requirements, regardless of standardisation, is growing, since the actual usability and adaptability of spaces are essential requirements for users’ autonomy, independence and well-being [1]. Topics on improving inclusiveness of residential housing for frail users [2] have been established for a long time as interdisciplinary fields where specialized contributions participate in the adaptive customization of spatial and technological solutions, which evolve according to changes in the needs, and functional abilities of people [3], [4], [5].

Social and cultural evolution, which led to the development of OMS documents [6], created an important drive in the EU framework in determining policies to overcome disadvantage conditions of frail users; in Italy, these prepared the ground for an important directive addressing assistance for gravely disabled people without family support (“Dopo di noi” law n. 112/2016) [7].

This directive opens opportunities for numerous residential options able to support co-housing and community situations [8], with the view of creating autonomy for the future, with solutions allowing wide participation from local entities, families and disabled persons themselves, in order to define the “life project”, supported by a funding of 90 million euros and by specific trusts.

With these objectives, the regions are publishing the expression of interest for the identification of the so-called “solidary real estate assets”. A survey that will allow the creation of a list of properties divided into three distinct sections: public, private and social heritage [9].

The next step will be the need for implementing innovative housing and service solutions [10], which require renovations mainly related to adaptation/refurbishing/technological equipment and domotic solutions for existing buildings [11].

Research in this context, especially studies financed by the EU, has produced substantial scientific literature over the years, by identifying methodological tools and innovative solutions, many of which are applied and applicable.

To this purpose, the intended proposal is to structure a review and rethinking of the numerous scientific outcomes produced with European funding, in order to assess technical and financial feasibility of some applicable solutions, and to develop a learning and orientation tool to plan and design renovations.
The survey on inclusive design topics [12] will refer to several relevant community fields (IST, Information Society Technology, ICT, Information and Communications Technologies, Quality of Life, Societal Challenges - Health, demographic change and wellbeing - Personal Health and Care) and will be structured into macro groups (Universal Design and Inclusive Design, Design for needs, Assistive technologies; Assisted living).

The proposal aims therefore at sharing information, also through networking activities, cooperation and benchmarking, helping understand both how “good practices” can be exported among countries, and what are today the keywords of inclusive design [13] and which hypotheses can be formulated for the future.

References


Childhood cancer is the second leading cause of child mortality in Brazil today. The treatment of pediatric cancer – although invasive and difficult – does not determine the patient's hospitalization. Thus, the child may be treated on an outpatient basis within an ambulatory space. However, there have been changes in the nature of hospital environment since the 20th century, as well as a need for them to be multidisciplinary and, as a result, more complex.

There is little emphasis given by the discipline of ergonomics to hospital architecture in Brazil. As such, this paper aims to present a case study of an ergonomic evaluation done in the Brasília Children's Hospital in the capital of Brazil. The research focused on the spatial quality and user satisfaction through an ergonomic standpoint. It analyzed the pediatric oncology therapy area, focusing on chemotherapy treatment. Therefore, the intent here is to increase the scarce existing material on the architecture literature dedicated to the study of this spatial typology.

The Methodology of the Built Environment developed by Professor Villarouco (IEA 2009; 2012) was applied to evaluate the space. It entails four overall phases: Global Analysis of the Environment, Identification of Environmental Configuration, Assessment of Environment in Use, and Analysis of User's Perception. All this together allows the researcher an in-depth understanding of how the space is used, how the work is performed, and how the environment is viewed by those who use it. This way it is possible to detect interactions that are harmful to productivity or are likely to enhance spatial deficits.

The case study showed that ambiance is key in creating a sense of well-being, hospitality, and comfort to users. It contributed to a didactic interaction with patients, breaking the usual concept of sobriety and sterility of a hospital. This promoted the interaction between different actors, which avoided the habitual isolation of a child in new spaces and discomforts with certain therapeutic practices. Also, the ludic, recreational and teaching spaces, in conjunction with external areas, allowed the users to have a sense of belonging and appropriation of their environment, which contributed to attendance of treatment.

There are specific demands for the design of oncological ambulatory space, making architecture a powerful contributor to the better development of activities. Thus, the architect should be aware of the difficulties the space may cause the users, since certain design decisions could create serious physical barriers. Therefore, it is necessary to learn more about this type of space through detailed diagnosis’s of this architectural typology, allowing for recommendations to similar spaces. As such, this paper discusses evaluation and proposal – under the focus of Ergonomics applied to the built environment – of a children's day hospital for cancer treatment.
The airplane (de)boarding process has certainly room for improvement. One of the improvement possibilities is seat finding. To improve seat finding a Boeing 737 was equipped with spotlights above the seats that starts to become more intense when you come closer. To test the effect 10 passengers received a ticket with the number of the seat on their ticket and after that they board with same ticket, but now the spotlight is added. 10 other participants started with the light and then followed the normal boarding procedure. The effects on time were recorded and a questionnaire was used to gain insight on the experience. In both situations the boarding with light was 2 seconds faster. The experience data were hard to interpret as a part of the participants were not aware that there was a light. The first results were promising, but further research is needed to study the effect on a flight where many passengers board at the same time.
Human gaze behaviors carry a large potential for being an indicator of various mental conditions. In this study we have investigated which eye-parameters that most reliably can indicate increased mental workload. Being able to detect high mental workload in individuals, allows for early detection of potentially dangerous situations, and possibly adjustment of the information flow that creates the high workload. Poor performance due to high mental workload can bring severe consequences for critical jobs such as driving, aviation, and surgical operations. For example, in the driving context higher mental workload and poor performance can be a cause of accidents (Brookhuis, 2003)

In the study, visual N-back tasks with four difficulty levels were designed to induce mental workload for a sample of 21 university students (12 males, mean age = 25 years). N-back tasks are considered a good choice for inducing mental workload. (Jaeggi et al., 2010) Within the memory capacity of a user, it is possible to let them use more mental effort on a task by increasing the complexity level. In the experiment, the participants only task was to do the different N-back tasks, which is slightly different from using N-back tasks as workload inducer in secondary task type of experiments. NASA-TLX form developed by Hart & Staveland (Hart & Staveland, 1988), was used to measure subjective mental workload between each block of N-back. 17 eye parameters were measured using SMI RED250 mobile Eye Tracker at a sampling rate of 250 Hz.

Data from this experiment indicate that peak fixation duration was the most suitable eye parameter to estimate mental workload. It has a negative relationship with the mental workload, where higher peak fixation duration can be observed at lower mental workload and lower peak fixation duration at higher mental workload. Moreover, blink frequency, blink count, peak blink duration, and pupil diameter show a significant positive relationship to the mental workload. Most of the saccade parameters failed to show a significant relationship, while fixation frequency, fixation duration, fixation count, blink duration, saccade velocity, and peak saccade amplitude showed a partial relationship with mental workload.
Relations with the general public are a key component of many working situations. This is notably the case for pension schemes technicians. In these situations, the quality of service is conventionally measured using two sources: an array of indicators used to steer the services provided and control the work carried out, which are considered to be synonymous with quality; and continuous customer satisfaction surveys which aim to measure quality from the service beneficiary’s perspective.

However, research has shown that these indicators do not measure the full range of skills used by members of staff. Furthermore, they often have unintended consequences which actually complicate the work.

This is the case for the body employing "Pension Advice Technicians" responsible for handling the case files of beneficiaries - future pensioners - and managing relations with them. Our research shows how they ensure the reliability of the service they provide, through interaction with a number of different contact people.

Our methodology was based on an ergonomic approach to work activity. In order to determine the work dynamics, we used two analysis protocols: 12 half-days of work observation and 22 interviews with technicians on their handling of the different cases they were working on.

This paper will present the results of our research, with an emphasis on: following up the case portfolio and chasing up the different contact people involved, which the technicians are required to do on a daily basis in order to meet the deadlines for closing each case file; and how employees adapt to the beneficiaries’ requests and changes of plans for their retirement.

On the basis of these analyses of the work, we show that the technicians' work corresponds to process control involving multiple dynamics. They manage constantly evolving case files (dates, cut-offs, deadlines, etc.) and are required to liaise with other services and organisations each with their own procedures. They also have to take into account a number of limitations: technical, access to information, internal and external liaison etc. Their contribution to the quality of the service provided is therefore very closely linked to their ability to follow-up and organise the multiple dynamics over a complex timescale, which the existing indicators do not measure. This quality of service also depends to a great extent on the relationships the technicians establish with the beneficiaries themselves, as well as the internal control bodies.

This profession, which requires high levels of administrative rigour, also requires an ability to manage uncertainty, given the multiple dynamics involved. Understanding how these
dynamics are managed is vital to specify how regulatory frameworks should be applied and to build on the intra and inter-profession communication on which the quality of service depends.
Scenario-based-training (SBT) is widely regarded as an effective practice for the development of the necessary skills for working in complex systems. The debriefing is the SBT stage in which trainees have the opportunity to understand their activity in the context of the broader system performance, and by realizing the gap between work-as-done and work-as-imagined. It also allows for the discussion of the necessary resilience to accomplish the goals and opportunities to improve the socio-technical system (STS) design. The aim of this study is to discuss the use of the Functional Resonance Analysis Method - FRAM as a debriefing tool in SBT. This discussion is based on data collected during a training simulation session carried out as part of a Research and Development Project involving the development of resilience skills of grid electricians. The scenario of this simulation had a client complaining that the power had went off in his residence.

The participants identified seven functions performed by the trainees: (a) to receive the service order from the control center; (b) to go to the place where the service was requested; (c) to check if the power shortage was limited to the private electrical facilities of the client or if it had been caused by a failure in the distribution network; (d) to identify the cause of the defect; (e) to make the repair; (f) to turn on the circuit, re-establishing power to the client; (g) to inform the central operations control that the repair was made.

The use of the FRAM evidenced the variability of the function’s outputs, which allowed analysis such as: the output of function e (execution of the repair). The defect was found to be a broken cable. The Standard Operational Procedure (SOP) recommended the replacement of the damaged cable by a new one. Three work constraints, which were not anticipated by SOPs, were impacting at the moment of the repair: the need for lifting weights and using physical strength, pressure from clients, and activity carried out previously, at the same location, in an inadequate way. The work constraints, as well as the variability of the output of function (c) in terms of time, which created time pressure for all downstream functions, encouraged workers to make a temporary repair, rather than replacing the cable.

In the debriefing, two actions to re-design the STS were raised: to increase investments on preventive maintenance; to improve the design of lifting equipment and tools. The instantiation presented showed that borrowing concepts from FRAM can be useful for analyzing workers’ and system’s performance in the debriefing, since it presents the resonance arising from the variability of everyday performance and lead to recommendations for coping with the variability.
Towards an engineering process to design usable tangible Human-Machine Interfaces

Type: Abstract Oral Presentation
Category: Manufacturing

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In the wake of Internet of Things (IoT) technologies and the ubiquitous availability of computing devices in all areas of human work and life, new opportunities and challenges for creating human-machine-interfaces arose (Gorecky et al.; Schmitt et al., 2013). For those types of ubiquitous computing devices not only new software interfaces (GUI) are to be designed, but also tangible user interfaces (TUI) providing the haptic controls for manipulating the GUI and in extension tangible human-machine interfaces (tHMI), also including hardware elements for handling and operating the computing device (Pereira et al., 2013; Wächter & Bullinger, 2016). One prime example are mobile devices like tablets, which initially developed for consumer use now find their way into production settings, e.g. for machine control. When designing usable tHMI for these devices to be used on the shopfloor special requirements from industry, e.g. one-handed versus two-handed operation, must be considered. However, only rudimentary design guidelines exist and current engineering methods are not comprehensive enough to cover the design process. In this paper, we follow a design science based approach (Hevner et al., 2004) to develop and evaluate an engineering method for usable tHMI.

We empirically evaluate the design process by instantiating it to create a tHMI for a mobile assistance system for maintenance workers, detailing the individual iterative steps and focusing on the subjective quality measures for the created artifacts. Measuring electrical activity in involved muscles , following Pereira et al. (2013), we show that tHMI created using our method are objectively significantly better than current available commercial alternatives. Additionally, we show our tHMI to be subjectively preferable to a conventional tablet by evaluating feedback from potential future users employing methods like the Comfort Questionnaire for hand tools (Kuijt-Evers, Vink and de Looze, 2007) and the System Usability Scale (Brooke, 1996). The prototype resulting from our instantiation provides a basis for useable mobile devices in an industrial context and is rated as highly suitable for use (Wächter, Neumann and Bullinger, 2017).

Hence our proposed engineering process can be considered one of the first comprehensive approaches that covers all aspects of designing, building and evaluating tHMI (for IoT devices in production settings) and is supplemented with a choice of rigorous methods for both subjectively and objectively measuring its outcomes' usability in the field.
Measurements of movements and neck/shoulder pain among forklift truck operators

Type: Abstract Oral Presentation
Category: Manufacturing

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Background: Work in large, high level warehouses as a forklift truck operator involves repetitive arm work, unnatural neck positions, and extensive neck movements. It has been estimated that there are 150000 forklift truck operators in Sweden, six million in Europe and, globally about 20 million.

Purpose: The aim of this study was to investigate prevalence of neck/shoulder pain, perceived health, and work load among male forklift truck operators. A further aim was to analyze neck and arm movement patterns and working postures during a working day.

Method: A cross-sectional cohort study was conducted in 2017 including 27 randomly selected forklift truck operators at a high-level warehouse, average age 37 years (SD 12), BMI 27 (SD 3). The used questionnaire comprised questions about sociodemographic, neck and shoulder pain, health, work ability and work demands. Upper arm postures were measured during the whole work-day using inclinometers (accelerometer attached on the upper arm) and validated using video analysis on 20 subjects. For the neck the measurements were focused on rotations in the horizontal plane, for which the gyroscopes in two (head and upper back) inertial measurement units (IMUs) were used. The back gyroscope rotation in the horizontal plane was subtracted from the head ditto, and the left/right head rotations above 45 degrees in less than 1 second were counted. Three types of forklift trucks were used; low-lift order picker, reach decker and counterbalanced tilting mast.

Results: In the questionnaires, 15% perceived poor health, 37% reported neck pain (mean intensity 5.9 on an 11-item scale), and 48% shoulder pain (mean intensity 5.5) the latest seven days. Physical work load was reported on a 20-item scale: 12.1 (SD 2.4) and work ability was 7.5 (SD 1.8) on an 11-item scale. On an average, the forklift truck operators worked with the right and left arm elevated > 45 degrees for 8% and elevated > 90 degrees less than 0.5% of the total workday, respectively which on average was 6.3 hours. In preliminary results (n=19), the mean number of head rotations (i.e times that driver looked to the right plus the times the driver looked to the left) was 222 (SD 33) rotations/hour.
Conclusion: Neck and shoulder pain is a major problem for forklift truck operators, as supported by the present pain reporting. The technical measurements showed that the arms were elevated limited time during the working day. The number of head rotations seemed high, although reference material for this new parameter is still lacking: This study indicate that there is a need to improve the working conditions for the forklift truck operators. For examples, efforts could be made to increase job task rotation, as forklift truck operators today usually have very little variation of work tasks.
[933] Analysis of physical workloads and muscular strain in lower extremities during walking with sidesteps and “mixed” steps in simulated U-Shape in the lab

Type: Abstract Oral Presentation
Category: Education and Training

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The muscular strain at the lower extremities was analysed in the IAD-lab using the simulated U-shape with short-cycle tasks (approx. 80 sec.) with walking „sideways“ and „mixed“ walking (sidesteps and normal steps). Additional focus was analysis of the effects of “walking sideways counter clockwise” vs. “turn clockwise sideways” on the muscular strain in the three selected muscles in the right and the left leg. Four different scenarios were tested and analysed. In two scenarios walking with “sidesteps” the U-shape consisted of five work stations and was 2m long and 1.4m wide. In two scenarios with “mixed” walking the assembly U-shape was about 3.2m long and 1.4m wide.

The EA-activities in selected three muscles in the left and right legs were analysed using surface EMG-method. Six test subjects, between 19 and 30 years old, without experience in assembly work took part in the study.

The results complement the study of Wakula et al. (2017) and show that walking „sideways“ counter-clockwise (CC) cause the selected right leg muscles more strain compared to the left leg muscle by some test persons. When walking clockwise (C) two muscles in the left leg were more stressed compared to the right leg muscles.

Changing the direction of moving/walking at the U-line: CC -> C -> CC -> C was positive for the muscular strains - it brings the balance of the EA values in analyzed right and left leg muscles.

Walking with “mixed” (lateral and two-three normal) steps in the analyzed U-shape did not reduced muscular strains in the legs compared to walking with “sidesteps” only.

Practical Relevance

The results of the analysis of muscular stress/strain in the right and left legs reveal the influence of the direction of moving at simulated U-shape in the lab. This leads to the conclusion that a moving and circulating strategy is as variable as possible with regard to changing working stations in the U-shape with short-cycles in practice.
The notion of an optimum temperature in which to enjoy home life, be productive at work, travel comfortably, and participate in social and relaxation activities is a highly contested one. A large and diverse literature using multiple theoretical frames shows the temperate deemed comfortable at any one time depends on a very wide range of variables, not all of them related to the ‘objective’ air temperature. These include the task at hand, gender and physical characteristics, cultural norms and practices (such as appropriate levels of clothing and bathing) social and status factors (where, for example, being able to keep yourself cool is a sign of wealth and progress). Indeed, perceptions of comfort can be manipulated by a wide range of sensory stimuli including the hue and intensity of lighting, material choice and sound. Beyond these physiological and psychological characteristics, the choice of an appropriate temperature is also influenced by within and between group power structures and relationships, often played out for example in workplaces as part of office politics. It is in these contested spaces that adaptations, even sabotage to carefully engineered systems can occur as individual end-users attempt to regain control over their comfort. This can lead not only to buildings and thermal control systems not achieving their expected performance but to secondary effects on human relationships, work efficiency and life satisfaction.

Guiding appropriate engineering and design solutions for heating and cooling must be able to account for the flexible and contested nature of thermal comfort. In this study the first stage of Cognitive Work Analysis (a Work Domain Analysis (WDA)) is constructed to explore these issues in a systemic and user-centred fashion. From this, user-thermal requirements will be extracted, as well as the potentials for unexpected user behaviours. This includes instances where behaviours are constrained and whether those constraints could/should be reinforced or removed. The WDA will also be systematically explored to reveal the ways in which existing (and future) heating/cooling technologies could be combined to support key user requirements. From this a set of innovative – radical even – technology combinations and initial design solutions will be derived. The fundamental goal is to approach thermal comfort from user-needs upwards rather than engineering or technology downwards. The results are intriguing in terms of new ways to meet increasingly aggressive energy use reductions.
Introduction:

Low back pain (LBP) seems to be a general epidemic, it was found to be more prevalent in certain occupations compared to the general working population. Besides others, standing is considered to be a risk factor in the development of LBP. A possible pathological mechanism in the development of LBP during standing is the constrained posture and thus forced immobility over prolonged periods. Therefore we aimed to investigate whether and how pelvic tilt (as a surrogate parameter for lumbar spine movements) during ~4.5 hours of static standing is associated with the development of low back pain. In order to distinguish between age, sex and standing work experience, we measured pelvic tilt during multiple hours of standing in younger (including male and female) and older subjects as well as standing workers. It was tested if ‘pain developers’ (PD) and ‘non-pain developers’ (NoPD) showed significant differences in movement patterns.

Methods:

60 healthy subjects from three groups were recruited to participate in the present study (30 younger, 15 male, 15 female; 15 older males and 15 male standing workers). Participants stood for four hours and 35 minutes in three periods with two additional seated breaks (35 and 10 min) after 110 and 220 min standing, respectively. 3D gravimetric and polarized optical position sensor (PS) on the spinal process of S1 was used to measure continuously during the standing periods. Subjects rated their low back pain on a numeric scale from 0 to 10 (NRS) every 12.5 min. Post hoc, participants were assigned to one of two groups by NRS results, PD and NoPD. A multivariate mixed model approach with the factors group, time and pain with interactions was conducted.

Results:

55 complete datasets were analyzed in the final results of which 22 were assigned to the PD group (40%). NRS ratings increased during the standing periods and decreased almost to baseline level during the seated breaks. Interquartile ranges of pelvic anterior/posterior and lateral movements ranged between 1 and 4° in all measured periods. Lateral pelvic tilts tended to be smaller at the start of the exposure periods compared to the end; however, the differences were not statistically significant. No statistically significant differences were found in the pelvic movement (anterior/posterior and lateral) between groups and PDs vs. NoPDs (p>0.05).

Discussion:
Our results showed no clear association between lumbar spine movements and LBP development during multiple hours of standing. Age and standing work seem to increase the risk of developing LBP. Neither groups investigated, nor PD or NoPD groups, differed in any of the measured parameters. Thus, measures of pelvic mobility are not useful to predict LBP development in healthy adults.
Augmented reality is one of the upcoming topics in the development of human machine interfaces. The most promising technology using augmented reality to assist the user in his driving task is the Augmented Reality Head-Up Display (ARHUD).

The main difficulty for ARHUDs is the challenge of precisely positioning virtual content in the real environment. Pfannmüller, Walter and Bengler (2014) showed that deviations of 3 to 6 meters from the ideal position already have a negative effect on system usability. This criterion is problematic to verify in road based experiments because the deviation between virtual content and the environment cannot be determined.

In the presented study, latency between physical event and displayed content is considered in order to provide a quantifiable criterion. In a driving simulator the influence of a contact-analog lane marker, which was subjected to different stages of latency (17 ms, 50 ms, 100 ms), is examined. A detection response task was conducted to evaluate the subjects' reaction times and cognitive workload (Bubb, Bengler, Grünen, Vollrath, 2015). Driving performance was tested using the standard deviation and the number of zero crossings of the steering angle (Knappe, Keinath, Meinecke, 2006). Finally usability was assessed by applying the system usability scale (Brooke, 1996).

Changes in latency have a significant influence on stress and usability. Specifically latencies over 50 ms have a negative effect on the dependent variables. Results suggest that latencies of up to 50 ms are still considered acceptable in terms of usability as evaluated in the implemented use case.

In the first study a very basic human machine interface (HMI) design consisting of virtual lane markings in red as an overlay to those on the road was used. This induces a substantial problem. In overlaying a virtual line onto a real line the user can detect even small discrepancies and thereby detect small latency as well.

In a second experiment the HMI was especially designed to mask latency born discrepancies between virtual and real objects. The setup of the first experiment was reproduced and stages of higher latency were added. Again driving behavior, stress, reaction times and usability were recorded and analyzed.

A significant effect of HMI design on the afore-mentioned dependent variables was recorded. It was shown that a proficient HMI design can greatly improve user acceptance of latency. This can help to correct the effects of latency which originate in sensors, underpowered 3D hardware or simply in the time needed for data to be transferred from one to the next processing step.
The feasibility of using heart rate variability to measure stress in occupational settings: lessons from healthcare

Type: Abstract Oral Presentation
Category: Healthcare

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Much of the research on the interruptive aspects of clinical work is founded on notions that events such as interruptions contribute to a clinician’s cognitive load, and that the cognitively burdened mind is then more prone to poor performance, including making errors. Directly and continuously observing the cognitive state of a clinician over time, in parallel to their work activities, is not possible. Some researchers have used the NASA task load index as a proxy, applied at several disparate time points in during work observations, but this measure cannot be applied in a continuous way.

Heart rate variability (HRV), that is, variations in the time between successive heart beats, is governed by activity of the both the sympathetic and parasympathetic nervous systems. Reduced HRV indicates an increase in the contribution of the sympathetic (fight or flight) nervous system to the heart beat regulation. Changes in HRV over time have thus been used as a marker of an individual’s system load, such as overtraining in athletes or early detection of infection. It has also been used as a measure of stress or cognitive load.

In theory, HRV has the potential to be used as a continuous indicator of a clinician’s cognitive state and can be recorded in parallel with observations of task activities. This would enable assessing which aspects of events during the work process contribute to increased cognitive load, and whether that was linked to negative outcomes, such as task errors. Such insights could allow adjustments to clinical practice to manage cognitive load and hence mitigate error risk. The approach would also be applicable to many occupational settings beyond healthcare.

In reality, however, interrogating these questions requires recording high quality data and applying advanced analysis techniques. Drawing upon a study in which heart rate data was collected on emergency physicians in parallel with observations of their work activities, we will discuss the feasibility of tackling these research questions, including what HRV can and cannot tell us about cognitive state, and considerations for accurately measuring individual heart beats in the field. We will also outline the important challenges and considerations for analysing HRV as a function of observed activity.
Auditory alarms are most effective when designed to convey an appropriate hazard level. Intensity (subjectively perceived as loudness) plays an essential role in perceived urgency. However, intensity may be dictated by factors outside the alarm designer’s control (e.g., background noise, manufacturer’s sound system specifications). Therefore it is essential to examine other acoustic parameters that can be used to convey scalable levels of perceived urgency. Previous work suggests that looming sounds, or sounds perceived to be coming towards a listener, can be scaled by manipulating the rate of change (ROC) in intensity of the sound. Namely, sounds that increased in intensity quickly were reported to elicit faster response times than sounds that increased more slowly. However, these studies neglected to consider the impact of overall intensity. Thus, the present study measured urgency ratings (highly correlated with response times) of auditory looming stimuli with different ROCs in intensity that were also equated for overall intensity. Results revealed no differences in urgency ratings across the three ROCs. These results confirm the importance of intensity in designing auditory alarms and suggest that parameters other than ROC in intensity must be explored to achieve scalable alarms.
The eye tracking technique has been widely used in usability evaluation of electronic information systems. Eye tracking collects users’ visual scanning behaviors during interaction with the system. While eye tracking data contain rich information about user’s performance, appropriate use of eye tracking findings requires sound analysis and correct interpretation. In this methodology paper, we will (1) analyze the structure of a saccadic eye movement (saccade) and its underlying cognitive mechanism, (2) describe the method of mapping the eye ball location to a two-dimensional visual field, (3) discuss the relationship between eye tracking and other performance indicators.

Saccades are the primary means for an individual to direct gaze to the point of interest. Saccades thus play a crucial role in visual information processing. A saccade can be characterized with temporal parameters (e.g., latency or initiation, velocity) and special parameters (e.g., amplitude, accuracy). These parameters are influenced by one’s cognitive processes. This association of cognitive activity and saccade behavior provides the scientific basis for inferring cognitive processes through analyzing eye tracking data.

The pupil-center-cornea-reflection method is a non-invasive eye movement recording technique with high spatial accuracy, and popularly used in usability testing. Using this technology, a beam of infra-red light is impinged upon one’s eye. The light is absorbed in the pupil area forming a distinct circular shape, while the light is also reflected at the highest point of the cornea sphere with respect to the light source. Through image processing, a vector between pupil center and cornea reflection point is translated to a gaze point on the visual field. To accurately record the location of a gaze point on the visual field, a calibration procedure must be carried out prior to actual eye movement recording. This calibration is critically important to the quality of the eye tracking recording, and consequently to the interpretation of the findings.

In usability evaluation, gaze plots and heat maps are two types of commonly used graphical presentation of eye tracking data. A gaze plot depicts gaze locations, gaze durations, and a visual scan path over time. A heat map looks like a blurred version of a gaze plot. With color coding, the heat map provides a gross picture of gaze distribution on the visual field. However, gaze plots or heat maps are not the primary measures of user’s performance. Gaze shift patterns are not always in sync with other performance indicators and provides only supplementary information. To correctly interpret eye tracking data, one needs to understand the distinction between primary and secondary performance measures, the information contained in a secondary measure, and assumptions required to make an inference from the secondary measure. A meaningful use of eye tracking data can enhance the effectiveness of usability evaluation.
In order to promote the development of science and technology, and to improve people's quality of life. People are carrying out a variety of scientific experiments, many of which are highly dangerous experiments. In order to better protect the safety of the human body, we need a device that can replace the real person to experiment, to test the thermal resistance of the garment and to evaluate the environmental parameters. Thermal manikin is a device that simulates the exchange of heat and moisture between the human body and the environment. Thermal manikins have been quite mature in foreign countries, but there are still few studies in China. So far, more than 100 thermal manikins have been successfully developed worldwide. Thermal manikins have the repeatability, the processing of production process has taken into account the standard of the average person, at the same time, it can eliminate the influence of the individual differences of physiological and psychological factors on the experimental results. It can also effectively solve the problem of experimental candidates, thereby shortening the experimental cycle, reducing experimental costs, high accuracy. According to their different uses, they can be divided into: Only sensible hot and dry thermal manikin; Can simulate real sweat sweating thermal manikin; Breathing manikin that simulates human breathing; Immersion thermal manikin for underwater testing; Different from the traditional manikin: warm numerical manikin and local thermal manikin prostheses and fake head. Immersion thermal manikins are primarily used to measure the thermal resistance of garments or life-saving equipment that need to work underwater, and to evaluate the thermal comfort of the garment. For immersion thermal manikins, to achieve the waterproof function and to control the manikin through the program and to achieve continuous measurable under the water are the technical difficulties. In this paper, I give a brief introduction to the software system, hardware system and the construction of immersion thermal manikin.
Background:

Crossing-domain collaboration becomes the trend of future work. Communication is the main factor of successful collaboration work in cross-field. However, one of the key challenges is knowledge differences impedes communication. The objective of this study was to explore how the layperson communicating with expert and describe the characteristics of communication.

Methods:

The dyads of expert and laypersons were communication in the experiment. The laypersons' experiment task was to understand the HIP model via a conversation with the expert. No time limit was given in the conversation. There were 1 expert and 10 participants joined the experiment (5 male and 5 female). Their age was between 20 to 31 (Mean=24.5 years, SD = 4.0 years). After the task, the participants would express their thought about the communication process and share their expertise communication experience in everyday life.

Results:

The words of expert speakers in the conversation about 85 to 88%. The average time participants spent in communication is 49 minutes (SD = 15.6). Three main conversation types of layperson were noted: ask questions before the end of the communication, ask questions immediately in the communication (interaction of high-frequency), ask questions immediately in the communication (interaction of low-frequency). The type of ask questions immediately in the communication (interaction of high-frequency) performance was better than others types.

Conclusion:

An expert and a layperson talking with each other must assess each other's expertise and accommodate their differences. From the expert perspective in this study, it is hard to judge what the layperson's understanding level is in the communication process. Therefore, the way the expert relied on was to ask layperson questions to estimate whether he/she comprehended the expertise. The results show that layperson feedback affects the communication performance with the expert.
Both pressure and shear force on the seat contact surface has been suggested to affect sitting discomfort (Reed et al. 2000). It is generally recommended that peak pressure should be reduced and located at the area of the ischial tuberosities. Though large differences in pressure distribution and sensitivity among individuals make specifying a quantitative “optimal” pressure distribution difficult, some investigators tended to determine ideal distribution (Mergl et al, 2005). It is also recommended that surface shear on the seat cushion should be minimized by increasing the cushion angle and/or contouring the cushion (Reed et al, 2000). Goossens and Snijders (1995) theoretically and experimentally investigated the relationship between seat and backrest inclinations for removing shear force. They found that a fixed inclination between seat and backrest can be chosen between 90° and 95°. However, few researchers have verified whether people prefer a seat pan angle minimizing the shear force. This was one of the research questions we investigated experimentally using a newly built multi-adjustable experimental seat (Beurier et al, 2017) in a research program for improving the comfort of economy class aircraft seats.

Two imposed seat pan angles (A_SP=0°, 5°) and one self-selected were tested for two backrest angles (A_SB=10°, 20°, from the vertical). The flat seat pan surface was used. The backrest was composed of three panels positioned at specific anatomical points (occipital bone, T9 and L3). 18 males and 18 females were recruited based on their BMI and stature. Seat pan length was controlled to keep approximately a free distance of 70mm behind the knee. Participants were asked to keep their back in contact with the lower and middle supports. The foot support was adjusted until the knees were set at approximately 90 degrees. All contact forces in the seat symmetric plane were measured once naturally seated. The six conditions were tested randomly.

Shear force on the seat pan surface was found significantly affected by both seat pan and backrest angles. As expected, shear force increased with backrest recline and decreased with seat pan recline. No significant difference in self-selected seat pan angle was found between two backrest angles. An average of 6.2° (±3°) was observed. Shear forces were 9.6%, 6.4% and 5.4% of body weight on average respectively for A_SP of 0°, 5° and self-selected. The lowest shear force was obtained when participants could self-select their seat pan angle, supporting the idea that seat pan should be oriented to minimize shear force. However, self-selected angle did not completely remove the shear. A zero shear would require a more reduced trunk-thigh angle, suggesting a minimum trunk-thigh angle should also be maintained.
The analysis of foot-eye coordination strategies among middle-aged and elderly adults - a case study of foot positioning

Type: Abstract Oral Presentation
Category: Others

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The purpose of this study is to help prevent trips among middle-aged and elderly people by analyzing their foot-eye coordination strategies for foot positioning tasks in different experimental conditions. 10 older females above 55 years old and 10 young females ranging from 20 to 30 years old were recruited. All of them had 20/40 vision or better, achieved a score higher than 41 on Berg Balance Scale (BBS), and completed Timed Up & Go Test (TUG) in no more than 12 seconds.

The experiment was a 3x2 factorial design. There were 3 levels of obstacle height (0cm, 5cm, 10cm), whereas 2 levels (1step, 2steps) were set for the distance between the obstacle and the target. In every trial, each participant had to walk from the starting position, and step over the obstacle while completing the foot positioning task. If the participant’s both feet are placed within the target without kicking the obstacle, the trial is defined as a success. Every of the six conditions needs to be successful for five times, or the participant cannot proceed to the next condition. Besides, two different colors (among red, orange, yellow, green, blue and purple) will be displayed through the monitor in front of the walkway from toe-off to mid-swing and from mid-swing to heel-strike of the leading foot respectively. After the participant completed the foot positioning task, he or she had to recall the colors been seen as the performance measure of the secondary task. Each participant was required to wear the eye-tracking glasses and motion capture suit, for collecting gaze and motion data.

All collected data were normalized to 100% of the gait cycle, and hence 50 equal segments for every 2% of the gait cycle were divided by 51 key frames. There are 37 parameters obtained, including the angles (roll, pitch, yaw) and positions (x, y, z) of the hip, knee, and ankle joints for both feet and the vertical viewing angle. Principal component analysis (PCA) was first conducted to reduce data dimension. All PCs were extracted until they accounted in total of 85% of variance. According to the participant’s age, the samples were divided into two groups. Then, ANOVA was used to test whether the average of each PC score has significant difference among the two groups. If a significance was found, cluster analysis was then used to determine different strategies based on the PC score. Subsequently, MANOVA was performed to test if the strategies affect the foot positioning errors and task completion time significantly. In addition, chi-square test was performed to find out the relationship between the strategies and obstacle heights, distance between obstacle and target, and the performance of the secondary task.
Understanding resilience and adaptation in the blood transfusion process using employee accounts of problem resolution

Type: Abstract Oral Presentation
Category: Healthcare

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Background

Blood transfusion is usually considered a reliable procedure. Everything is expected to be satisfactory if staff comply with standard operating procedures (SOP). The focus for improvement has been on assessing the extent of staff adherence to evidence-based guidelines. This approach often fails to understand many adaptations staff need to make to deal with the complex and dynamic environment and thus does not identify meaningful and credible information about how to improve the process. There is an urgent need for better understanding of the adaptation and resilience of healthcare staff in the blood transfusion process to facilitate the design of more efficient and safer blood transfusion processes.

Aim

To explore a new way of discovering the extent to which the processes involved in transfusion are being adapted and using this for process redesign.

Methods

Three hospitals in England were visited to assess a method of identifying adaptation and resilience. The complete vein to vein transfusion process was investigated. An open question was adopted, based on previous studies in a hospital dispensary (Sujan, 2011a,b) which allows staff to develop their account naturally from identifying a problem to volunteering information on any adaptation(s) used to resolve the issue. Staff were interviewed and asked the following question.

“Please give a short outline of the biggest or most recent difficulty that you have faced when carrying out this procedure and what did you do about the issue?”

Their responses were captured and analysed using the following three considerations: why they adapted?; how they adapted?; how they feel about their adaptations?

Results

All employees questioned (n=37) gave at least one example of a problem/adaptation and several gave more than one (total n=66).
They usually adapted to overcome actual or potential difficulties with processes and to cope with deficiencies in staffing, resources or training.

The ways they adapt can be categorised into: 1) preferred adaptations – developments expected to improve the process; 2) forced adaptations - workarounds and coping strategies when ideal solutions are outside of their control.

Adaptations are made within their sphere of influence, and participants felt managers may have opportunities to make more resilient changes, while frontline staff may be reluctantly forced to make adaptations to get things done. Under-resourcing of the UK National Health Service (NHS) means adaptations can result from an acceptance that requesting more staff, training or equipment is not realistic. Understanding these drivers, mechanisms and experience of adaptations at different levels suggests possibilities for system redesign and improvement.

**Conclusion**

This research is demonstrating a useable method to understand work as imagined compared to work as done (Braithwaite, 2016) and to assess resilience within an organisation’s transfusion process. Further research will be undertaken to evaluate the resilience in more detail.
The Analysis Method of Visual Information Searching in the Human Computer Interactive Process of Intelligent Control System

Type: Abstract Oral Presentation
Category: Education and Training

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Introduce

Through the reliability analysis of operator information searching in intelligent control system, this paper presents the information structure relation models and physiological evaluation analysis methods of digital and intelligent control visual information interactive interface so as to improve the human-computer interaction in the system effectively.

Background

With the rapid development of computer technology and information control theory, the control system becomes more complicated and intelligent. Especially in the background of large data, intelligent control system such as process monitoring of production line, intelligent traffic, police monitoring, satellite GPS, terrestrial geographic information system and other complex information display is characterized by a large quantity of information carrying capacity, complex information structure and task execution entering complex cognition. When the operator executes task such as producing or dispatching, the complicated human computer interactive process increases the cognitive load of the operator. Meanwhile, the execution task is difficult and the execution environment is complicated in the complex information system, which also brings the system unpredictability. The system is at high risk, so minor errors can lead to failure of the mission and cause major accidents easily. As the back-end of system operation, visual information presentation of intelligent control system has become an important means and operation basis for people (operators) to obtain information, make inference and evaluate decision.

Method

The complicated information in the system is analyzed and processed by the computer and finally presented to the operator to observe, analyze, judge the situation and make decision as visual information sources and bases. Therefore, it is necessary to classify, cluster and explore the reliability analysis method of visual information searching in intelligent control system. That should start with the cognitive behavior of visual information searching in the human computer interactive process. Then we can establish a physiological evaluation model of visual information which is the premise of the interface design of information interaction.

On the premise of visualization structure analysis of complex network information, taking reliability analysis of operator information searching as key point and main line, this paper studies characterizations of information elements relationship, information multi-dimensional attributes, information layouts and coding rules in information interactive
interface. Therefore, this paper presents the analysis method of visual information searching in intelligent control system.

Conclusion

The rational design of intelligent control system plays an important role in maintaining the safety and stability of production and operation in large enterprises. The analysis method of visual information searching requires a large quantity of complex information classification, clustering, the establishment of visual cognitive information structure model and efficient information interaction. Besides, it also need to establish multi-objective and multi-dimensional information evaluation method on dynamic reliability of information interaction interface in intelligent control system.
Identifying Work System Barriers and Facilitators to Resiliency of Informal Caregivers of Patients with Dementia

Type: Abstract Oral Presentation
Category: Healthcare

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Background: Informal caregivers (unpaid, nonprofessional) of a person with dementia (PwD) face a myriad of challenges due to the dynamic and unpredictable nature of the illness and its symptomology. The challenges faced by informal dementia caregivers often lead to negative physical and psychological outcomes for both the informal caregiver and the PwD. However, some caregivers exhibit what is referred to as caregiver resiliency, which can be defined as a property of a system (i.e., an informal caregiver in a care system) and refers to the ability of a system, e.g., the caregiver work system, to sustain required performance under expected or unexpected conditions [1, 2]. Caregiver resiliency can affect caregivers’ ability to provide optimal care to the PwD. Identifying caregiver work system barriers and facilitators can point to potential mechanisms for improving caregiver resiliency.

We applied a work systems model, the Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 model, to examine the barriers and facilitators to informal caregiver resiliency. SEIPS 2.0 is a person-centered adaptive feedback model in which the five elements of the work system structure (environment, individual, organization, tasks, and technology/tools) interact to perform the process of providing care, which produce outcomes that feedback into the system.

Objective: We aimed to identify work system barriers and facilitators that influence caregiver resiliency.

Methods: We conducted semi-structured interviews with 20 informal caregivers focused on specific events that were challenging when providing care. For the purposes of the present analysis, we focused on the process of managing behavioral symptoms. A thematic analysis was conducted [3] guided by the SEIPS 2.0 model.

Results: We identified four themes that represent overarching categories of work system barriers and facilitators that influenced caregiver resiliency: 1) stability of informal caregiver physical and/or emotional health – participants described how physical and/or emotional health affects their ability to manage unpredictable behavioral symptoms, 2) access to family support – participants explained the importance of family emotional support when unpredictable behavioral symptoms occurred, 3) availability of care resources – participants described challenges finding and accessing resources to support management of unpredictable behavioral symptoms, and 4) ability to create and implement care strategies – participants expressed the need for creating and implementing personalized care strategies to address unpredictable behavioral symptoms.
Discussion: As a critical first step in understanding caregiver resiliency, we identified both barriers and facilitators across each element of the caregiver work system that influence caregiver resiliency. Future research should focus on creating and testing a model of caregiver resiliency so that more guidance on how to reduce specific barriers to resiliency can be addressed.
During an automated drive, drivers will be able to perform different non-driving-related tasks, such as writing text messages [1] or watching videos [2,3]. However, their drowsiness might still represent a system limit [4]. To date, studies have shown that drowsiness develops more slowly when participants execute a non-driving-related task compared to being inactive [5] or when participants perform a motivational compared to a tiring non-driving-related task [6]. However, previous work has failed to evaluate the reactivation potential of different non-driving-related tasks, when drivers are already drowsy [4].

Therefore, this study investigates the potential of non-driving-related tasks to minimize drivers' drowsiness. To simulate an automated drive in a real driving environment, we used a Wizard-of-Oz approach. For this we modified a right-hand-drive vehicle (Audi A4 sedan). During the experiment 71 participants experienced a relaxation phase (18.5 minutes), a reactivation phase (8.5 minutes) and an effectiveness phase (10 minutes).

The relaxation phase, which was implemented to generate drowsiness, can be considered as successful, as a significant increase of drowsiness was found. This was subjectively assessed by using the Karolinska-Sleepiness Scale (KSS). After the relaxation phase the sample was divided into three groups that were given different non-driving-related tasks. One group was asked to write down a dictation. Another group was asked to perform a sportive activity (handytrim). This activity was tested as many people suffer from back problems due to having desk jobs. Using travel time to improve physical fitness could increase the benefits generated by automated driving systems to both drivers and society. The third group was asked to continue to relax.

A KSS-Score greater than 7 was considered as a system limit, based on the findings of Ingre and colleagues [7]. It was found that offering non-driving-related tasks has the potential to be a suitable driver-state-related option for managing driver drowsiness, as no participant of the handytrim or dictation group exceeded level 7 after the reactivation phase. Even after the effectiveness phase, there was still a major difference between the number of participants exceeding level 7 between the relaxation (38.9%), the dictation (10.6%) and handytrim (15%) group, indicating that the reactivation remains effective even beyond the reactivation phase. Further research is needed in order to identify the critical drowsiness level in the context of automated driving.
Anthropometry plays an important role in industrial design, ergonomics and clothing design. Manual measurement of anthropometry is time consuming. With techniques for digital anthropometry it will be easier to adjust (automatically) the workplace to the anthropometry of the worker. The workplace adaption to the worker is important for a higher productivity and health prevention. There are different methods of digital anthropometry. The approaches based on low-cost techniques (like microsoft® kinect®) analyse depth images and silhouettes [e. g. Robinson & Parkinson 2013; Annichini et al. 2013; Aslam et al. 2017] or automated calculated stick figures of the kinect® device [e. g. Chiu et al. 2016; Hamilton et al. 2013]. The second ones used the first generation of microsoft® kinect® based on structured light and stick figures with 20 joints. The depth sensing technology used in the second generation changed to the time of flight principle. [Lun & Zhao 2015] Also the joint number (grow to 25) and the joint position accuracy is higher [Wang et al. 2015].

This study examines if the stick figure dimensions are correlating with the anthropometric dimensions and if it is possible to get the manual anthropometric data out of the calculated parameters based on joint positions. 15 german, female participants in the age of 18 to 36 years (average age = 24.1 years) were measured manual with anthropometric instruments and digital with the depth camera kinect®. The manual measurement of anthropometry was measured up directly from the person from the anthropometric points according to DIN 33402 [2005]. The digital measurement is based on the integrated stick figure and the 25 joint positions. Based on the 3d-coordinates of these joints we analyse 1d-data like height, width and length of human body and segments. We detected different static standing poses from frontal. We want to find the best pose for calculating each parameter.
This contribution examines the possibility to use the integrated stick figure of Microsoft® Kinect® version 2 for digital anthropometry. First comparisons between the direct manual anthropometric measurement and the indirect parameter calculation based on Kinect® joints show the trend for a linear regression (e.g. see picture - arm span). Thus, a determination of a correction factor is possible. This allows a fast calculation for anthropometric dimensions, e.g. for workplace adjustments.
Ergonomics and design analysis: case of embroiderers from Pontal da Barra – Maceió – AL - Brazil

Type: Abstract Oral Presentation
Category: Others

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Title: Ergonomics and design analysis: case of embroiderers from Pontal da Barra – Maceió – AL - Brazil

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Thematic area: Ergonomics in Design

Productive sectors and services: Others
Craft productions are, above all, a form of expression of those who with skillful hands daily transform simple raw materials into art. Among the various manual typologies present in Brazil, there is the Filé of Pontal da Barra Embroidery at Maceió - Brazil as one of the most representative symbols of the culture of the state of Alagoas. Consisting of an artisan typology known for its authenticity and complexity, Alagoas Filé is an embroidery made in a net attached to the ends of a loom, resulting in authentic and geometric stitches made with cotton thread. In this context, ergonomics is an area focused on the understanding of the interactions between human beings and other elements of a work situation, so an empirical research was done at the embroiderers community at Pontal da Barra - Maceió. A methodology based on the Ergonomic Work Analysis (EWA) proposed by Wisner (1987), Guerin (2001) and Vidal (2002) was used. It is a method that assures the positivity of the transformation by its characteristics and properties of focus, order and systematicity, application of observational and interactive methods. In this perspective, Design as a multidisciplinary area, besides the morphological, symbolic, economic, functional and emotional aspects, ergonomics should be an integral part of the development of products and services, since its purpose is to develop projects aimed at improving safety, comfort, well-being and effectiveness of human activities. To make it possible, it is necessary to model the work activity, a process that is possible by the realization of EWA in order to characterize how the technical, human, environmental and social factors in a work situation determine the activities of workers (VIDAL, 2008). From the data collection and analysis, ergonomic inadequacies were identified in the embroiderers activity that can result in occupational diseases in the medium and long term, thus compromising the quality of life and the development of the activity of the Filé embroidery artisans. Such inadequacies are intrinsically related to the furniture and tools used at the activity and the absence of interventions aimed at ergonomics. The ergonomic analysis, for recommending and effecting the social and technical construction, proved to be fundamental for identification and validation of the demands found in the community of fillet embroiderers. Thus, it is understood that it is necessary to promote improvements in the workplace and in the embroidery production process, in order to improve the working conditions of craftsmen through design and ergonomics. Thus, the objective of the present work is to understand and show how design can contribute to the craft of embroiderers through participatory ergonomics, focusing on the analysis of the activity.

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**Assessing the experimental effects of interruptions and multitasking on task errors in the wild**

Type: Abstract Oral Presentation  
Category: Healthcare

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**Introduction:** Experimental cognitive psychologists have consistently demonstrated negative effects of fatigue, interruptions and multitasking on task performance and error. Testing these same effects in ‘real-world’ workplace settings is fraught with methodological challenges. Several studies of emergency physicians have demonstrated that they experience a high rate of interruptions to their work and that this rate is significantly greater than for other health professional groups. The aim of this study was to undertake a direct observational study of emergency physicians to assess whether interruptions and multitasking experienced by emergency physicians were associated with task errors.

**Methods:** Over 120 hours, 36 physicians were shadowed and all details regarding their work tasks, interruptions and multitasking activities were recorded using the Work Observation Method by Activity Timing (WOMBAT) software on a handheld computer. Prior to observation sessions, demographic details of participants were recorded and their working memory capacity (WMC) was assessed using an automated version of the OSPAN. Following each observation session clinicians were asked about their sleep in the previous 24 hours in terms of whether they had received their average, less than average or more than average sleep. Task performance was assessed in terms of number and type of prescribing errors made during the observation session. Multivariate Poisson regression was applied to determine the association between task errors and interruptions and multitasking.

**Results:** Interruptions and multitasking were each significantly associated with different types of task errors. Physicians who reported receiving less than their average amount of sleep in the previous 24 hours experienced very large and significant increases in task errors (rate ratio 16.44, 95%CI 4.84-55.81) relative to those reporting average sleep. WMC scores were negatively correlated with task errors.

**Conclusions:** Interruptions, multitasking and poor sleep were associated with increased rates of task errors among these physicians performing their everyday clinical work, confirming experimental findings. This study provides some approaches for how to tackle many of the significant methodological challenges of assessing the impact of individual and contextual factors on task errors in the wild.
Machinery and systems safety aims at prevention of occupational hazards and risks with the consequence of improving system availability and reliability as well as operational safety. Taking a comprehensive approach requires addressing different stakeholders (e.g. manufacturers, users, occupational safety and health experts) and considering risk assessments for manufacturers and users less a legal obligation but a tool to make human interaction with machines safer, ergonomic and in consequence more reliable and productive. With some future work systems remaining unchanged, others in the context of digital manufacturing may develop into cyber-physical systems. New challenges will therefore arise for human factors, ergonomics and safety disciplines as dynamics and interactions will be more predominating in function allocation, human-centred design requirements, safety measures, and intelligent environments. Therefore, the Machinery and System Safety Section of the International Social Security Association (ISSA) established a working group on human factors, ergonomics and machinery safety in order to provide information about how to integrate human factors and ergonomics design requirements into machinery construction, integration in workplace design and use at the shop floor level.

Most common design requirements and recommendations in human factors and ergonomics for improving safety in machinery and system design were identified based on reviews of relevant standards, occupational safety and health (OSH) research and OSH expertise in machinery design. Explanations on what, why, when, and how to apply requirements and recommendations will be given for three different but interwoven topics:

- ergonomics in work place design (e.g. biomechanical requirements, display and control design),
- software ergonomics (e.g. task, interaction and information design),
- psychological issues in systems design (e.g. health, safety and well-being, workload and performance, human error).

Information will be made available as a specific internet platform located at the Machinery and System Safety Section of the ISSA. So far individual sheets on biomechanical issues and on software design issues in ergonomics are available in text and pictures (e.g. work space arrangements for body postures and physical workload; task, interaction and
information design and mental workload). All information will be provided on the internet platform to guide designers and safety and health experts at early stages in machinery and systems design and to provide input for training courses by the Machinery and System Safety Section of the ISSA.
[2205] Developing a Methodology for Collecting Real-time Data of Child and Parent Responses During the Ambulatory Surgical Environment

Type: Abstract Oral Presentation
Category: Healthcare

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Background: The outpatient surgical experience can be a stressful event in a child and their parent’s life that produces feelings of anxiety, depression, and fear, with up to 60 percent of all children undergoing outpatient surgery experiencing significant psychological and/or physiological manifestations of anxiety throughout the ambulatory surgical process. The operating theater, where the majority of children are induced alone, without the support of their parents, can further contribute to children’s level of anxiety due the imposing, sterile environment. Induction rooms, which have been widely integrated into surgical environments throughout the United Kingdom (UK) and Europe, are considered to reduce patient anxiety by buffering patients from the sights and sounds of the operating theatre, thus providing a calm environment for the patient and anesthesiologist during induction. However, no empirical studies have been conducted to date that investigate the effect of using an induction room vs. the operating theatre on child and parent anxiety, respectively, during the ambulatory surgical process. Further compounding our lack of evidence regarding child and parent anxiety during the ambulatory surgical process is that the majority of evidence collected to date has focused on retrospective data that is garnered using adult proxies from parental and healthcare professional’s perceptions of what the ambulatory surgical experience is like for children.

Purpose: This research sought to examine how the use of induction rooms vs. the operating theater for anesthetic induction either intensifies or mitigates perioperative anxiety for children who are undergoing an outpatient surgical procedure and their parents utilizing real-time data collection techniques that extend equal regard to both child and parent perspectives.

Methods: As part of a multiple-case study, a methodology was designed for capturing both subjective and objective measures of child and parent physiological, psychological, and neural responses in a fast-paced healthcare environment. A web-based photo questionnaire was developed to elicit multiple-repeated assessments of child and parent psychological responses to the physical environment and determine which features in the ambulatory surgical environment either intensify or mitigate anxiety. Additionally, non-invasive technologies were utilized to garner physiological and neural responses during the ambulatory surgical process.
Results: This intensive data collection strategy yielded rich data that supports a deeper understanding of child and parent physiological, psychological, and neural responses to the physical healthcare environment during the ambulatory surgical process, while reducing biases associated with retrospective and proxy evaluations.

Conclusions: With more pediatric surgical procedures being conducted each year within the ambulatory care environment, it is imperative that the design of these facilities support the physiological and psychological needs of both the children who experience those procedures and their parents.
Definition of an occupational risk prevention approach for networked organizations: the case of road freight transport and logistics

Type: Abstract Oral Presentation
Category: Others

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Road freight transport and logistics companies represent an important sector of the French economy (10% of GDP). This sector concerns 1.8 million employees who, in terms of health and safety claims, are 2 to 3 times more likely to be injured than those in other sectors. Today, goods are handled by a succession of interconnected companies that form a complex network from the supplier to the customer. In this network each of these companies depends on what happens upstream and downstream of its activity, therefore modifying the activity all the workers of this sector. In this context, previous INRS studies have highlighted two elements. First, the phenomenon of "propagation" which questions the perimeter of the consequences / effects of a work situation element (an ICT, an organizational element ...). Second, its relation in terms of prevention: the "act elsewhere" principle which questions the most relevant work situation on which to intervene. Following these observations, and in a context of prevention of occupational risks, the INRS conducted a study whose aim was to develop a prevention approach specific to this mode of organization in network by integrating the phenomenon of "propagation and to act elsewhere". Basically, this approach called PROPAGIR includes an ergonomic diagnostic, in which the identification of companies and / or services connected to the work situation analyzed is added compared to the traditional approach. This step allows to access the sources of the disturbing factors specific to the company, but, above all, to identify those coming from the entities connected upstream or downstream. Then comes the stage where this diagnosis is discussed with all the players in the company and those of the connected companies. Among other things, this step allows to them all to share the same representation of disruptive factors but also to become aware of their role as the origin of the problems. Then comes the phase of the definition of prevention solutions. The nature of solutions remains traditional (technical, organizational and human), the added value of the PROPAGIR approach lies mainly in the fact that the solutions deployed aim to control the disruptive factors at the source rather than at the level of the situation in the environment where they express themselves. Implementing a prevention solution centered on a work situation concentrates the effectiveness of its on the disturbing factors peculiar to this situation and does not prevent the further propagation of the effects of the latter to the connected situations. To illustrate the PROPAGIR approach, an example of ergonomic intervention in one of the companies participating in this study will be presented during the oral communication.

It is not the business case
For the user centered product design within the virtual planning process, the application of digital human models has been widely established in vehicle industry since the middle of the nineties. These models are used by engineers to optimize the vehicle ergonomics in an early phase of the CAD design, thus decreasing the expensive physical tests with real subjects in hardware prototypes.

While anthropometric data for sizing digital human models are usually provided by international size surveys for different age groups, the human behaviour models are based on experimental data of healthy mean age people in general. Hence these models cannot be used for the difficult challenge of vehicle manufacturers to develop ergonomic human machine interfaces that are also suitable for ageing customers. Applying the current digital human engineering process to elderly occupants, however, is a requirement gaining importance with the demographic change in industrial countries and with a large palette of vehicles sold to the steadily growing population segment of elderly and wealthy people.

In order to fulfil this industrial requirement, the most important human engineering applications of the digital human model RAMSIS were extended to take age-related human performance changes into account. After collecting detailed user requirements and a comprehensive literature review on available age-related human performance data, the most user relevant parameters of anthropometrics, flexibility, force and vision were identified and analysed. Here, the research focused on age-related limits of gaze and peripheral vision fields, acuity, glance eversion time, limits of joint motion range as well as joint strength distributions over age.

The results of identified age-related changes of human performance were processed and transferred to the RAMSIS human model to extend the existing simulation database. The enlarged simulation database facilitates applying the current human engineering standard applications of RAMSIS to occupants with age-related performance restrictions. These applications include e.g. the analysis of visibility conditions of displays, task-specific posture prediction, reachability and operation force analysis of devices in virtual vehicle environments.

The differences in simulation results of different age groups were analysed with respect to relevance and significance in the ergonomic vehicle development from a user’s point of view. For this typical automotive test use cases were set up for the criteria posture, reachability, force effort and visibility for occupant models in a vehicle model. The quantitative simulation results such as body point coordinates, accessibility and vision limit surfaces as well as force values significantly differ between the age groups.
Hence, the extended simulation methods of RAMSIS reflect the consequences of age-related performance changes of humans and support important human engineering applications for age-based automotive product planning.
Impact of adaptive behaviours on thermal comfort in aircraft cabins

Type: Abstract Oral Presentation

Category: Transport

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With the development of air transport and improvement of living standard, people are increasingly demanding comfort when travelling by air. The recommended range for comfortable air temperature in an aircraft cabin was within the ranges of 18–28 ºC as prescribed in the standards (ASHRAE 2013a; CMH 1996; CEN 2013). However, the designed thermal comfort environmental parameters is basic on the experiments in climate chamber, in which the effect of adaptive behaviours on thermal comfort was not considered or studied. Furthermore, the rules of behavioural and psychological responses while boarding an aircraft cabin in winter remain unclear.

To examine the impact of behavioural adaption on thermal comfort, two comparison studies were conducted in a model aircraft cabin in Chongqing University. In series I, 32-68 subjects participated in different experiments, i.e. at air temperature 20 ºC, 22 ºC, 24 ºC, and 26 ºC, in which the clothing insulation and personal air supply were controllable by themselves in a certain degree, and meantime the thermal environment was evaluated. In the series II, 20 subjects evaluated the conditions as same as series I, while the behavioural adjustment were not allowed.

Results show: Subjects are more comfortable when they can actively control the microenvironment by behavioural responses than they are not in the same conditions. Their thermal sensation are more neutral, the perceived air quality are better and the skin temperature are more stable with thermal environment. Thus, to evaluate and create a thermal comfort environment in aircraft cabins should take the factor of adaptive behaviours into consideration.

The passengers who made adjustments possibly had a narrower acceptance threshold or a higher expectancy regarding the cabin environment, causing a quite different percentage of subjects who are sensitive to discomfort environment in different clothing or nozzle opened conditions. That makes the precise evaluation of thermal environment more difficult and complex.
INCREASING ATTENTIVENESS’ STUDENT WITH AUTISM SPECTRUM DISORDER (ASD), ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD), OR TYPICAL DEVELOPMENT (TD) USING COGNITIVE ERGONOMICS THROUGH VIDEO GAMES

Type: Abstract Oral Presentation
Category: Education and Training

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INCREASING ATTENTIVENESS’ STUDENT WITH AUTISM SPECTRUM DISORDER (ASD), ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD), OR TYPICAL DEVELOPMENT (TD) USING COGNITIVE ERGONOMICS THROUGH VIDEO GAMES

Theme: Cognitive Ergonomics

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Background:

Students with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), or Typical Development (TD) have limited concentration or hard to focus while they're studying. It will be resulted negatively impact on their learning outcomes. Several ways have been used to increase their focuses, one of them is video games.

Purpose:

This research's purpose is to examine video games which will be used by students with Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder ADHD, or Typical Development (TD) in National Polytechnic Jakarta in Indonesia. Therefore, attentiveness’ student with Autism Spectrum Disorder (ASD), ADHD or Typical Development (TD) using cognitive ergonomics through video games could be increased.

Design / Methodology / Approach:

This paper will carry out by giving questionnaires or doing interviews to participants with ASD, ADHD, or TD. Questionnaires will be given in daily hours of playing video games before class. Meanwhile, the observation will be observed while playing video games and not playing video games before class.

Findings:
As the examination is done to be tested, the expected output of this research is to find out whether the video games can significantly increase the attention level of study in their class or not. If it is yes, this study wants to decide what’s category of game which suits for them to increase their focus.

Research Limitations / Implications:

From the analysis conducted, the limitations can be drawn. The scope of study has been limited to students with ASD, ADHD, or TD in National Polytechnic Jakarta in Indonesia.

Originality / Value:

The paper is an attempt to open up new teaching styles for students with ASD, ADHD, or TD to increase their focuses while they’re learning. It also can be impactful on their learning outcomes.
A new blow dryer design – implications for upper arm load in hairdressers

Type: Abstract Oral Presentation
Category: Others

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Work-related musculoskeletal problems in the neck, shoulders and upper arms are frequent among hairdressers. Several of the hairdressers' work tasks imply use of the upper arm in a non-neutral position, which may strain the upper extremities. Among these work tasks are blow-drying with a hand-held blow dryer. Chen et al (2010) measured the time a hairdresser spend on different work tasks when working with a customer, and found that blow-drying amounted to 18% of the work time with men's haircut and 32% of the work time with women's haircut. A Norwegian company (Dual Air, http://www.dualair.no/) has developed a blow dryer with a two directional airflow, as compared to the traditional design of a hand-held blow dryer. The aim of the present study was to evaluate, both in a laboratory setting and in the hair salons, whether blow-drying with this new blow dryer design influenced the arm elevation of the hairdresser.

Methods

Nineteen right-handed female hairdresser working in hair salons in the greater Oslo area had the inclination of both their upper arms measured with accelerometers (Axivity AX3, https://axivity.com) for a full workday on two occasions after a period of 2-3 months using either the blow dryer with the new design or the traditional blow dryer. The order of measurement was random, with nine of the nineteen having the measurement with the new blow dryer design first. In addition, the hairdressers blow-dried doll heads with both types of blow dryers in a laboratory setting. We report here the amount of time with the upper arm above 60° inclination. Significance was tested with paired samples t-test.

Results

Nine hairdressers used only the right hand to hold the hairdryer when working in the hair salon, whereas this count was ten hairdressers when blow-drying in the laboratory. The other hairdressers changed frequently between holding the dry blower in the right and the left hand, and are excluded in the present analysis. The arm holding the blow dryer had significantly less time with arm-inclination above 60° when using the blow dryer with new design both in the hair salon and in the laboratory setting. However, the other arm showed
the opposite result in the measurements from the hair salons, whereas there was no
difference for this arm when blow-drying in the laboratory setting.

Conclusion

The blow dryer with the new design enabled the hairdressers to work with less time with
arm-inclination above 60° for the active arm holding the blow dryer. However, the opposite
result for the other arm in the hair salon needs further investigation.

References

Understanding the cognitive work underlying blood culture use and sepsis diagnosis: implications for clinical decision support development

Type: Abstract Oral Presentation
Category: Healthcare

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Background:
Sepsis, a severe complication of blood-stream infections, can lead to significant morbidity and mortality in children.1, 2 Timely and accurate diagnosis of sepsis requires the appropriate use of blood cultures. However, considered a low-risk test for a disease with disastrous outcomes, blood cultures are excessively used in practice, which may result in additional laboratory tests, unnecessary antibiotic use, prolonged hospitalization, and increased healthcare costs.3, 4

Health information technology supporting the cognitive work of clinicians and integrated into the clinical workflow has the potential to improve medical diagnoses and the use of diagnostic tests.5 As part of a project aiming to develop a clinical decision support (CDS) tool to improve blood culture use when evaluating children with signs and symptoms of sepsis, we conducted a qualitative study to examine the individual and team cognitive work underlying blood culture use and sepsis diagnosis. We will present the findings of the qualitative study and discuss the implications for CDS development.

Methods:
This study was conducted within the pediatric intensive care unit at a large urban academic medical center. Critical decision method interviews6 were conducted with 2 attending physicians, 4 fellow physicians, 3 resident physicians, 4 nurse practitioners, and 4 nurses. During the interviews, the clinicians were asked to review 1 to 3 preselected cases where a patient they had cared for had (1) a fever (a major sign of infection) and a blood culture ordered, (2) a fever but no blood culture ordered, or (3) no fever but a blood culture ordered, and to discuss the process of making the decision on (not) ordering a blood culture (e.g., information needed, critical decision points, people involved). Interview data were transcribed and analyzed using various cognitive work analysis tools (e.g., work domain analysis, information flow map, role network analysis).7
Results:

The blood culture ordering decision-making process included both analytical thinking (e.g., balancing evidence supporting and opposing the use of blood cultures) and intuitive thinking (e.g., recognizing clinical patterns based on prior experience). Information needed was distributed and shared among different clinicians (e.g., physical examination by physicians, vital sign monitoring by nurses) and technological artefacts (e.g., electronic health records). Clinicians with different levels of expertise recognized and utilized the information differently (e.g., experienced clinicians emphasizing a patient's entire condition).

Conclusion:

Blood culture ordering decision-making is a complex team cognitive process. The CDS tool for improving blood culture use needs to support both analytical thinking (e.g., prioritizing and grouping clinical data) and intuitive thinking (e.g., identifying and suggesting key patterns), facilitate communication and teamwork of different clinicians (e.g., enabling information exchange between physicians and nurses), and meet the needs of clinicians with different levels of expertise (e.g., helping inexperienced clinicians recognize a patient's entire condition).
[2186] Relationship between Acceptance of Workforce Diversity and Mental Health Condition among Japanese Nurses

Type: Abstract Oral Presentation
Category: Healthcare

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PURPOSE: Diversity management has been expected not only to progress productive nursing service, but also to promote well-being among Japanese nurses. However, Japanese conventional studies have not shown enough statistical evidence. Hence, this study examined the relationship between perception of workforce diversity and mental health condition among Japanese nurses.

METHODS: This study conducted an internet research supported by Macromill Inc (Tokyo) in 2017. We collected a total of 1,031 valid data (male=217, female=814). To assess the acceptance levels of diversity, we designed original items through the preliminary study. This scale dealt with diversity elements included in the seniority, managerial post, clinical experience, job history, educational background, age, sex, race, language, job role, employment pattern, license, personality traits, physical function, health condition, family situation, priority, location, job performance, work motivation. Acceptance levels were evaluated by (1) Refusing diversity (Resistance), (2) Ignoring diversity (Assimilation), (3) Valuing diversity (Separation) and (4) Utilizing diversity (Integration). Mental health condition was evaluated by the 12-item General Health Questionnaire (GHQ-12, standard=0-5 points, high risk=6-12 points).

RESULTS: This study conducted a logistic regression analysis (LRA) to examine the relationships between acceptance levels of diversity elements and high risk group of mental health condition with adjustment of the age, sex, license, marriage and managerial post. As the results, higher acceptance levels of the diversities of managerial post (Resistance-Assimilation: OR=0.52, 95%CI=0.30-0.92, Resistance-Separation: OR=0.44, 95%CI=0.24-0.81, Resistance-Integration: OR=0.34, 95%CI=0.17-0.69), personality traits (Resistance-Integration: OR=0.37, 95%CI=0.16-0.87) and priority to the work (Resistance-Separation: OR=0.37, 95%CI=0.19-0.71) were negatively related with high risk group of mental health condition. Moreover, higher acceptance levels of the diversities of employment pattern (Resistance-Assimilation: OR=1.82, 95%CI=1.03-3.23, Resistance-Integration: OR=2.58, 95%CI=1.29-5.15), work motivation (Resistance-Integration: OR=3.71, 95%CI=1.63-8.44) were positively related with high risk of mental health condition.

DISCUSSION: These results indicated that valuing and utilizing the difference of managerial post, personality traits and priority to the work were meaningful to promote
good mental health condition among Japanese nurses. On the other hand, in our data, it was not effective approach to utilize the part-time nurses and poor work-motivation nurses.
Distribution of the local required coefficient of friction in the shoe–floor contact area during straight walking

Type: Abstract Oral Presentation

Category: No productive sector applicable

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The distribution of local ground reaction force (GRF) and local required coefficient of friction (RCOF) in the shoe–floor contact area will provide information on the location in the contact area where a large coefficient of friction is required, contributing to the development of a slip-resistant shoe sole pattern. However, there is no study on the distribution of local GRF and RCOF values in the entire contact area between the shoe and floor during walking. We developed a shoe mounted with miniature tri-axial force sensors and investigated the distribution of the local RCOF in the contact area between the shoe sole and floor during straight walking. Four miniature force sensors were mounted on the shoe outsole. Five healthy young adult males with a mean age of 22.4 years participated in this study. Participants were asked to walk straight at their normal pace on a level resin floor under 25 different sensor layouts to measure three-directional ground reaction forces (GRFs) at 52 local positions in the shoe sole area. The local RCOF value (the maximum peak value of the ratio of the horizontal GRF to vertical GRF) was calculated at each sensor position. The results indicated that the mean local RCOF values at 29 local positions were greater than 0.4, and those at the rear foot, metatarsal head, and toe were greater than 0.6. These local RCOF values were much higher than the mean RCOF values calculated based on resultant local GRFs (0.18). Our results suggest that much higher coefficient of friction is needed to prevent local slips compared to that required to prevent a global slip between shoe and floor during straight walking. The results of the present study ultimately contribute to the understanding of the friction needed at the shoe sole area during walking to prevent slips and the development of slip-resistant shoe sole patterns.
Bowing has been done in Japan from a long time ago, and it is considered important in business etiquette. In recent years, the bowing is thought to lead to the basis of Japanese hospitality as Omotenashi and attracted attention. Especially in the service industry, they hope to improve the quality by incorporating hospitality. Studying Japanese bowing is important to understanding Omotenashi.

We measured the movement of the Japanese bowing as a target the instructors of the bowing, clarified the angle of the neck and the waist, which are important in the Bowing. In the measurement, one person's experiment participants said, "Since it is rude to divert eyes right after the start of the Bowing movement, I am conscious of seeing the other person straight after the start of movement." We thought that conscious of seeing the other person straight after the start of movement was Zanshin in the Bowing.

Zanshin is mental attitude of martial sport and Geidou. It mean unrelaxed alertness even after finishing one action. It is seen as a beautiful gesture that was caring respect for the opponent. Therefore, to acquire it will be useful improvement of hospitality.

The purpose of this research is to clarify Zanshin of the Bowing from correlation between the angle of the neck and the waist. By doing this, we will search for application to hospitality.
Fuzzy Comprehensive Evaluation Method for Assessing User Interface Design Based on Mental Workload

Type: Abstract Oral Presentation
Category: Others

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Abstract

Purpose: The human-computer interface (HCI) is the field related to communication between people and computers. However, reality shows that poor interface design can affect work efficiency, decreased job satisfaction, stress or even overloading. Therefore, the evaluation of interface design is very important as it will affect the quality of design products, and user’s mental workload (MWL) is a commonly used as an evaluation criterion. Many studies that focus on the optimization of MWL by creating appropriate designs and interfaces increase. Recently, with the goal of reducing the disadvantages of each MWL measurement when using only one tool and improve the reliability of the assessment results, there have been many studies using the multidimensional methodology to evaluate the in HCIs. However, applying the comprehensive evaluation methods based on operators’ MWL have not been studied and widely used yet.

Method: This study developed a method for assessing comparison between two user interface designs using the fuzzy comprehensive evaluation (FCE) model based on operators’ MWL. A new interface of Ship navigation control system was designed after analyzing the limitations of the original interface with new menu bar’s layout, improving color and contrasts to evaluate the MWL and compare it to the original interface. The evaluation index system (EIS) had been developed, and it includes three methods of MWL measurement: Subjective ratings (NASA Task Load Index), performance-based measures (speed and accuracy of task) and physiological measures (pupil dilation, blink rate, saccade distance, number of fixations, fixation duration of eye movement method). The weight value of the evaluation index was computed based on the combination of the variation coefficient and the entropy weight. Twenty engineering students complete the simulation using two interfaces in a randomized order and their data is used to calculate based on the FCE model.

Results and conclusions: The result of combination weight showed that eye movement method was the highest value, indicating that the physiological measurement is of particular importance for the evaluation of operator’s workload in HCI. In addition, comprehensive evaluation score of the original interface is the relatively “high” while the redesigned interface is “normal” of the MWL level. Therefore, it is not difficult for other people to make the decision, special who not acquainted with professional knowledge. Because of, in fact, decision-makers are sometimes not required to completely understand these details in most cases. This FCE model could also be applied for evaluating other HCI, but the EIS should be selected according to the actual situation of the task, the type of HClS, and the condition of assessment. It is necessary for the results will ensure the highest reliability.
Using Machine Learning to Blend Human and Robot Controls for Assisted Wheelchair Navigation

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The powered wheelchair is an enabling, assistive technology that has been used to improve the quality of life for individuals with severe disabilities through enhanced independent mobility. However, individuals with certain motor, cognitive, and visual impairments are excluded from using powered wheelchairs, thus restricting their independence and quality of life. One approach to this problem is to provide a "smart" wheelchair with a shared-control architecture. A common control split has robot autonomy handle path planning and the human user handle manual driving [5]. To maintain, or improve, an individual’s quality of life, these systems aim to provide the right amount of control to the user, in the sense that the user is given as much control as they wish within the constraints of keeping them safe.

In this work, we present an algorithm for blending user and robot control based on learned task variability. We extract this variance from a set of demonstrated executions of the task, based on the insight that variance in the demonstration data encodes allowable flexibility in the task execution. A deep learning based method is used to extract the variance from the demonstrations. The result is a shared-control, assistive robot navigation framework. Of note is that our algorithm uses demonstration only to learn task variance for blending control that is, only in order to decide how much control authority to cede to the user—and not to learn generalized motion trajectories or understand user intent.
Validation and comparison of three positioning protocols of inertial and magnetic sensors for measuring trunk movement

Type: Abstract Oral Presentation
Category: Healthcare

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Background

Work in non-neutral or awkward trunk postures is a critical risk factor for low back pain. Accelerometer (ACC) or inclinometer have been validated and used in several studies for monitoring trunk motion. The disadvantages of using ACC for trunk motion measurement include worse accuracy during dynamic motion and inability to detect the trunk rotation. Inertial and Magnetic Measurement Systems (IMMSs), which integrate accelerometer, gyroscope and magnetometer, offers the opportunity to improve the accuracy.

However, there is a lack of standardized protocol of positioning the sensors on the trunk. Different positions have been used by different research groups, which varied from (i) on the sternum and L5/S1; (ii) the upper thoracic spine; and iii) the C7 vertebrae. In this study, three protocols were written as St-S1, T4 and C7.

The main objective of this study was to compare the IMMSs for measuring trunk motion in the sagittal, frontal and transverse planes against an optical tracking system (OTS), using three different positioning protocols.

Methods

Four subjects (2 male and 2 female) were recruited and performed in an optical motion lab, equipped with Elite 2002 (BTS Bioengineering, Italy). Four 9-axis motion sensors (LPMS-B2, LP Research, Japan) were used and placed on the sternum, L5/S1, C7 and T4. Eight reflexive markers were placed on acromion and greater trochanter on both sides, and on the back at the level of C7, T4, L2 and L5/S1. The subjects were instructed to stand straight as a reference posture to start. A postural test of maximal movement in three planes, a symmetric and an asymmetric lifting test were performed following a metronome (20 bpm).

Trunk angle in three plans were calculated from the IMMSs in Euler angles. For the OTS, to calculate trunk flexion, a vector between L5/S1 and C7 was created and compared against the reference posture. To calculate lateral bending and rotation, one vector between both acromion and the other between greater trochanters were compared.

Sample-to-sample root mean square differences (RMSDs) were calculated between the criterion and three estimates from different positioning protocols of the IMMSs.

Results
The RMSDs of trunk measurement from C7, T4, and St-S1 varied during different tests. For the postural test, the RMSDs of the flexion angle were 4.7°, 3.6° and 10.0° from C7, T4 and St-S1 separately. Of the lateral bending, the RMSDs were 1.7°, 2.1° and 1.5° accordingly. The symmetric lifting task had larger RMSD in general from C7 and T4: <14.2° of flexion, while < 7.2° of lateral bending.

Discussion and conclusions

The study found that different positioning protocol had a considerable effect on the measurement of trunk movement using motion sensing systems. Hence, consideration should be made when comparing results from different measurement protocols in ergonomic studies.
How will the driver sit in an automated vehicle? – The qualitative and quantitative descriptions of non-driving postures (NDPs) when non-driving-related tasks (NDRTs) are conducted

Type: Abstract Oral Presentation
Category: Automotive

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Highly automated driving (HAD) is currently one of the most discussed innovative topics and likely to become a series product within the next few decades (Gold, 2016). From the level 3 automation (SAE) on, the driver does not have to constantly monitor the vehicle while driving (SAE J3016, 2016), which enables the driver to carry out different activities and be out of the control loop. By conducting the Non-driving related tasks (NDRT) like eating, texting, talking, relaxing and so on (Pfleging, Rang, & Broy, s2016), the driver may take other sitting positions – defined as “Non-Driving Postures (NDPs)” – rather than the driving position. Different postures result in different requirements for the seat and other interior elements, which are not necessarily fulfilled by the current driving-task-oriented interior.

An online survey (n=122) was conducted to identify the NDRTs and the corresponding NDPs. As a result, 12 activities are identified to be conducted by significantly (α=0.05) more drivers in highly automated driving compared with the manual driving. Four basic postures are mostly chosen: seated facing/against the driving direction, seated facing the side window, and reclined facing the driving direction. Each posture and each activity are matched respectively, it’s an N:N mapping, which means an NDRT could be matched to more postures, and each posture also fits more than one NDRT. This can explain the usage context of each posture and predict the possible transitions among postures during one activity. As to the driver’s space, most of the current dimensions satisfy the driver, while the space between the seat back and the steering wheel could be bigger.

A follow-up study (n=16) was conducted in the Modular Ergonomic Mock-up (MEPS) at the Chair of Ergonomics. Participants sitting on the driver’s seat were instructed to perform different NDRTs with their individual postures as well as four specified postures. Subjective evaluations and opinions were collected by a recorded semi-structured interview. The major joint angles of each posture and seat adjustment were measured and photographed. This enables a quantitative description of the non-driving seat adjustment (NDSA) with seat direction (°), seat inclination (°), and seat back angle (°); a quantitative description of the non-driving posture (NDP) with torso angle (°), thigh angle (°), and knee angle (°). The statistic distribution of ten NDSAs and NDPs were analyzed. Furthermore, the level of trust of automation is identified as a factor that influences the driver’s choice of an NDP.

Combining the survey (n=122) and the study (n=16), 15 requirements of the driver’s seat in terms of the construction, positioning, adjustment, and material; four requirements of the driver’s space; three requirements of storage and 11 other requirements of infotainment, lighting system etc. are derived.
the reference (literature) is uploaded separately.
The implementation of human factors engineering in the development of complex systems can be challenging. For this reason that we sometimes see that the subject is not part of the routine design process in small companies, as well as in well-founded corporates. The result can be in some cases poor usability, that require users to “fight” inefficient procedures in order to operate a system. But in many other cases the result is financially measurable. Looking at possible end results, the costly consequences can be:

- Inefficient work which leads to longer non-productive times
- Complex interface that requires longer training time and higher probability for errors
- Difficult maintenance accessibility that results in longer repair duration
- Probability to significant ergonomic risk factors that may cause occupational injuries and excess workforce
- Frustrated and low motivated workers
- Sales impact

After understanding the impact, firms are becoming proactive in seeking the path to improve their design process. Some industries already understand the importance of human factors, and even obligated and standardised certain aspects of it. Standards that highlights good practices as well as integration procedures, assessment methods and design guidelines are common and available. Yet, in many cases the way to full implementation is not clear.

It is important that the organisation shall acknowledge the benefits it may gain from such an activity as stated above, and then consider the aspects of adopting a human factors approach. Concerns may be raised about the influence it may have on the costs and duration on the product development. These concerns shall be handled seriously and in many cases we find the the result is cost reduction, and duration shortening.

Human system integration (HSI) provides a point of view and a systematic path to integrate human factors engineering with system engineering. Given that the system engineering is encompassing the technical management and integration of the product, It is responsible for the performance, function and requirements compliance.

In HSI we include the human factors consideration as a complimentary discipline. By including the user to the set of consideration engineers should refer while designing the system. Working alongside with the system engineering, leads to implementation of human factors engineering in the design process.
This lecture shall cover a systematic method for implementation of HSI into the design process and the culture of the organisation. It shall highlight the relevant points for successful implementation and leading a change in the engineering thinking, while using mostly the organisation internal resources.
[2683] What contribution of ergonomics to improve performance of educational system? A developmental research on disadvantaged schools network organization

Type: Abstract Oral Presentation
Category: Education and Training
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Issues and context

As Smith (2007) argues, while ergonomics has demonstrated its contribution to improving health and performance in most occupational sectors, its contribution to the improvement of educational system is still marginal. The purpose of this paper is to show how ergonomics can contribute to the improvement of the educational system. Our research focus the work of organizing a network of path in the disadvantaged schools in order to improve performance of students learning.

In France, since 2013, disadvantaged schools in the same area (sometimes a part of a city) have to organize themselves into a network to help organize the students’ learning path and curriculum. The management of the networks is ensured by the director of the middle school of the area, as well as by the inspector in charge of elementary schools of the area. The organization of the network is carried out through 2 annual meetings gathering various actors involved in the organization work: director of elementary schools, vocational trainers, manager of the area, etc.

Methods:

5 school networks were involved in this research-intervention (30 schools). Each management meeting were audio-video-taped. Autoconfrontation interviews (Falzon & Mollo, 2004) were carried out with each person involved in the meeting. The analysis aimed at highlighted the contradictions between the activity system of each of the stakeholders. In a second phase of the research-intervention, the development of the activity of the network of establishment through the Change Laboratory (Engeström, Virkunen, Helle, Pihlaja.& Poikela, 1996) on the basis of the contradictions highlighted in the previous phase.

Results

Primary results show several contradictions within each activity system as well as between activity systems (Engeström, 1987). For a director of the middle school, the management of the network is in contradiction with the management of the middle school. For example, the high turnover of staff in the middle school implies that it is organized his school as a vocational training institution. But this training institution is not designed around objects allowing communication and shared training between teachers from different schools in the network. Fo the contradictions between activity systems, the results show that the differences in status and availability between primary and secondary teachers limit the possibilities of networking.
Discussion

The results will be discussed in relation to the possible contribution of ergonomics to the improvement of the education system, both at school level as well at the level of teaching practices.
The Centre of Research Expertise for the Prevention of Musculoskeletal Disorders at University of Waterloo in Ontario, Canada, is leading a two-year project to collaborate with workplace stakeholders to develop a new Ontario Musculoskeletal Disorder (MSD) Prevention Guideline. This abstract summarizes findings from the first phase to determine workplaces’ needs for prevention, and synthesize best practices for MSD prevention.

We based our evaluation upon an environmental scan, interviews with small and micro businesses, an online survey and stakeholder workshops and interviews. We saw firstly that despite many resources being available online, MSD prevention resources could be improved by targeting micro and small businesses and matching the guidelines to the characteristics and diversity of these organizations. Secondly, we saw that processes for implementing MSD prevention programs and activities, such as Participative Ergonomics, did not fit well with business processes. In reviewing challenges to making workplace (ergonomics) changes to reduce MSD we noted that the barriers were similar to those found in making any Occupational Health and Safety (OH&S) change, or even any organizational change. We noticed that the well known Plan-Do-Check-Act (PDCA) framework has elements that can address each barrier and that implementing such a framework is a systematic and well accepted way to organize (prevention) activities within a business context. Lastly, ‘Management Systems’ are not necessarily in conflict with Participative Ergonomic, however, participation needs to be emphasized within them. In our workplace visits to micro and small businesses we observed that they had difficulty identifying potentially problematic physical demands. A large proportion relied upon administrative, worker-focussed controls such as “lifting properly” rather than workplace changes and that they preferred traditional forms of information on MSD such as posters.

In our online survey, respondents said that the prevention guideline should be linked to current business practices (e.g. PDCA) (64%), be compatible with Canadian management system standards (74%) and address non-physical MSD risk factors (52%).

Synthesizing the findings from the above sources we heard: Strong support for the PDCA approach; Strong support for workers’ participation; Strong support for compatibility and comparability with national and international OH&S standards; Strong support for micro and small businesses being an important target audience and support for a range of hazards including physical loading, work organization and workplace psychosocial context. These findings need to be considered when developing MSD prevention guidance.
State of Research in the Design and Development of Emergency Response Vehicles and Equipment: A scoping review

Type: Abstract Oral Presentation
Category: Healthcare

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Introduction: The high rates of death, injuries, and musculoskeletal disorders (MSD) in paramedics are largely attributable to their complex work conditions. For example, death and injury rates of paramedics were 2.5 and 2.9 times higher, respectively, relative to the US national population; and may be largely related to attending patients during transport without being properly restrained. Furthermore, MSD claims were 13 times higher among paramedics than nurses, likely because paramedics face ergonomic hazards with frequent handling of equipment to extricate and transport patients in uncontrolled environments.

It is difficult to change the activities required in providing quality prehospital emergency care, or the context in which such care is provided. However, the design of the ambulance and the equipment paramedics use can be readily modified. The objective of this scoping review was to identify interventions or features that could enhance the design of ambulances and paramedic equipment to improve the performance, health, and safety of paramedics.

Methods: A scoping review methodology was applied to systematically search, screen, and extract data from relevant articles. Three key concepts (human factors AND paramedics AND ambulance vehicle/equipment) were used to inform the selection of search terms and MESH headings. We searched three databases including EmBase, Scopus and PubMed. Articles were screened, where retained articles clearly pertained to the performance, health, and safety of paramedics within the ambulance or when using equipment. Study characteristics and main findings were extracted, where each study was also categorized into an adapted version of the 6 Steps of Quality Intervention Development (6SQuID). The steps included: 1) define and understand the problem; 2) clarify modifiable causal or contextual factors; 3) design intervention; 4) intervention implementation; 5) lab testing; and 6) field testing.

Results: 54 relevant articles were identified through the systematic search and screening process, and nearly 80% of the articles were published after 2005. Categorization of studies based on the 6SQuID showed that 61% of the articles aimed to understand the problem and identify modifiable factors, 17% focused on intervention development and implantation, and 22% focused on evaluating the intervention (in the lab or field).

Discussion and Conclusion: Considering the timeline of the research (predominately since 2005) and the current state of intervention development (most research still targets understanding the problem), we conclude that the overall body of research available to improve the performance, health, and safety of paramedics is limited. Evidence has improved our understanding of the ergonomic challenges faced by paramedics, but we
have a less evidence to inform standards or best practices. Future research efforts should fill this gap by focusing on developing, implementing and evaluating strategies to address HFE concerns within the paramedic sector.
A Human-Machine-System Model of Paramedic Work to Enhance the Inclusion of HFE within the Development of the Canadian Standard for Paramedic Ground Emergency Response Vehicles & Equipment

Type: Abstract Oral Presentation
Category: Healthcare

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In 2012, the IEA published a strategy to develop the discipline and profession of human factors and ergonomics (HFE). The strategy identified several barriers to the adoption of HFE. Barriers included a lack of awareness of the benefits of HFE amongst relevant stakeholders, and a lack of application due to its multidisciplinary knowledge sources. Embedding HFE principles into industry specific technical design standards offer a unique opportunity to inject HFE principles into design and could remove the need for designers to have expressed knowledge or awareness of HFE. Moreover, most standards development processes are multidisciplinary and consensus based, allowing HFE professionals to engage directly to enhance the quality of technical design standards by ensuring that those standards will likely yield designs that also conform to key principles of HFE. However, as an essential first step, it is necessary to understand the overarching work system for which the technical design standards will operate in. Therefore, the purpose of this paper is to present a human-machine-environment system model of the paramedic work system that can be used to help inform the design of a Canadian standard for paramedic vehicles and equipment.

The human-machine-environment system model described in ISO 26800-2011 offers a generic conceptualization of human-machine interactions in the context of the task and environment (spatial, physical, organizational, and social/cultural). Using the ISO 26800-2011 as a framework, we applied a combination of methodologies and data sources to understand these interactions within a paramedic context. Information on paramedics’ tasks and spatial environment were generated by completing a scoping review of the scientific literature. The review identified how paramedics interacted within their workspace while completing required tasks and how HFE principles could be applied to improve specifications for ambulance design or paramedic equipment. Information on the organizational environment were generated by completing an environmental scan. Publically available sources (i.e., government websites) were scanned to identify existing ambulance and equipment standards or guidelines, where additional consideration was given to identify governance structure (i.e., private vs. publically operated services), legislative authorities, and specific ambulance design and equipment requirements. Interviews and focus groups were applied to gather information on the social and cultural environment along with interactions throughout the system. Interviews and focus groups were targeted to manufacturers, procurement personnel, paramedic leadership, regulators and frontline paramedics.

Data were triangulated to inform the human-machine-environment system model for paramedic work. The model enabled us to detect unique interactions between the
paramedic, their tasks, the patient and the spatial environment (e.g. on-the-scene vs. in the back of the ambulance). Moreover, our analysis revealed nuanced differences in the organizational, and social/cultural environment of paramedics, which reinforce the need for national standards, and particularly those that are inclusive of principles of HFE.
Improving Hand Hygiene Compliance with Patient Zone Demarcation

Type: Abstract Oral Presentation
Category: Healthcare
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**Background** Hand hygiene compliance can be difficult to improve as this prospective activity may not come to mind easily during busy clinical operations. Clinicians are often driven by clinical goals under time pressure, and the sudden recall to clean hands can either be disruptive or too late. Using patient zones as a reference has been known to be helpful. **Methods** A low-tech solution of taping patient zones on the floor was introduced in a children's intensive care unit (CICU). Coupled with this demarcation is a simplified hand hygiene protocol guideline that uses the patient zones as references for “just-in-time” reminders. Clinicians now clean their hands "before patient zone", "after patient zone", "before aseptic procedure", "after body fluids". The mandatory national quarterly hand hygiene surveillance data for CICU and the entire hospital was tracked. **Results** Since the implementation, hand hygiene rates for CICU increased from around 77% to 93%, higher than the hospital average of 89%, and CICU's hand hygiene compliance sustained at above 90% for a full year. **Discussion** Patient zone demarcation, along with more intuitive hand hygiene guidelines, is a cost-effective, operationally-sensitive intervention that can catalyze a stronger safety culture and improve hand hygiene compliance. The bundled solution taps on human factors science and applied psychology in understanding the cognitive challenges faced by clinicians during day-to-day work, without being intrusive and disruptive to patient workflow. The positive effects are most profound in multi-bed cubicles where patient zones and infection control barriers are not clearly visible.
A reach motion generation algorithm based on posture memory

Type: Abstract Oral Presentation
Category: Manufacturing
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Various models and algorithms (hereafter, simply algorithms) have been developed to simulate human motions. Most of these algorithms generate, among many possibilities due to the kinematic redundancy of the human body, only a single "would-be-realistic" motion for a given scenario by optimizing a biomechanical or psychological objective function or utilizing a certain learned statistical relationship; thus, they cannot inform the designer of the full range of feasible human motions for the given scenario. An ability to generate and report the full range of feasible human motions for a given scenario allows a more complete understanding of the consequences of a design decision and also provides a basis for simulating human motions under different constraints, including those of avoiding obstructions in the workspace. In this paper, we present a novel reach motion generation algorithm based on the use of a posture memory, which aims to inform the range of feasible human reach motions for a given simulation scenario.

A posture memory is a collection of pre-generated feasible postures that satisfy basic physiological and biomechanical constraints, such as the constraints of joint range of motion and body balance maintenance. Posture memory is constructed using a random posture generation and registration process: the workspace is divided into small cells. Then, a physiologically and biomechanically feasible posture is randomly generated for a human figure and stored in the memory space corresponding to the cell containing the hand position of the human figure assuming the posture unless the memory space already contains a posture sufficiently similar to the posture. This generation and registration process is repeated for a predetermined number of times or until the posture memory is saturated.

For a given simulation scenario (the starting and ending hand positions and a human figure), the human reach motion generation algorithm produces different "feasible" motions using the following process: first, different paths connecting the starting and ending hand positions are created. Then, for each such path, different reach motions are generated by selecting and connecting "connectable" postures found within the neighboring cells of the path. Two postures are considered connectable if their dissimilarity in the angle space is less than a certain predetermined threshold.

A collection of motion simulation examples, including the ones subject to obstruction avoidance constraints, are provided to illustrate the working of the algorithm. The human reach simulation algorithm is expected to contribute to the virtual ergonomics analyses utilizing digital human models. The human reach simulation algorithm can be used in combination with different occupational biomechanics models to evaluate physical stresses of feasible motions in different workstation/workplace configurations and thereby improve their design.
A wearable product such as an oxygen mask, a full-face mask for snorkeling, or a VR headset needs to have an ergonomically designed shape, which can fit well to a certain amount of a target population. 3D body scanning and its analysis technologies have been usefully applied in studies on the ergonomic design of a form of a product. A 3D scanned image of a human body contains not only anthropometric dimensions (e.g., length, width, circumference) but also complex dimensions such as arcs, cross-sectional curves, surfaces, areas, and volumes. A product design based on those 3D shape characteristics of the human body has resulted in gaining a better fit and increased comfort, satisfaction, and safety for the users. This study is aimed to develop a design method of an ergonomic wearable product based on numerous 3D body scan database and finite element (FE) analysis technology which is applied for estimation of contact pressure between a 3D body scan image and a design of a product.

Around 300 of 3D scanned faces were used in this study. First, a template face model having appropriate mesh structure was prepared with considering the FE analysis. Second, all the 3D faces were template-registered using a non-rigid ICP registration method. Third, from 3D scanned images of an oxygen mask, a full-face mask for snorkeling, and three VR headsets, shapes of those products’ part contacting to a facial area were saved as a spline curvature. Fourth, during the curvature (as a shape of a part contacting to a facial area) is virtually aligned to all template-registered faces, a pressure of a curvature towards a 3D face were predicted using a finite element method. All technical process was conducted through a Matlab-coded program. As results, a variation of the predicted facial contact pressure between all the faces and a product was analyzed. Differences in the contact pressure variation by different types and designs of products were observed. The contact pressure analysis methods proposed in this study can be usefully applied to find an optimal shape of a product’s part that contacts the human body. Different body parts and different product types and designs will be further considered in order to investigate an applicability and usefulness of the developed method.
Usability evaluation of an online return on investment calculator – how valuable is it to health and safety practitioners?

Type: Abstract Oral Presentation
Category: Others

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Introduction: There is a myriad of tools available that perform an economic evaluation of workplace health and safety (WHS) investments. However, most do not adequately capture the majority of indirect costs associated with the reduction or elimination of health and safety risks in the workplace. In Australia, it is estimated that the total economic burden to society attributed to indirect costs of workplace injuries is $61.8 billion, equivalent to 4.1% of GDP in 2012-13. Furthermore, occupational health and safety professionals are increasingly required to perform cost benefit evaluations justifying the investment of workplace interventions and solutions. This PhD study provides a preliminary insight into the role and value of a Queensland Government developed online WHS return on investment (ROI) calculator in the management of work health and safety risks.

Objectives: This study aims to answer the following research questions: 1. How does the user of the online WHS ROI calculator perceive the calculator's usefulness, ease of use, and value? 2. Does the online WHS ROI calculator adequately accommodate for chronic or cumulative health conditions? 3. What are the benefits of evaluating worker productivity and health as part of the WHS ROI calculation process?

Methods: Semi-quantitative and qualitative research techniques were used to ascertain user behaviour and perceptions regarding the online ROI calculator under various scenarios. Pre-post intervention usability and worker performance evaluations were conducted (n=3 businesses and n=200 workers respectively), with a focus on musculoskeletal disorder risks. Usability questionnaires were also administered to users (n=20) estimating a ROI for controls already implemented in the workplace. Further, semi-structured mock scenarios with four cohorts (WHS students, WHS professionals, WHS Regulator, and Ergonomists) were conducted (n=70). Finally, Google analytics of the online ROI calculator site were also analysed.

Preliminary Results: Introductory results indicate that WHS practitioners do see value in the online ROI calculator and deem it most suitable and useful for businesses that do not have their own costing models, such as small organisations or business units. It is seen as a tool that adequately encompasses various direct and indirect costs associated with
workplace injuries and illnesses and the benefits from implementing controls. Across all cohorts, it is a tool that a majority of users (80.77%) would use again in the future.

However, only 55.56% of participants found it easy (5), very easy (6) or extremely easy (7) to use the ROI calculator, with participants providing recommendations to enhance the user experience and interface. Initial Google analytics of the ROI calculator show a high bounce rate (81.66%) with users spending on average 45.64 seconds during a session. Results, including pre-post evaluation data, and conclusions will be finalised in April 2018.
Abstract: With the development of technology and society, the demand for ergonomics of hardware and software of mobile phones has become increasingly prominent. Therefore, how to improve the user experience and improve the users' willingness of using the mobile phone from the perspective of ergonomics have become a key concern for handset manufacturers. Based on both the current development trend of the mobile phone industry and the previous relevant conclusions, this paper established a universal evaluation index system on hardware and software of mobile phones. The system includes a total of five dimensions. Usability, efficiency and system support are used to evaluate the performance of software, while body design and key performance are used to evaluate the performance of hardware. Based on the evaluation system above, the paper produced a 7-level Likert Scale and verified the reliability and validity. In order to verify the practicability of the evaluation index system, the paper calculated the weight of each dimension and index given by the experts through the score matrix and used AHP method to evaluate three different types of mobile phones quantitatively. Besides, the paper verified the mobile phones qualitatively with fuzzy comprehensive evaluation method and obtained the same conclusion as AHP. Furthermore, single-factor analysis of variance (ANOVA) was used to verify the universal applicability of the system in different genders by selecting the equal number of the scoring results in different genders from the sample. The results showed that gender did not significantly affect the evaluation results concluded by the system. In summary, the evaluation index system established in this paper is scientific, practical and universal. It is of great help to evaluate and compare the user experience of mobile phones and to find the shortcomings and deficiencies of hardware and software in mobile phones.

Key words: hardware and software of mobile phones; evaluation index system; AHP method; fuzzy comprehensive evaluation method
Background: Agricultural, mining, construction, and transportation workers commonly experience whole body vibration (WBV), a risk factor for many chronic health conditions including low back pain [1]. WBV may also negatively affect human performance, which can lead to fatal and non-fatal occupational injuries and accidents, such as equipment-related falls and vehicle collisions [2]. Current international WBV exposure guidelines were designed to prevent long-term development of musculoskeletal disorders and discomfort; however, it is uncertain whether these standards protect workers from short-term effects. Evaluating current WBV standards for their suitability in minimizing the risk of acute accidents, errors, and injury will require understanding of the relationship between WBV and human performance.

Methods: Eighteen participants were recruited to undergo realistic all-terrain vehicle (ATV)-derived WBV, simulated with a 6-degree of freedom hexapod platform at four different vibration conditions. Conditions were randomized and were performed at least 24 hours apart. Two conditions were based on guideline thresholds for long-term health, specifically the “Exposure Action Value” (EAV) and the “Exposure Limit Value” (ELV). A mechanical shock condition consisted of shocks superimposed on EAV at 1-minute intervals. During the control condition, participants were seated on the stationary no-vibration ATV simulator. Before and after each 60-minute condition, a cognitive, sensorimotor, and physical measurement battery was collected. This abstract will focus on a sub-set of measures: rating of headache/discomfort using a visual analogue scale, postural sway, and psychomotor vigilance task (PVT). Pre- and post- differences for each condition were analyzed using either a paired t-test (parametric) or Wilcoxon signed-rank test (non-parametric). To determine differences between conditions, normalized pre/post changes were subjected to a one-way repeated measures ANOVA and Tukey-Kramer post hoc test (parametric), or Friedman’s test and Wilcoxon signed-rank post hoc test (non-parametric).

Results & Discussion: We observed significantly higher ratings of headache or head discomfort after low vibration (t=−2.44, p=0.03) and high vibration (t=−2.91, p=0.01), PVT mean reaction time (t=−3.27, p=0.005) and median number of lapses (S=−42.5, p=0.002) were significantly greater after high vibration. Postural sway significantly increased after low vibration (t=−2.88, p=0.01) and high vibration (t=−2.57, p=0.02) conditions. Differences between conditions were limited to PVT median number of lapses, where pre/post changes were significantly higher during the high vibration condition compared to control (F=2.58 p=0.05, control vs. high: p=0.037).
**Conclusion:** Whole body vibration did not induce acute effects any more than quiet sitting without WBV; thus, WBV may not be fully responsible for the observed acute sensorimotor or cognitive effects. However, effects increased with vibration intensity, with sensorimotor effects even after low vibration (EAV). Therefore, current threshold guidelines might not fully protect workers from the risk of acute effects leading to accidents, errors, or injury.
Investigating the Sequential Combined Effects of Whole Body Vibration and Physical or Mental Work Demands: Are Fatigue Effects Additive?

Type: Abstract Oral Presentation
Category: Agriculture

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Background: Whole body vibration (WBV) is highly prevalent in agriculture, mining, construction, and transportation. There is strong evidence for the longer-term effects of WBV, including increased risk of low back pain. In the short term, increased vibration intensity might lead to cognitive and sensorimotor effects that are risk factors for vehicle collisions, accidents, and egress falls [1]. However, WBV might not induce acute effects any more than prolonged sitting without WBV [2]. Since agricultural work is non-routine and the arrangement of tasks could be at the discretion of workers, there is an opportunity to arrange and schedule work tasks to minimize the effects of both WBV and prolonged sitting. However, the combined effects of sequential work demand and WBV have yet to be explored. This study investigated the combined effects of occupationally-relevant WBV and physical, cognitive, and concurrent task demands.

Methods: Sixteen participants underwent 30 minutes of realistic ATV-derived WBV simulated with a hexapod platform. WBV exposure was combined with four task conditions: (1) physically demanding work, (2) mentally demanding work, (3) concurrent physical and mental work, and (4) a seated control condition. A test battery was recorded at four periods: beginning of the session, after the first 15-minute task condition, after 30-minutes of WBV, and after a second bout of the 15-minute task condition. This abstract report on a sub-set of measures: self-perceived low back discomfort using Borg's 6-20 RPE scale, postural sway, maximum voluntary back extension contraction, and blink frequency. For each measure, data from the four time periods were submitted to either a repeated measures analysis using a general linear mixed model approach (parametric) or Friedman's test (non-parametric).

Results & Discussion: Trends of significant measures during the control condition indicate increased body discomfort, but decreased blink frequency after WBV. During the physical condition, perceived exertion increased after both bouts of physical activity but decreased after WBV. This trend was also observed with postural sway and blink frequency. Maximum back extension force significantly decreased after physical activity and increased after WBV, but did not recover to baseline levels. The mental condition led to significant increases in body discomfort after the first 15-minute bout of seated Stroop test that further increased after WBV. Finally, trends from the concurrent condition were similar to the physically demanding work task: perceived exertion increased after the two bouts of concurrent activity but decreased after WBV.

Conclusion: Findings suggest that the effects of seated WBV in combination with physical, mental, and concurrent work demands were not additive. From a work arrangement perspective, there is a beneficial effect of WBV to increase task variation.
However, optimal task ratios remain unclear and therefore future research should be devoted to better understanding these complex interactions.
[758] Validation of a conceptual model for shoulder pain risk factors in three independent French working populations

Type: Abstract Oral Presentation

Category: No productive sector applicable

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Objective The study aims to validate the same conceptual model for shoulder pain risk factors in three independent samples of French male industrial workers recruited among a regional population and two large companies. Direct and indirect relationships between workplace risk factors, perceived stress, and shoulder pain were explored.

Methods The study used longitudinal data from a surveillance network, the Cosali study (n = 334), and cross-sectional data from two large companies: a manufacturer of pharmaceutical preparations (n = 487) and a truck assembly plant (n = 306). All workers were asked to complete a self-administered questionnaire about shoulder pain, individual factors, and exposure to workplace risk factors: factors related to work organization (industrial work rate and market constraints), psychosocial factors (decision authority, skill discretion, psychological demand, supervisor support and co-worker support) and physical factors. Perceived stress was assessed on a visual analog scale ranging from 0 to 10 and was not available for the truck assembly plant. A conceptual model was defined by drawing from literature and the authors’ expertise. Structural equation modeling was used to test the direct and indirect relationships among the variables.

Results In the three samples, exposure to industrial work rate constraints decreased psychosocial factors (decision authority and skill discretion), while exposure to market constraints increased psychosocial factors (decision authority, skill discretion, and psychological demand). There were some differences between the samples, however. For the pharmaceutical and truck assembly plants, industrial work rate constraints increased physical factors and decreased psychological demand. In the same way, industrial work rate constraints decreased co-worker social support only in the case of the truck assembly plant.

Perceived stress was increased by psychological demand in both study populations and decreased by co-worker social support only in the pharmaceutical plant.

Physical factors were decreased by skill discretion in the three samples and by decision authority in the pharmaceutical and truck assembly plants and increased by psychological demand for the Cosali study and the pharmaceutical plant.

Physical factors and social support were correlated negatively only for the truck assembly plant.
Shoulder pain was significantly increased by physical factors in the Cosali study, the pharmaceutical plant and (with borderline significance) truck assembly plant. Perceived stress increased shoulder pain in the pharmaceutical plant, but not in the Cosali study.

For the truck assembly plant, skill discretion decreased shoulder pain, whereas the association was of borderline significance for psychological demand and co-worker social support.

**Conclusions** The results provide a deeper understanding of the complexity of the distal and proximal determinants of shoulder pain and highlight that workplace interventions should act on multiple dimensions (i.e. organizational, psychosocial, and physical factors) to ensure greater effectiveness.
Cars manufacturers provide customers with more and more complex embedded systems whose aim are to improve security and/or comfort and to provide entertainment. To interact with them, drivers use HMIs that have undergone a significant change in type and complexity over the past decade. In this context, embedded HMIs usability is a major concern for their acceptability, safe use while driving and customer satisfaction.

To design and assess those HMIs, a system approach/logic is applied by cars manufacturers. This traditional approach (V-model) is coupled with iterative phases involving different stakeholders and the end users (Human-centered design), the aim being to enhance human-system interactions and the overall customer satisfaction.

But, despite the user-centered approach applied to the design of those systems, some usability issues are reported by customers, while the system is under development and after market’s release. Why is it so?

This paper aims at describing the work that led us to considerer the research-practice gap as a candidate factor explaining how in the design process the user-centered approach fails. In this paper, we present the three major axes of our work: (1) Renault’s infotainment systems feedbacks analysis, (2) activity analysis of the Renault’s cognitive ergonomics design team and (3) literature review on embedded HMI design/evaluation processes and methods.

In the first axis, we examined a database containing a set of feedbacks (customers complaints from surveys and forums, user tests results, expert’s feedbacks…) on Renault’s infotainment systems. The feedbacks were categorized with a list of ergonomic criteria to gain a better understanding of the system’s impacted usability dimensions as well as the possible deficiencies in the overall design/evaluation process.

In parallel (axis 2), an activity analysis was carried out (internal standards study, observations (by following-up ongoing projects), interviews…) to better understand how the design team accomplishes its missions. The aim was here to identify the work processes as well as the human-factors and ergonomics methods used.

The third axis concerned a literature review. This review covered the human-factors and ergonomics methods. A database of 155 records was created. The database is still under progress and will be refined gradually.
The first conclusion that can be drawn from this work is that the research-practice gap could explain how and why design decisions fail to be supported by the human-centered design cycle and its associated methods.

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Firefighters are encountered accident and cardiovascular diseases. This study aimed to assessing of cardiorespiratory fitness and determination of affecting factors on it in Iranian firefighters. In this cross-sectional study, 45 firefighters participated from 5 stations from 16 firefighting stations in Shiraz. Data were gathered by demographic questionnaire, American thoracic society questionnaire, spirometer (model Vitalograph), and Tuxworth- Shahnawaz protocol (for assessing the maximum aerobic capacity). Mean± standard deviation of age and work experience as firefighter of participants were 29±5.1 and 4±4.7 year, respectively. The findings of this study were shown that more than 87% of firefighters did not have any respiratory symptoms. The maximum (3.01±0.24 l.min⁻¹) and minimum (2.86±0.31 l.min⁻¹) values of the maximum aerobic capacity were related to the first (shirt, pants and sneakers) and second conditions (firefighting clothing, boots, helmet, gloves, Self Contained Breathing Apparatus), respectively. The results were shown that it goes without saying that weight, height and waist had a significant association with maximum aerobic capacity in different clothing conditions. Vital Capacity (VC) and Forced Vital Capacity (FVC) parameters had significant differences with maximum aerobic capacity in the first, second and fourth (firefighting clothing, sneakers, Self Contained Breathing Apparatus) conditions. Also, there was a significant association between the conditions of firefighting clothing, except the second and fourth conditions. The findings of our study were shown that different conditions of firefighter clothing could be effective on maximum aerobic capacity of firefighters. This can be considered in firefighting jobs.
Comparison of the HEART and CREAM techniques used for evaluation of human reliability in health care systems

Type: Abstract Oral Presentation
Category: Others

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Previous disasters, have revealed the importance of human errors in chemical, nuclear and marine workplaces. The same applies to medical field and statistics show that many patients have lost their life due to human errors. Although the importance of human errors is beyond doubt, the prominent application of systematic methods to recognize and prevent them in healthcare is rare. The aim of this study was to investigate the applicability of CREAM and HEART considered as two human reliability assessment techniques among the nurses working in the ICU ward and to compare the results of these two techniques with previously recorded errors. The results showed that there was a significant correlation between CREAM and HEART techniques in prioritizing the likelihood of error. Although both techniques have the capability of being used in health-care, there is a need to localize the coefficients and definitions, especially in the HEART technique in order to achieve more accurate results and take appropriate controls.
The control room in a chemical industry or a nuclear power plant is a critical place in which human factors should be considered to prevent accidents. Furthermore, the non-ergonomic situation in a control room has an impact on operators, for example, cause anxiety, stress, and fatigue. The challenge of human factors in a control room mainly include physical ergonomics of a computer workstation, sedentary postures, lighting, adverse noise, and communication difficulties. The aim of this study is to present how these challenges could be managed by virtual reality to modelize human factor changes and to improve the situation work in a control room.

The study includes diagnostic phase, modelization in a virtual reality platform and implementing changes to improve work situations. We firstly perform various ergonomic analyses such as the interview with operators, ROSA assessment, lighting and noise measurement. Then, several interactive sessions were held with decision makers and operators to present the results of the human factors diagnostic and to propose changes for improving the situation. To make changes more visible and tangible, the control room before and after changes were modeled and visualized in a virtual reality platform. This study describes various changes such as the solutions to reduce disturbing noise due to radio communications or passing people, new conception for a lighting system, and improvement in the computer workstations. Most of the solutions were modeled in a virtual reality platform and three operators of the control room tested the virtual situation. Some solutions were modified following the operator's feedback and final design to improve control room was proposed. This study showed that a comprehensive approach including diagnostic, virtual modelization and stakeholder involvements provide a substantial improvement in a control room.

Key Words: Human factor, virtual reality, improvement, chemical industry
Early Detection of Mental Fatigue based on Heart Rate Dynamics in a Sedentary Computer Work in Young and Old Adults

Type: Abstract Oral Presentation
Category: Healthcare

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Mental fatigue can be defined as a mental state by which the ability to maintain an optimal mental performance is remarkably declined. This may temporarily occur during a sustained mentally demanding task. The growing number of elderly workers calls for finding objective measures for monitoring mental state to avoid any detrimental effect on productivity and health associated with mental fatigue. Heart rate is a physiological index which nowadays can accurately and reliably be measured with affordable devices in an unobtrusive manner e.g. without electrode attachments. In this study, 36 participants (17 old and 19 young adults, aged 58±7 and 23±3 years, respectively) were recruited to perform a prolonged 40-min mentally demanding computer task including 240 cycles with 10 s duration of each cycle. The participants' heart rate was measured throughout the computer task. Each cycle began by memorizing a random pattern of connected points displayed on a computer screen following by replicating the pattern while only the points constructing the pattern were displayed. The replication was performed by clicking using a computer mouse on the points to redraw the connecting lines in a sequential manner. The task performance in each cycle was calculated based on the accuracy and speed in responding. After each 20 cycles, i.e. one segment, participants rated their perceived mental fatigue on Karolinska Sleepiness Likert scale (KSS) while the task execution was paused for 5s. The mean and range of heart rate, HRM and HRR respectively, in each cycle were calculated and together with the task performance were averaged across each segment for each participant. Repeated measures analysis of variance was employed to assess the effect of time-on-task (TOT), i.e. 12 segments, on the aforementioned cardiac (HRM and HRR), behavioral (task performance) and subjective (KSS) measures considering the effect of age as the between participant factor. The statistical analysis revealed that the range of heart rate followed an increasing trend both in the young and elderly groups with a significant main effect of TOT, p<0.001. The HRM exhibited a tendency to increase as a function of TOT both in the young and elderly groups, p=0.054. The performance was also significantly affected by the TOT in both the young and elderly groups, p<0.001, with an increasing trend in the elderly group and a fluctuating trend in the young group. The KSS increased in both groups with the TOT, p<0.001. No interaction between TOT segments and age groups was found in any of the measures. The task performance was higher in the young group, p<0.001. The results provide useful information on the feasibility of using heart rate as an index to monitor the transition into mental fatigue state in both young and elderly workers.
Prediction of workload and staffing in train dispatching on track yards: application of the WASCAL-tool in the design process of a track yard

Type: Abstract Oral Presentation
Category: Transport

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Abstract.

The Dutch rail infrastructure manager builds new track yards or enlarges existing track yards to facilitate servicing and maintenance of new rolling stock to be commissioned next few years in The Netherlands. One of the design issues is the choice for a certain level of automation for the process of train dispatching on a track yard. A high level of automation requires higher investment in technology, but is expected to result in lower mental workload of a train dispatcher and therefore require lower staffing and thus lower operational costs; a low level of automation is expected to result in higher mental workload of train dispatchers, requires more staff and thus higher operational costs for train dispatching. For this design issue the WASCAL-tool was developed.

The WASCAL-tool is imbedded in a heuristic workload model based on scientific theories and professional insights on workload and human performance. This model guides a framework of tools for assessment and prediction of mental workload from early design to simulation and real operation.

The WASCAL-tool is based on cognitive task analysis of the process of train dispatching. In this cognitive task analysis attention is paid to monitoring and decision making processes in train dispatching and in planning and replanning of train service because of delays of trains or other reasons for changes in train service. These cognitive processes are assessed with respect to task demands and related workload combined with time-line analysis of the dispatching and planning processes.

The tool results in a prediction of workload of a train dispatcher, based on characteristics of a plan for train service and operational processes for maintenance and servicing of trains on a track yard. The tool enables assessment of train service for 24 hours a day, 7 days a week. The tool distinguishes predefined automation levels, currently in operation in the Netherlands. This workload prediction is bases for calculation of staffing for train dispatching.

The calculation results of the tool with respect to prediction of task demands are validated based on observations of train service on several track yards. Reliability of the output of the tool is appropriate for the choices to be made during the design process of a new track yard. An example of application of the tool in the design process for a new track yard is shown.
Keywords: staffing, workload, train dispatching, prediction, design, rail track yard, level of automation
Protection of pregnant women at work in Switzerland: implementation and experience of maternity protection legislation

Type: Abstract Oral Presentation
Category: Healthcare

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Objectives

Like most industrialized countries, Switzerland has introduced legislation in order to protect the health of pregnant workers and their unborn children from workplace exposures. This legislation includes a risk assessment, protective measures at the workplace, and a preventive leave (prescribed by a gynecologist) if the exposure is not removed (Praz-Christinaz et al. 2008). This study aims to 1) analyze to which degree companies, gynecologists and midwives implement the law, in the French speaking part of Switzerland, and 2) understand the barriers, resources and outcomes of this implementation.

Methods

This presentation draws on two sets of data. 1) A questionnaire filled by gynecologists and midwives about their practice and difficulties in implementing protective legislation. 2) Exploratory semi-structured interviews with workers (nurses) who have had a pregnancy in the last 5 years, focusing on their perception of workplace hazards and their experience of protective measures.

Results

The response rate for the questionnaire was 32% (n=105) for gynecologists and 54% (n=356) for midwives. Data show that the implementation of maternity protection policies could be improved under several aspects. In particular, 92% of gynecologists and 96% of midwives estimate that they receive a risk assessment from the employer in less than 10% of cases where patients encounter workplace hazards. Preventive leave is underused: only 32% of gynecologists report that they “often” or “always” prescribe a preventive leave in case of occupational hazards; 58% of gynecologists report that they “often” or “always” prescribe a sick leave instead.

Five exploratory interviews were organized. Workers pointed out several barriers, which hinder the implementation of protective policies in workplaces. In particular, the interviewees felt that there was a lack of information about protective measures and pregnancy rights, organizational problems triggered by job and schedule adjustments, an underestimation of occupational hazards by the management or the gynecologist, and that
some safety measures do not match their personal or the company’s needs. Contrastingly, colleagues are a key resource to ease the balance between work and pregnancy. Workers sometimes put in place unexpected strategies in order to deal with the perceived discrepancy of protective measures with theirs needs, for example they may delay the announcement of their pregnancy. Our findings are consistent with most of the results described in the international literature (e.g. Adams, 2016; Lembrechts & Valgaeren, 2010; Malenfant, 2009).

Conclusions

The results demonstrate the need to improve the knowledge and implementation of maternity protection legislation by gynecologists and midwives in Switzerland. More research is required to evaluate the degree of implementation of this legislation in the workplaces. Qualitative interviews with relevant stakeholders from various workplaces would be useful in order to grasp more accurately the barriers to maternity protection's implementation and figure out ways to overcome them.
Background: It has proven challenging for clinicians to monitor and maintain preterm neonates’ oxygen saturation (SpO₂) levels within prescribed target ranges in the first 10 minutes after birth. The challenge is compounded because for every minute of those vital first 10 minutes, the boundaries for the target range of SpO₂ change. Monitoring oxygen saturation in newborn preterm neonates is crucial: low oxygenation can result in tissue damage and increased mortality rates, whereas high oxygenation can result in blindness and lung disease.

The pulse oximeter provides visual and auditory displays of heart rate and SpO₂ levels: its tone rate corresponds to heart rate and tone pitch to SpO₂. While monitoring the neonate’s SpO₂ in the first 10 minutes following birth, clinicians perform many other visually demanding tasks. In these cases, clinicians could rely on the pulse oximeter’s auditory display to inform them of the neonate’s wellbeing. However, clinicians have difficulty judging SpO₂ levels using the current auditory display of the pulse oximeter.

Objective: In a simulated setting, we compared non-clinicians’ ability to judge SpO₂ ranges using (1) a conventional auditory display comprising varying pitch to represent SpO₂ and (2) an enhanced auditory display that added the acoustic dimensions of tremolo and brightness to the varying pitch. While judging SpO₂ levels, participants performed an arithmetic distractor task. We predicted that performance on both SpO₂ range identification and the distractor task would be better with the enhanced display compared to the conventional display.

Method: The experiment was a between-subjects design with two auditory display conditions: (1) conventional display and (2) enhanced display. After training, 50 non-clinician participants completed three blocks of 17 30-second trials each. Participants monitored displays while SpO₂ varied over three designated ranges—low, target, or high—and while they responded to arithmetic problems. Participants identified SpO₂ range at the end of each trial as either low, on target, or high. In addition, we measured participants’ arithmetic accuracy.

Results: When using the enhanced display, participants identified SpO₂ level more accurately (81%) than when using the conventional display (63%) (p<.001). There was no difference across conditions in arithmetic task accuracy (p>.05).

Discussion: Current neonatal pulse oximeter auditory displays can be improved to better support SpO₂ monitoring in the first 10 minutes after birth, where target range boundaries are continually changing. In the visually and cognitively demanding environment of the delivery or operating room, an effective auditory display would allow clinicians to preattentively monitor and accurately identify neonatal SpO₂ levels with lower workload,
while also supporting their ability to engage in visually demanding tasks. Such a display may lead to more accurate and timely decisions regarding control of neonatal SpO₂ and potentially reduce the risk of health complications in an already vulnerable population.
Intra-rater reliability of the Visual Ergonomics Risk Assessment Method (VERAM)

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Introduction: Visually demanding near work can cause both eye- and neck/shoulder discomfort. Apart from visual demands and dry eyes, a number of environmental factors including design of the work station, lighting, glare, and the quality of the computer screen might exert an impact on eye-related symptoms. To date, there is a lack of valid and reliable instruments assessing factors associated with eye- or visual symptoms. Therefore, a new method to assess visual ergonomics at workplaces was developed in Sweden between 2014 and 2016, the Visual Ergonomics Risk Assessment Method - VERAM. A preliminary version of the method was drafted by the researchers mainly from existing checklists and instruments, and tested in the field by ergonomists and work environment engineers with additional training in visual ergonomics. The method was then revised and used in the field to collect data for validity and reliability analyses. The final version of VERAM includes both a questionnaire for the employee’s assessment, and an expert evaluation of the employee’s workplace. The questionnaire consists of subjective ratings in six domains: eye discomfort (frequency and intensity), musculoskeletal discomfort (frequency and intensity), ratings of visual symptoms (e.g. blurred and double vision) and ratings of the visual environment (e.g. illumination levels, glare and reflexes from a work object or a computer screen). The expert evaluation consists of both technical measurements and subjective assessments resulting in an overall expert risk assessment (no risk, low risk or high risk) of eight workplace factors: daylight, lighting, illuminance, glare, flicker, work space, work object and work posture.

Aim: At the IEA conference in Florence 2018 the new VERAM method will be presented together with results from intra-rater reliability analyses.

Result: Intra-rater reliability was evaluated with a test-retest interval of 2 to 3 weeks and the results are based on 99 repeated measurements. The Intraclass Correlations ranged between 0.70 and 0.87 for the six questionnaire domains, and there were no significant systematic differences between the first and second rating for any of the domains (repeated measures ANOVA, p > 0.05). For the eight environmental factors, the experts estimated equal risk at the two assessments in 69-92% of the cases, and, as seen for the questionnaire domains, there were no significant systematic differences for any of the eight factors (Wilcoxon sign rank test, p > 0.05). To control for multiple comparisons, the Bonferroni method was used.

Conclusion: The Visual Ergonomics Risk Assessment Method – VERAM showed good intra-rater reliability, both for the employee questionnaire, and for the expert evaluation.
when performed by an ergonomist or a work environment engineer with additional training in visual ergonomics.
The layout evaluation of human-computer interface based on eye movement data

Type: Abstract Oral Presentation
Category: Others
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There are four design principles that should be followed in the layout of human-computer interface: principle of the importance, usage frequency, using sequence, and functional grouping. Much experimental data have proven the importance of the front three principles, but the principle of functional grouping lacks quantitative experimental data to support. There are many ways to quantify the evaluation of interface layout and the eye movement tracking is one of them and it also is an effective method. The purpose of this study was to test the effect of the functional grouping on layout of interface. Meanwhile, show how to apply eye movement indicators to the interface evaluation and to explore the cognitive process that the subjects interact with the interface information by the eye movement indicators. First, a pretest was conducted. Seventeen icons that is commonly used in office software interface were selected. They have the function of drawing, word editing and file manipulation. Seventeen icons were randomly divided into different groups that formed 9 kinds of interface layout. Thirty five undergraduates were asked to make icon search test to the 9 interfaces. The search time was compared to 9 interfaces and 3 interfaces that the search time was of significant difference were selected. The 3 interfaces were separately called interface 1, interface 2 and interface 3. The result of the pretest showed that the icon search time was the shortest to the interface 1 that the interface was fully organized according to the principle of functional grouping; the search time of the interface 3 which the layout is completely random was the longest; the search time of the interface 2 that the layout of part icons on the interface is organized according to the principle of functional grouping and the layout of part icons is random was between interface 1 and interface 3. And then was the formal test of eye tracking to the 3 interfaces. Another 35 undergraduates participated the test. The subjects made a subjective evaluation on the layout of the 3 interfaces after the test. The results of the subjective evaluation were that the layout of interface 1 was optimal, the interface 2 was worse, and the interface 3 was the worst. The results of the eye tracking were that the fixation number and saccade number was the least of the interface 1, less of the interface 2, and the most of the interface 3; the length of scanpath was the shortest of the interface 1, shorter of the interface 2, and the maximum of the interface 3. So the conclusion can be made that the principle of functional grouping is an important principle during interface design and it can obviously improve the efficiency of human-computer interaction.
Assessing Facial, Thermal and Eye Discomfort, Acceptability and Perceived Protective Efficiency of PAPRs in Simulated Healthcare Work Settings

Type: Abstract Oral Presentation
Category: Healthcare

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Objective

Powered Air-Purifying Respirators (PAPRs) are increasingly being used by healthcare workers (HCWs) in close contact with patients with virulent respiratory infectious diseases to provide high level protection and have recently been used for infectious disease emergencies. However, little is known about user comforts and barriers such as vision clarity, acceptability and perceived protective efficiency in comparison with more commonly used N95 filtering facepiece respirators (FFRs). The objective of this study was to assess these indicators in various respirator models while HCWs are performing different tasks in simulated healthcare work settings.

Methods

Thirty-two HCWs from four departments at Cook Children’s Medical Centre (CCMC) in Fort Worth, Texas, USA, participated in the study to evaluate breathing and thermal comfort, eye discomfort, vision clarity, communication acuity (speech clarity), exertion level, tolerance time, and perceived efficiency using pointed vertical visual analog numerical scales. After wearing four models of loose-fitting PAPRs and an FFR and performing simulated work tasks at high-risk level (such as contact with patient blood or body fluid) and low-risk level (such as administering fluid and medications), participants completed a questionnaire with their evaluations. The study protocol was approved by Institutional Review Boards. Data analysis was performed using repeated measure analyses of variance and Tukey’s multiple comparisons to compare the differences in various respirator models and HCWs.

Results

Preliminary data analyses indicated that while there was no significant difference in overall performance and general comfort between PAPRs and the N95 FFR, PAPRs were
perceived as providing “somewhat high” protection against biological hazards. They were also shown to require less inspiratory/expiratory efforts. However, PAPRs were more difficult to operate, caused eye discomfort and obstructed the use of glasses/goggles/contact lenses. They also affected communication acuity, generated somewhat high level of noise inside the respirator hood/shroud, and interfered with work duties. The N95 FFR was also perceived as providing “somewhat high” protection, had much lower interference with the use of glasses/goggles/contact lenses, provided much clearer vision and was easier to operate, but they had more breathing and thermal discomfort and pressure or pain. When performing low-risk tasks, an N95 FFR was preferred, more acceptable, and considered providing more effective protection. When performing high-risk tasks, PAPRs were more preferred and acceptable, but they were not considered more effective than N95 FFR.

Conclusions

While both PAPRs and the N95 FFR were perceived as “somewhat high” in personal protection, each had its own barriers in comfort, user interference with vision, breathing, and communication effectiveness. There were some variations among different PAPR models in assessed indicators. Further study with a larger sample size is needed to identify more significant differences among PAPR models and HCWs performing different tasks.

Please note: this is not a business case.
[716] Validation of Computational Fluid Dynamics Models for Evaluating Loose-Fitting Powered Air-Purifying Respirators

Type: Abstract Oral Presentation
Category: Healthcare
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Objective
Loose-fitting powered air-purifying respirators (PAPRs) have been increasingly used in healthcare settings to reduce exposure to high-risk respiratory pathogens and infectious body fluids. Innovative computational fluid dynamics (CFD) models were developed for evaluating loose-fitting PAPR performance. However, the computational results of the CFD models have not been validated using actual experimental data. The objective of this study was to collect and use actual experimental data to validate the CFD models.

Methods
Experimental inward leakage (IL) testing was performed in a test laboratory using two models of loose-fitting PAPRs. Each model was mounted on a static (non-moving) advanced headform which was then placed in a sodium chloride (NaCl) aerosol test chamber. The headform was able to cyclically breathe via connection to a breathing machine. High-efficiency particulate air (HEPA)-filtered air was supplied directly to the PAPR facepiece using a mass-flow controller. Six supplied-air flow rates from 50 – 215 Lpm were tested. Three different work rates (minute volumes) were evaluated: low (25 Lpm), moderate 46 (Lpm), and high 88 (Lpm). Condensation particle counters were used to measure the NaCl concentrations of both the chamber and inside the PAPR. Manikin Penetration Factor (mPF) was calculated as the ratio of chamber concentration to the in-mask concentration. The CFD models were also run using the same test parameters used in the laboratory experiments. The experimental results were compared with simulation results.

Results
Overall, preliminary data analyses indicated that the mPF results from the simulations were correlated with the experimental laboratory data (R²>0.75). For Model A, the measured and estimated mPFs were all greater than 10,000 at lighter work rate and supplied-air flow rates of 75 Lpm and higher. At the moderate work rate and supplied-air flow rates of 50 and 205 Lpm, the measured mPFs were 9 and 10,000 as compared to the estimated mPFs of 9 and 10,000 (R² = 0.95). At the high work rate with supplied-air flow rates of 50 and 205 L/min, the measured mPFs were 5 and 4990 as compared to estimated mPFs of 3 and 205 (R² = 0.98). Similar comparable results were observed for Model B except light work rate.

Conclusions
The measured experimental results were correlated with the estimated simulation results (R² > 0.75). The CFD models for the two PAPR models were validated and may be applied
for PAPR evaluation. Further research is needed to include more PAPR models and to consider the impact of human movements on PAPR particle leakage.
The effects of the type of rest breaks on return-to-task performance in semi-automated tasks with varying complexities

Type: Abstract Oral Presentation
Category: Aerospace
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Automation in the aviation industry is acknowledged as a useful tool in reducing pilot workload (Hoh, Smith & Hinton, 1987; Beringer & Harris Jr., 1999). Typically, the role of the pilot (operator) shifts from active participation in a process to monitoring the system with the resumption of control should the automation 'fail' (Byrne & Parasuraman, 1996). Unfortunately, the skills necessary to do so would likely degrade from non-use, during this process (Landry, 2012). This project investigates the "attentional demands" for the human operator during interaction with semi-automated operations of the flight.

One of the problems causing disharmony between crews and their automated systems is the incorrect upset recovery, owing to the human being out-of-the-loop from the system (Abbott, 1996). Recovery, or rather return to task, is the ability of the pilot to loop back into control, once situational awareness has been decreased due to lack of alertness and a decrease in arousal. Different types of rest tasks are commonly prescribed fatigue countermeasures in the industrial setting and have been showed to elicit beneficial effects on prolonged human performance. Understanding the effects of different rest break activity and time out-of-the-loop during semi-automated flying on return to task performance has been studied, highlighting its importance in the context of flight safety.

The present study requested participants to perform a tracking task in a laboratory where they changed from activity (30 minutes) to a break (2 vs. 30 minutes) and back to the activity (20 minutes). The task varied in the complexity of the activity (pure tracking vs. tracking plus memory plus rule-based decision making), the type of break (passive rest vs. actively supervising) and the duration of the break (2 minutes vs. 30 minutes). Performance was measured as effective response time in the tracking task and number of correct responses to secondary cognitive tasks. Physiological measures included heart rate, heart rate variability (time and frequency-domain), eye blink frequency and duration. The Karolinska Sleepiness Scale was used as a subjective measure.

Concerning the most appropriate rest break tasks, the study concluded that active, administrative tasks, which allowed the operator to maintain some form of situational awareness by monitoring the automated system, achieved favourable effects of being more alert than the passive rest break of being disengaged from the system. In terms of the most appropriate rest break durations, the shorter duration of being out-of-the-loop from controlling the system was more advantageous than the longer out-of-the-loop duration. In looking at the workload levels of arousal, the results suggest that the higher workload level is better at maintaining the alertness of operators. This study functions as a foundational framework for future investigations around the topic of human-automation interaction, looking specifically at return-to-task performance.
Website usability can be defined as the extent to which a web presentation can be used by a specific user in order to achieve a specific goal, while achieving appropriate effectiveness, efficiency, and satisfaction in use. The usability of a web presentation depends on a large number of usability features. On the other hand, readability can be defined as an ease with which one can read and understand the presented text. The readability also depends on a large number of features. Research has shown that readability features can affect the efficiency of reading text that is presented on different media. Although readability is a concept with a long history, it is rarely considered in the context of the usability of a website. In many global considerations of usability of web presentations, the concept of readability is not represented at all, or it is represented in the most general form. In view of this, the subject of this paper consists in determining the influence of the basic characteristics of readability on the usability of a web presentation. In order to determine this relationship, seven basic usability features and four basic readability features were selected. On the basis of these features, a questionnaire was formed. The task of the respondents consisted in providing answers to the questions after getting acquainted with the various web presentation modalities of the company providing banking services. Respondents gave answers to questions from the above-mentioned questionnaire on the Likert's five-level scale. The results of the research showed the existence of a strong connection between some basic characteristics of readability and usability. In connection with this, a high correlation of 0.943 is established between the organization of information on the screen (a usability feature) and the structure of the headings, the sub-headings, and positioning of the text (a readability feature). A significant correlation has also been registered between the compliance with the user's expectations (a usability feature) and the structure of the headings, the sub-headings, and positioning of the text. In addition, the existence of a link between the possibilities for finding information (a usability feature) and the content (explanations, arguments) of the textual presentation (a readability feature) has been established. The obtained results indicate that certain readability features should be taken into account when designing web presentations and evaluating the usability of websites.