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in everyday life, medicine, and work**

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BOOK OF ABSTRACTS



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SESSION 1: SURFACE TRANSPORTATION [1]

Driving with a multi stage warning system in the head-up display – How do drivers react upon it?

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Driver warnings are a good way to reduce accidents in urban areas as they support drivers in complex and critical situations common for urban areas. This was shown in a previous driving simulator study of the research project UR:BAN. However, some critical situations might demand emergency braking, others might require mere attention allocation or moderate braking. Thus, a multi stage warning system (prewarning and acute warning) for the head-up display inducing different driver reactions depending on the situation's criticality and intervention need was developed. Of focus were the subjective system evaluation (understanding and acceptance) and the driving performance over time of twenty-four drivers in eight urban scenarios with varied criticality. The test included a first drive without any warning, a learning phase and an end phase with previously unknown scenarios. Aim of this driving simulator study was to see how drivers differentiate between the two stages and to what extent this has to be learned (through a learning phase). The data shows that the warning system is well accepted and understood by the drivers, with them differentiating between the two stages. Furthermore drivers learned to drive with it resulting in improved driving performance through the learning phase.

Perceived criticality of different time headways: are they really independent of velocity?

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Driver assistance systems like Adaptive Cruise Control (ACC) allow drivers to automatically maintain a comfortable distance to a preceding vehicle. One crucial parameter for these systems is the optimal following distance in seconds (time headway, THW). Studies show that drivers decrease their THWs as velocity increases (e.g., Brackstone, Waterson & McDonald, 2009). This contradicts reports suggesting clear independence of velocities and chosen THW (e.g., Siebert, Oehl, & Pfister, 2014). Contrary to a meter-based distance, THW promises a velocity-independent measure for comfortable following distances. This study aimed at investigating this relationship using an experimental setup in a dynamic driving simulator. N = 29 participants followed a preceding vehicle in five different velocities ranging from 30km/h to 140km/h in urban, rural and highway environments. At each velocity level, drivers were instructed to follow with three different THWs (0.7s, 1.1s, 1.5s). Subjective criticality ratings were analysed for the different combinations of factors (IV1: velocity, IV2: THW). Drivers rate short THWs as more critical when following with slower velocities compared to higher velocities. These results indicate that theoretically velocity-independent THWs are still perceived as different regarding their criticality. Based on these findings, automated driving functions should carefully adapt comfortable THW-ranges to the velocity range.

Performance differences between auditory and peripheral-visually presented secondary tasks while driving and the impact of peripheral vision ability

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The primary task of driving requires concurrent processing with a high demand in visual resources. Secondary tasks as in interacting with in-vehicle technology (IVT) compete for resources, which are limited (Wickens, 2002). Visual delivery of information from IVT can result in performance losses, as it usually requires taking the eyes off the road. To avail separate resources not used in the primary task of driving IVT increasingly relies on auditory output. A majority of driving simulator studies comparing auditory versus visual delivery of in-vehicle task information point to the advantage for auditory delivery in both primary and secondary task performance. However, some IVT interaction can be still performed with peripheral vision (Langlois, 2013) and studies indicate that the location of the visual display is a relevant factor (Horrey & Wickens, 2002).

In our driving simulator study, we measured the peripheral perception of 45 participants. Participants then drove on routes composed of alternating segments with or without secondary task. The task was either presented in a visual (PVSAT) or in an auditory manner (PASAT). The visual display was located in the periphery of the vision field. While driving, the participants occasionally had to react to critical events. After each segment, we asked drivers to rate their subjective workload level (NASA-TLX). Driving performance and secondary task performance were assessed. We found that drivers generally perform better responding to auditory than to peripheral-visual delivery of secondary task information. Driving with auditory delivery was associated with a higher secondary task performance, fewer collisions, shorter reaction times and a lower subjective workload. Interestingly, drivers with high peripheral vision (HPV) were able to handle peripheral-visual delivery as well as the comparison group with auditory delivery. We also found that drivers with HPV made less errors in the PVSAT than drivers with low peripheral vision.

Methods for assessing driver behaviour in manual and automated driving

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Future automated driving will change the role of the driver and the driver's behavioural patterns. As a consequence, the assessment of driver behaviour will also change. Traditional methods, used for assessing manual driving, will only be applicable for the parts of Driver-Automation-Interaction (DAI) that include manual driving, hand-over, and take-over situations. In the MODAS project, a new driver information system for automated driving was evaluated. The drivers should detect a sudden hazardous event but not interfere the automated driving. Thus, traditional methods were not applicable. A new assessment selection strategy was needed. During an iterative process, a systematic assessment selection model called the Failure-GAM2E emerged. It was based on a combination of the hazard analysis ISO 26226-2 and GOMS – a standard model used in behavioural analyses. The Failure-GAM2E could be described as a systematic step-by-step procedure that includes definition of failures (Failure), driver goals (G), driver actions (A), subjective methods (M), objective methods (M) and equipment (E). As a result, an Optimal Risk Management model for assessing automation was drawn. In short, drivers should detect hazardous events and prepare for take-over without interfering the automated driving, except if automation fails. Prepare for take-over was assessed through observing foot behaviour.

SESSION 2: HMI [1]

Gestures while driving: A guessability approach for a surface gestures taxonomy for in-vehicle indirect interaction

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Surface gesture interaction in the automotive context is still exploratory and lacking guidelines. To address this issue, a guessability study was developed to associate end-user gestures with functionalities of an in-vehicle HMI system. Interaction with the system was done indirectly, through the use of surface gestures. Participants were presented with instructions, followed by a static interface image, and prompted to create a gesture that would allow them to respond to the instruction. Results demonstrated that the gestures proposed in the concept phase were simple and familiar, and allowed the creation of a taxonomy of gestures consisting of gestures for adjustment, acceptance, refusal, and navigation actions. The guessability methodology proved useful and demonstrated how user-centred design can improve the usability of an interaction even at an advanced stage of the design and development process.

Need some help? Effects of system reliability and degree of automation on performance in luggage screening

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The present study investigated whether flexible automation can improve performance in a safety-critical luggage screening task. 120 student participants were asked to detect the presence of dangerous objects (either a knife or a gun) in a series of X-ray pictures of bags and suitcases. Participants either worked with a support system offering static support at a low or medium level (indicating that a target was present without specifying its location vs. pointing out the exact target location), or they could freely choose between levels of automation (flexible automation). Furthermore, automation reliability was manipulated (low or high reliability) to assess operators' trust in automation. The results showed an advantage of medium static automation (i.e. the exact location of the target is pointed out to operator) over flexible automation. Furthermore, high system reliability led to better performance and higher operator trust. The findings overall suggest that flexible automation might not be the best automation design in luggage screening.

Controllability of Partial Vehicle Automation at Lateral Guidance Boundaries

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Driver assistance systems that are capable of taking over both longitudinal and lateral vehicle control have been recently introduced to the market. All of these systems allow drivers to take off their hands for a limited amount of time, but also require drivers to be able to take over vehicle control at all times and can therefore be classified as Partial Automation systems. An open question for these and upcoming systems is, whether prolonged hands-off intervals diminish the driver's ability to resume to the driving task. In a driving simulator study, two partially automated assistance systems with realistic and fully functional take over concepts were compared, differing in the permitted hands-off intervals (Hands-off system vs. Hands-on system, n = 20 participants per assistance condition, age 25-70 years). The situations subject to investigation were scenarios with exceptional lane features (e.g., missing or coloured line markings), that lead to lateral control system failures. Analysing objective vehicle data and subjective ratings, our research could show, that even with the availability of an in-vehicle secondary task, the driver's ability to control was not diminished in the longer hands-off-condition under the presence of fully functional take-over concept.

Consequences of disability-friendly website design for nondisabled users: Effects of age and type of device

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The aim of the study was to examine side effects of disability-friendly (accessible) web design on nondisabled users as a function of age and device. In a three-factorial experimental design, a website's conformance to established web accessibility guidelines (i.e., WCAG 2.0) was manipulated at two levels (low conformance vs. high conformance) and tested by two user groups (young users vs. elderly users). Furthermore, device was manipulated by using either a laptop or a tablet-PC. In a usability test each participant carried out five tasks on one of the websites. A broad range of performance measures (task completion rate, task completion time and click rate) and subjective measures (usability, aesthetics, trustworthiness, workload and affect) were taken. First results suggest that implementing web accessibility guidelines provide benefits to young and elderly nondisabled users alike, whereas these effects seem to interact with age and device. Implications for practitioners and web design are discussed.

SESSION 3: HEALTHY AGEING

Self monitoring - an age-related comparison

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Wearable devices like fitness tracker, measuring motion and steps, enable users to monitor their behaviour and might support a healthier lifestyle. These wearables might also motivate elderly to be active and live healthy. Unfortunately these wearables are mostly designed for younger users and it is unclear if they are usable by older adults.

In order to answer this research question we conducted a four week lasting empirical study about individual motivation and the fitness trackers' usability dependent on age groups. During the first session, participants put the fitness tracker into operation without further instructions while think-aloud-method was applied and mental effort was measured.

During the whole study participants used the fitness tracker according their personal needs. Usability was measured by PSSUQ at the introduction session, at the middle session after two weeks and at the final session after four weeks. The added values as well as the necessity of an app were evaluated in a crossover design. Therefore participants used the fitness tracker two weeks with and two without app. Aspects concerning customer requirements identified during interviews were weighted by a pairwise comparison at the final meeting.

Results show a comparison of younger and elderly users regarding usability, requirements, motivation, mental effort and technical affinity.

Needs Assessment for Individuals Aging with Impairment

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Adults with sensory and physical limitations are living longer and thus likely to experience age-related declines that can negatively influence their independence and quality of life. Worldwide, millions of individuals with visual impairment (i.e., blind or low vision), hearing impairment (i.e., Deaf or hard-of-hearing), or mobility impairment (i.e., using a wheelchair), are now aging into the senior population. However, this segment of the population has received very limited attention in the human factors community. The goal of this project is to develop a taxonomy of everyday support needs to determine the activities for which older people with pre-existing impairments need support; to understand the functional difficulties they encounter in the performance of everyday activities; and to assess use of existing assistive technologies. We present data from Subject Matter Expert interviews wherein we interview care providers, family members, and advocates of older adults with these specific impairments. Identifying the range of challenges experienced in everyday activities will allow us to develop a comprehensive assessment tool with which to interview members of these target groups. Our results have implications for technology design, instruction and use -- ultimately improving technology interactions for this understudied sector who are visually, hearing, or mobility impaired.

Shared Usability - a support mechanism to product and service system design for Older Adults

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Globally the Older Adult population is increasing ; people are living longer, often with physical or functional limitations whilst remaining in their own home. This indicates a requirement of responsibility by Associated Stakeholders to support ageing in place. The concept of 'Shared Usability' proposes that Older Adults can maintain independence, choice and empowerment, with mutual agreed levels of support from Associated Stakeholders when using products or services.

Research was conducted as a means to identify and explore 'Shared Usability' in the context of a user centred design process. Qualitative research methods with an ethnographic approach were conducted over a nine month period. The fieldwork involved observing and understanding everyday life for the Older Adult in their own home, with specific enquiry and task observation of eight areas.

Design methodologies of ideation, sketching and iterative sketch models were applied in order to select one specific area for design conceptualisation. Further to this, brainstorming sessions involving participants using storyboard and feedback were used to evaluate proposed concepts. The product concept outcome highlights how product and service systems can be developed with inclusion of 'Shared Usability'. The fieldwork offers recorded and detailed enquiry of the experience of ageing.

Finally it proposes a definition of 'Shared Usability' as a tangible consideration during the process of design that facilitates the user being supported by a network of Associated Stakeholders.

Human-Centred Development Of Automatically Accommodating Contact Lenses

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Every person is affected by a decreasing accommodation width. On average people won't notice this until their fourth to fifth decade of life. If the accommodation width drops below three dioptres, a person will be called presbyopia. As a result of this decrease people need a treatment for good vision in the near field. Therapeutic approaches like laser surgery or intraocular lenses are invasive and therefore may involve complications. Common reversible and non-invasive alternatives are glasses and contact lenses. Within this paper the human-centred development of a contact lens that automatically adapts the refractive power of the lens to the distance of a faced object is presented. This is an innovative approach that is going to integrate sensors, actuators and energy supply within the lens. A mixed-methods research design has been applied to identify user requirements as well as requirements by physiological aging. Deliverables from the evaluation of three focus groups, six in-depth interviews and one online survey indicate that experts acknowledge such a system as highly desirable. However they further see hurdles to overcome like pricing models, acceptance of older people and the competences to adapt such a system to a patient's eye.

SESSION 4: SURFACE TRANSPORTATION [2] & VULNERABLE ROAD USERS

‘Approaching hazard to your right!’ - What happens if it really comes from left?

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Driver warnings are increasingly complex with regard to the information that is displayed to the driver. For example, several studies suggest that including information about the direction of a conflict increases the effectiveness of driver warnings. However, this requires to recognize and track other road users by on-board or cooperative sensors. From the perspective of functional reliability, we have to consider that direction indications might be erroneous occasionally. Using a static driving simulator, N = 78 drivers completed several urban traffic conflicts, either without assistance (baseline), assisted by a visual-auditory advisory warning system (AWS) that displayed the direction of the respective conflict (direction specific AWS) or an AWS that only displayed that a conflict is imminent (unspecific AWS). For the direction specific AWS, the direction indications were erroneous in half of the situations (e.g., the warning indicated a hazard from the right, but it actually emerged from the left). The results show that driver reaction times to the AWS as well as the criticality of the situations did not differ between unspecific warnings and erroneous warnings with direction indication, while subjective assessments (e.g., usefulness, ease of use) were negatively influenced by erroneous direction indications.

Cyclists’ rule infringements: What may explain drunk cycling, cycling without light and cycling on forbidden paths?

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Cyclists have a rather high risk of being injured in traffic accidents but contributing factors other than being less physically resistant are not yet understood well enough. Data from case-control studies suggests that traffic rule infringements (i.e. cycling in forbidden direction on cycling paths) may enhance accident risk (Huemer & Vollrath, 2012). Observational studies (Fricke, 2012; Luber, 2013) showed that more than 50% of cyclists show at least one rule infringement. When asked about their motives for the infringements, most answered not to know about the regulations or considering them for “futile” (Fricke, 2012). Online questionnaires revealed that most cyclists do not know traffic regulations properly (Huemer, Eckhardt-Lieberam & Vollrath, 2014). An attempt to investigate the relationship between rule infringements, motivational aspects and knowledge, was made, consisting of three online surveys with more than 1300 cyclists. Subjects reported about their cycling behavior and motives for drunk cycling, cycling without light and cycling on forbidden paths. Neither the theory of planned behavior (Ajzen, 1985), nor a model by Krüger & Vollrath (1998) predicting willingness to infringements by perceived probability of detection and perceived severity of punishment were able to explain significant variance in infringements. Detailed descriptive results of the three studies on rule knowledge, behavior-patterns and motives will be presented at the conference.

Investigating the impact of attentional declines on road-crossing strategies in older pedestrians

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The aim of the research project FANS is the development of a warning system for older pedestrians. According to official statistics, the main reason for accidents involving older pedestrians is their lack of attention. The aim of the current research is to investigate the link between attention and road-crossing strategies of older people.

A literature review regarding attentional function declines in older persons served for identifying attention critical road-crossing situations. Afterwards, two focus groups have been carried out to investigate what types of crossing-locations are perceived as dangerous. Finally, an observation interview was conducted with 102 pedestrians to discover biases in perception of road-crossing behaviour. Most interestingly, older people significantly overestimated, while younger people underestimated, how often they had looked on the street before crossing.

Based on these prior investigations a questionnaire has been developed that examines attention and behaviour in road-crossing. The behavioural part of the questionnaire consists of eight different crossing-situations. Participants have to indicate their strategies by choosing possible actions from a predefined set. In the attention part participants have to answer 12 items regarding attention critical situations. The questionnaire will be carried out with 80 participants, half of them over 65 and half of them under 35 years. Answers will be analysed with regard to age differences in behaviour and attention. Additionally the relation between attentional declines and road-crossing strategies will be investigated.

Conceptualisation of the method will be described, results of the questionnaire presented, and further discussed with regard to the project goals.

SESSION 5: AVIATION

Understanding Flight Crew Performance Through the Lens of Honest Signals

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Objective: This study investigated the potential to predict flight crew performance from communication patterns, by applying a new paradigm of social interaction: honest signals.

Background: Models that illustrate flight crew communication are divided in two groups: pattern-based models and content-based models. The honest signal paradigm uses electronic devices (sociometric badges) to quantify the patterns of communication across four dimensions: influence, mimicry, activity, and consistency.

Methodology: Flight simulation experiments were conducted with the participation of 31 dyads of recently graduated pilots. The subjects were required to perform a flight from Amsterdam to London, while carrying a sociometric badge. During the flight, an engine failure manipulation was initiated. Two outcome measures were obtained for each dyad: time to detect the failure, and the quality of crew resource management (CRM) practice (the latter being evaluated by Type Rating Instructors).

Results: Data analysis showed significant correlation of two honest signals (influence and activity) with the outcome measures of flight crew performance.

Conclusions: The honest signal paradigm might be used to apprehend patterns of interactive communication between flight crew members, and might determinatively complement existing qualitative assessments.

Ice-Crean: A Visual Indication Tool in Air Traffic Control Tower Operations

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The main task of an air traffic controller is to assure safety in aviation. For safe decisions the controller must keep a sufficient picture of the current situation by scanning all relevant information visually. Ice-crean was developed from prior studies as a tool to observe controllers' scanning behaviour and indicate unattended information sources.

A total of eight air traffic controllers participated in a high fidelity simulation study in which the controller coordinated IFR-traffic at a regional airport. The eye movements were continuously measured. During take-off and landing clearances the ice-crean logic analysed the controller's scanning behaviour in real time and compared it with the predicted gazes due to database. As a result the ice-crean tool recognised which information had not been observed and responded accordingly by visual indication. Comprehensibility respecting the indication and the acceptance towards the ice-crean concept were interrogated.

The tool's indications were mostly perceived to be correct and comprehensible. The tool was evaluated positively and rated reasonable in tower operations as well as possibly helpful also in other application areas with minor restrictions. The study offers implications for actual implementation of ice-crean in airport towers and further areas. Assets and drawbacks of the tool are discussed.

Emotions in Decision-Making Processes of Air Traffic Management Stakeholders

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ATM-Simulation

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The aim of this study is to examine the most relevant emotions for efficient decision-making of Air Traffic Management (ATM) stakeholders. This is important, because ATM-stakeholders (airport operators, airlines, air traffic controllers, ground-handlers) have to cooperate in order to guarantee the most efficient air traffic. However, divergent goals and interests can affect the solution that is optimal for the European air traffic system. Moreover there are factors like workload and situation awareness, which have an influence on decisions. Emotions also affect solutions in decision-making processes, but have hardly been considered in ATM. To get to know, which emotions are relevant in the stakeholders' working life, an online-questionnaire was developed. This consists of a modified version of the Job-Affective Well-Being Scale and was distributed to stakeholders of European airports (N_airports=23). The paper will discuss results, in special that there are two key-emotions, which are supposed to have an impact on the tested stakeholders' decision-making. For the future, potential application of this research includes the development of an assistance system, which reacts adaptive on the user emotional requirements. Adaptive Systems can serve as a coworker and support the human, especially during decision-making processes in teams to guarantee the most efficient benefit.

Flight training in a network of simulators improves the ability of flight students to manage complex traffic situations

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Although the aviation environment has changed dramatically, the flight training procedures and devices have not evolved accordingly. We dedicate this paper to possible improvements of flight training procedures and devices to fill this gap in the ab initio pilot training. Nowadays flight students encounter high traffic density, complex airspace structures and procedures. However, at the beginning of practical flight training the complex environment is dealt with by the instructor and ignored by the flight student who focuses on handling of the aircraft. The flight students are trained gradually to monitor the environment at a later stage. Nevertheless, the development of a complex mental picture of the flight environment, and the handling of the situation in an anticipative manner is neither systematically trained nor proved. This gap might induce a systematic failure of teaching. We designed an ab initio flight training program using a network of simulators and evaluated it with 40 flight students (training vs. control group) in a pretest-posttest design. The results show positive training effects to improve the performance and reduce the effort of flight students related to monitoring, understanding and acting in the complex environment.

Attitude Indicator Design in Primary Flight Displays: Revisiting an Old Issue with Current Technology

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The attitude indicator (AI) in the primary flight display (PDF) conveys information about pitch and bank attitude of an aircraft. Two different options of design are available: (1) the “moving-horizon” display which represents aircraft movements by means of a moving horizon line, and (2) the “moving aircraft” display which depicts roll movements by means of movements of the aircraft symbol. Although, the former design currently represents the standard approach, human factors research from the 1960s and 70s with the then used round mechanical instruments has usually favoured the latter design, specifically for novice pilots. Some more inconsistent results are provided by recent studies, but these are mainly based on research with very artificial laboratory displays. Our experiment revisits this “old issue” with current technology, i.e. displays currently flown in the A320 and B787. Of particular interest was the question of whether or not we would find the old effects with the most recent technology including what we refer to panorama displays, which display the artificial horizon extended over the whole screen with overlying speed and altitude scales (e.g. B787). 36 novices flew several tracking and recovery tasks in a PC-based simulator equipped with moving horizon and moving aircraft displays in conventional and panorama format. The data show that the previous effects favouring a moving-aircraft display can be generalized to current PFD designs and different tasks. This suggests it to reconsider the design of the AI specifically for new applications, e.g. remote control of UAVs.

SESSION 6: HMI [2]

Digital Evidence Dashboard: a collaboration tool for uncovering criminal digital activities

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TNO

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Digital evidence is becoming increasingly important in criminal investigations. Due to the proliferation of digital devices, more and more digital information becomes available for examination. In addition, criminal investigators need to collaborate with digital forensic experts to uncover digital evidence of criminal activities. In practice, this leads to a high workload for the experts and delays in the investigation. To address these issues, the Digital Evidence Dashboard provides an environment for collaboration between investigators and experts. It allows investigators to conduct simple evidence review without the assistance of experts. Moreover, it provides visualizations of evidence analyses (geography, timeline, networks) and a structured overview of the workflow and uncovered evidence. The dashboard concepts were redesigned based on an existing tool called "Tracks Inspector". In workshops with experienced police investigators, we evaluated its added value for criminal investigation. Investigators appreciated the dashboard to search and collect evidence, and present this in a structured way. Conversely, the dashboard provided sometimes too much or too complex information. In ongoing research, the design is simplified and improved to match the operational processes in criminal investigation. During the paper presentation, we will present detailed results and a demonstration of dashboard functionality.

Comparison of an old and a new Head-Up Display design concept for urban driving

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In the future, full use of advanced driving assistance systems (ADAS) will move from highways and freeways to urban areas. This additional ADAS use case may require the communication of additional information and warnings. Consequently, how information it is currently presented in head-up displays (HUD) will need to change in order to not visually overload the driver. Current HUD design concepts are usually arranged in three clusters: the driven speed, navigation information, and various ADAS. The new design concept needs to be more generic, driver-focused, and action-oriented. For this experiment, an old design concept and a potential new one were compared in terms of reaction time (RT), response accuracy (RA), and a subjective evaluation. Thirty participants performed an occlusion task and a choice reaction time task (CRT) to find possible differences between the two designs. Statistical tests were performed to examine global and specific RA. The occlusion task showed a significant difference between the old and new design. Additionally, the new design yielded better CRT performance in terms of RA and RT. Nevertheless, the subjective measures showed an advantage for the old design. In sum, this paper shows the benefits and downsides of a new urban HMI concept for HUDs.

Towards developing a head-up display warning system - How to support older drivers in urban areas?

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Driver warning systems are essential, when pursuing safer urban areas. The complexity in these areas is very high, especially for older drivers (> 65 years) as they are over-represented in crashes. The aim of this driving simulator study (altogether 36 older drivers, aged > 65 years) was to determine what kind of warnings (Stop sign warning (SW), Caution sign warning (CW)) might have the best effect on the driving performance (brake reaction, maximum braking value) of older drivers compared to a control group, in scenarios with different criticalities. The results show that in most scenarios, the brake reaction times in the SW group were significantly faster compared to the CW and control group. Furthermore, the SW led to the highest maximum braking value, whereas the CW group led only to somewhat higher maximum braking values compared to the control group. The SW warning is recommendable for critical scenarios, which demand an immediate driver reaction. In less critical situations it might be sufficient to raise the drivers' attention and guide it upon the critical object, which is why the CW should be triggered. Accordingly, a two stage warning system combining both warnings (prewarning and acute warning) should be developed.

The effect of external and environmental factors on perceived comfort: the car-seat experience

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Today, the comfort and discomfort related to the automobile seat is a topic widely studied. A previous work published by same authors affirmed that the evaluation of the perceived comfort, associated to the driving experience, could not be performed by considering only the driver-seat. The authors offered a theoretical matrix to evaluate the comfort of car seats through the identification of all involved aspects and of the interactions with the external factors inside the vehicle (personal, task and environment characteristics). To verify this theoretical hypothesis, a sample of people evaluated a car seat by interacting with it in five different ways: interaction with the real prototype, presentation of real prototype, photographic presentation of real prototype, presentation of 3D virtual digitized prototype, interaction with the real prototype placed inside the car. The Kansei technique has been used as evaluation tool in order to assess the individual and subjective emotional impression on the car seat where all the senses of the consumer are involved. The results of the study show how the same object looks different if evaluated in different ways and what is the effect of external and environmental factors on the perceived comfort.

SESSION 7: MENTAL WORKLOAD

Boundary conditions for safe detection of clinical alarms: An observational study to identify the cognitive and perceptual demands on an ICU

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Many medical devices found on intensive care units (ICUs) use alarms to inform the user of critical, potentially life-threatening conditions. Urgent information is typically indicated by auditory stimuli, because audition is regarded a sentinel sense particularly suited for alerting purposes. In contrast to this general assumption, however, empirical evidence shows limitations to the notion that even salient sounds are always consciously perceived. Rather, apparently automatic perceptual processes, such as the detection of an alarm, depend on the availability and allocation of processing resources. Our aim was to identify those cognitive and perceptual demands that may compromise alarm detection in intensive care. We shadowed five experienced intensive care nurses during their morning shifts. We focused on activities and potentially disruptive events. Working conditions were characterized by frequent switching between activities: Analyzing 75 s time epochs for the occurrence of individual activities showed between two and five different activities (i.e. at least one switch) for 48% of the epochs. Alarms from a device in the room occurred every 140 seconds on average. In future studies we will investigate the degree to which coping with these conditions, characterized by task-switching, multi-tasking, and frequent distraction, draws upon the cognitive resources necessary for detecting alarms.

Human Factors Guidelines for CCTV-system design

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Dedicated Closed Circuit Television (CCTV) control centres can be found, for example, in traffic supervision and remote control. A limited number of HF guidelines is available. Based on an extensive literature search, 8 case studies, and several experiments, a set of HF guidelines for CCTV system design was developed. Two classes of task situations can be distinguished:

- Surveillance and security, which is the traditional CCTV application where operators are looking for specific events.
- Remote control and supervision of objects (such as locks and bridges), and process installations.

The surveillance related HF Guidelines might not be valid for remote control and supervision. Hence, we carried out extensive and comparative research both in practice and in laboratory settings. The research dealt with: 1) operator task characteristics, 2) Different parameters of image quality, and 3) workload parameters. A traditional workload parameter is the “number of camera images presented per operator”. As an alternative workload indicator we investigated the number of different scenes an operator can handle. This concept was tested qualitatively in three settings: a traffic management control centre, a lock and a social security control room. The research dealt with: image complexity, operator experience and design of scenes.

Automation Surprise in Actual Flight Operations: Effects of the Compatibility Between Degree of Automation and Pilot Workload

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Conflicting views and evidence exist with respect to the precise effect of degree of cockpit automation on the probability of experiencing an automation surprise (AS).

It was hypothesized that in order for rates of AS-occurrence to remain low: (1) a high degree of automation is combined with high pilot workload; or (2) a low degree of automation is combined with low pilot workload.

A survey was held under a representative sample of 200 airline pilots to ask them about their experiences with AS, in particular about the last time they experienced it. Pilot workload during the last AS-occurrence was measured in one of three ways: (1) flying intensity (average number of flights per month); (2) complexity of the flight phase during the last AS; and (3) elapsed Flight Duty Period (FDP) during the last AS (the number of hours that the pilot has been working without interruption at a specific moment in time).

Results show that compatible automation-workload combinations resulted in significantly lower AS-prevalence scores than incompatible combinations, but this was only true when workload was measured using elapsed FDP. For the remaining two workload indices, the effects were in the expected direction, though not significantly so.

Dynamic assessment of mental workload using a wearable eye tracking tool

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The use of eye tracking technology in HF/E research and practice has considerably increased over the years. Moreover, several ocular indicators have been validated for use in many domains: from usability of consumer products to operator functional state assessment. However, many indicators require eye movement recordings in controlled settings, allowing little or no movement to the user/operator. Of course, this is a strong limitation in those settings where the individual is required to move around a room for accomplishing a task. Based on previous research on the distribution of eye fixations and its relation with mental workload, we implemented a dynamic analysis of eye movement data collected using eye tracking glasses while the operator was freely moving around. Particularly, we monitored naval operators interacting with a simulated bridge during a typical coastal traffic: navigation through a sea area with established traffic separation scheme, VTS monitoring, with medium to dense traffic, including crossing ferries and selected off-shore activities. Taskload was manipulated throughout the sessions in order to analyse changes in ocular and motor activity during complexity peaks. Implications for the dynamic assessment of mental workload and the development of risk profiles will be discussed.

SESSION 8: FITNESS TO DRIVE

How to investigate fitness to drive in patients with Alzheimer's dementia

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Background: In early stages of dementia, some patients are still fit to drive, but others are not. Patients and their family members seek for advice from their physicians. The gold standard to determine fitness to drive is a test ride on the road, but it remains difficult to decide which patients should be advised to do such a time and effort demanding on-road driving assessment and which not, as sensitive alternative instruments are lacking. *Objective:* The goal of this study is to develop a validated off-road fitness-to-drive test battery for older drivers with dementia.

Method: Patients with Alzheimer's disease (n=100) performed a fitness-to-drive test battery consisting of interviews with the patient and an informant, various neuropsychological tests and rides in a driving simulator. All participants also completed a test ride on the road. *Results:* The validity of the off-road fitness-to-drive test battery was examined, in particular regarding its accuracy in predicting on-road driving performance. With information from the interviews only, 72,3% of the patients were classified correctly as fit or unfit to drive. When using neuropsychological tests or driving simulator rides, respectively 81,6% and 78,9% of the patients were classified correctly. A combination of the predictions based on the interviews, neuropsychological tests and driving simulator rides resulted in a correct classification in 88,5% of the cases. *Conclusion:* Interviews with patients with dementia and their informants have predictive value for fitness to drive. Neuropsychological tests and driving simulator rides both improve the accuracy of the prediction significantly. Three tests of the test battery were most predictive: tests for motor speed, hazard perception, and traffic theory knowledge. The test battery will serve both patients affected as well as those involved in the decision making process.

Predicting fitness-to-drive in elderly drivers with cognitive impairments

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The goal of the current study is to develop an assessment battery to assess fitness-to-drive of elderly drivers experiencing cognitive impairments. The study is part of a larger project focusing on assessment and training of elderly, cognitively impaired drivers. 136 Elderly drivers from the Limburg region of Belgium (mean age: 79, mean driving experience: 55 years, mean MMSE: 26.9) completed an extensive set of neuropsychological and physical tests. Driving performance was assessed on road by an evaluator of CARA (Center for Fitness to Drive Evaluation and Car Adaptations; official fitness-to-drive assessment authority in Belgium) resulting in a pass/fail/conditional pass decision. Furthermore the TRIP questionnaire (Test Ride for Investigating Practical fitness-to-drive (De Raedt, Ponjaert-Kristoffersen, 2000)) was scored after each on-road test. Classical fitness-to-drive evaluation outcome and TRIP score were predicted by different functional tests. A parsimonious set of functional ability tests that is useful as a screening instrument for fitness-to-drive in the doctor's office is proposed.

De Raedt, R. & Ponjaert-Kristoffersen, I. 2000 The relationship between cognitive/neuropsychological factors and car driving performance in older adults. *Journal of the American Geriatrics Society*, Vol 48(12), 1664-1668.

Embodied Virtual Agents and Electronic Bracelet to support independent Travel by People with Cognitive Disability

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Individuals with cognitive impairments have difficulties to independently use public transit. Some studies suggest that independence can be improved through effective orientation instructions and by reducing the travel anxiety. An Embodied Virtual Agent (EVA) as a travel assistant has the potential to provide valuable support. In this paper, we explore EVA capabilities, as a mean to improve the independence of Individuals with cognitive disability, within a personal navigation application for mobile devices. We explore EVA ability to provide location-aware instructions that motivate and reassure users (to reduce anxiety). Besides, we use an electronic bracelet equipped with an RFID-Reader to read mounted tags at bus stations and public transport vehicles. This allows the user to check if a specific station or vehicle is correct in the context of the current trip and therefore helping in the decision making. The user gets feedback via a simple light signal interface consisting of a bright LED array. The developed Embodied Virtual Agent (a) apply easy language complemented with contextual images, (b) uses the non-verbal communication as a main function to overriding verbal communication and reduce the understanding effort, and (c) is able to promote the emotional contagion by using believable emotions.

An ideographic study into the psychophysiology and self-reported workload of learning how to drive a car

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A driving instructor has to monitor the performance and state (e.g. cognitive (over)load) of the pupil she is learning to drive. However, the instructor is also responsible for road safety. Therefore, it might be beneficial when additional monitoring technology would be available to assess the state of the pupil and support the driving instructor in her tasks. Fluctuations in skin conductance are indicative of changes in the autonomic nervous system and have been operationalized as changes in stress or cognitive workload. For the present ideographic study we periodically followed (in total during 86 lessons) six pupils from the start of their training to their driving exam, while measuring their self-reported (and by their driving instructor) workload and their skin conductance levels (with a wrist-worn bio-sensor). The quality of the physiological measurements was acceptable in most cases. We found that the driving instructor was good at predicting the self-reported workload of her pupils. Importantly, there was no correlation between physiological fluctuations and fluctuations in self-reported workload. This makes physiological measurement unsuitable to replace subjective workload assessments. Yet, it might contain different information (not subjectively available), where high levels of physiological arousal indicate moments for the driving instructor to reduce (learning) demands.

KEYNOTE

Why traffic speeds up as you get older

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Humans are poor timekeepers. And it gets worse with age. Elderly persons are susceptible to a varied set of temporal illusions. They date events too far back in time ('reverse telescoping'), grossly overestimate the length of shorter periods of time or may even be convinced that life speeds up as they get older. Age-related temporal illusions are a window on a range of neurological and cognitive processes. In my lecture I will reflect on the question what time does to memory and what memories do to time.

SESSION 9: SAFETY CULTURE & WORK DOMAIN ANALYSES

Work domain analysis of an intensive care unit

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Work in intensive care units (ICUs) requires interaction with several medical devices and interpretation of dynamic information from several sources. The aim of the current study is to support the development of a new ICU concept with a more holistic information environment, which has the purpose to support both intuitive tasks processes and more demanding problem solving.

When developing complex sociotechnical systems an understanding of the constraints imposed by system purposes and affordances is needed. Therefore a total of 18 hours of observation at an ICU and interviews with three experienced ICU nurses were conducted in order to receive input data for the modelling of the work domain. The domain were modelled in an Abstraction Hierarchy, as according to the first phase of the Cognitive Work Analysis framework.

The ultimate purpose of the work carried out in an ICU is keeping patients alive while gaining time for treatment. The purpose is represented in the top level of the model, and lower levels includes functions as supporting the patients' vital functions and avoiding secondary complications. The two bottom levels of the model includes the functions of the medical technology and a representation of the physical form of the system.

Nigeria and UK helicopter accident: A cultural comparative analysis

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This paper explores the role of culture in helicopter accidents based on the cultural differences between the Western and non-Western countries. Helicopter operations in Nigeria and the UK share many common features including a prominent offshore oil industry that places heavy demands on helicopter transport, but they differ in terms of the cultural context within which these operations take place. Nigeria shows themes associated with high cultural context, such as collective views, submissiveness to superiors, lengthy decision-making processes and slow pace of change. The UK, themes were associated with low cultural context, such as a dislike for risk and ambiguity, high individual autonomy and striving for power equalization. Accident reports from both countries were compared using content analysis to explore the cultural variables influencing human error leading to accidents. The study shows two key findings. First, the sampled UK and Nigerian accident reports differ in respect to weak and strong uncertainty avoidance. Secondly, and more importantly, cultural factors, although not currently well represented in accident analysis were prominent in the sampled accident reports. As a result, more consideration needs to be paid on accident analysis and the role of culture within the national context.

Characterising influences on safety culture in military aviation: a methodologically grounded approach

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The self administered questionnaire approach to quantifying safety climate is the most widespread in the literature. However, much of this research has taken a methodologically top-down approach to exploring and characterising organisational safety culture. This approach risks imposing theoretical concepts, making unreasonable assumptions of the universality of defining influences, and underplaying the potential for social difference (subcultures). Increasingly, the benefits of using exploratory data-driven techniques that are grounded in the employee perspective are being cited. The current research aimed to address issues of ecological validity by using a qualitative approach to explore and characterise military aviation employee perspectives on safety culture and risk decision making. A thematic analysis of ten focus group transcripts (N=78 military volunteers of a range of ranks, job roles and functions) provided a unique insight into how military aviation personnel interpret their world, and the impact on decision making and behaviour. The analysis identified eight nameable constructs. Seven of these: 'policy & procedures', 'pressure', 'leadership', 'individual responsibility', 'risk perception', 'just culture & reporting', 'training & experience' corroborate findings from the literature, although not in the unique combination reported here. The eighth named as 'organisational commitment and identity' has not previously been cited in safety culture research.

Designing smart-grids interfaces thanks to Cognitive Work Analysis (CWA)

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Smart-grids are electricity network that can intelligently integrate the behaviour and actions of all users connected to it, in order to efficiently deliver sustainable, economic and secure electricity supplies. They may provide a tool for consumers to better control their consumption and, in fine, to save energy.

The success of smart grid deployment depending on consumers' acceptance, several studies have already dealt with the conditions of adoption of this technology. They rely mainly on the technology acceptance and/or on the norm activation models. However, some of them address this question from a more cognitive point of view. Considering that electricity-consuming activities are habitual and routinized ones, they investigate the means to modify these habits, i.e. to introduce a conscious decision-making process taking environmental norms into account.

We propose to use the Cognitive Work Analysis framework to define an interface facilitating this process. Following the five successive stages of this approach, we analyse i) the smart-grids system as a work domain, ii) the decisions made concerning the use of electrical devices as control tasks, iii) the possible strategies, iv) the possible human-machine cooperation and finally, v) the consumers' competencies that are required.

SESSION 10: SURFACE TRANSPORTATION [3]

The influence of visibility on driver comfort in autonomous driving

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In this experimental study we investigated the influence of different visibility conditions on comfortable time headways in autonomous vehicles. Participants were presented with 72 different driving situations in a driving simulator, in which speed and direction were controlled by the simulation, while participants were in a monitoring role. Each situation lasted 10 seconds. Situations were varied in speed (50, 100, 150km/h), time headway (0.5–4.0 seconds in 0.5 second increments) and visibility. Visibility was varied three-fold: In condition no.1, participants followed a normal sized car. In condition no.2 participants followed a truck that occluded the view on the lane ahead and in condition no.3 participants followed a normal sized car but fog was introduced, limiting the visibility of the driving environment around the driver. During the different driving situations, perceived levels of comfort regarding the distance to the car in front were rated by adjusting a bidirectional haptic lever. In all speed conditions, participants only reported a decline in comfort for time headways below a critical threshold. This threshold differed with the three visibility conditions. Results of this study will be discussed in terms of their impact on driver behaviour models and the design of adaptive vehicle automation.

Confidence and the everyday task of driving

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This paper reports on the result of a cross-cultural study on the relationship between drivers' levels of confidence and safety performance involving 139 British and Iranian drivers. In this paper confidence is defined and assessed as the discrepancy of drivers' levels of performance and perception. Using a driving simulator and a newly designed questionnaire (the Relative Self Rating Questionnaire) examination of drivers' confidence is presented from the perspective of four safety critical driving themes, overtaking, curve negotiation, amber dilemma and junction negotiation. The study found that drivers reveal varying levels of confidence across the driving task and that the assumption that drivers, or the majority of drivers, are overconfident is not correct. Conventional practice among traffic safety researchers is to divide drivers into overconfident and under-confident without a comprehensive assessment; thereby oversimplifying of complex issues that accompany this every day task. This paper examines drivers' performance, perception and confidence, with attention to nationality, gender, age and the relationship between participants' levels of confidence and performance and their driving society.

Ambient light based interaction concept for an integrative driver assistance system – a driving simulator study

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For today's vehicles several driver assistance systems are already on the market supporting the driver in critical driving situations or automating parts of the driving tasks and in future there will be even more. Currently, those assistance systems do not use a common and consistent interaction strategy to communicate with the driver. The goal of our study is to present and evaluate a concept using ambient light for integrating information of different assistance systems. Research on visual peripheral warnings shows positive effects on driver reaction times in demanding situations. In this paper we present results of a driving simulator experiment, in which we tested an ambient light concept using peripheral visual perception. A 360° LED stripe was installed around the driver in a fixed based driving simulator providing interaction signals via peripheral vision. The developed ambient light display should support the driver in different driving situations and in different levels of automation by a consistent color-coded interaction design. In a between-group design 40 participants (20 with ambient light, 20 without) drove 12 different highway scenarios to test the display. Results on subjective evaluation regarding usability, acceptance and comprehensibility of the ambient light concept and driving data are reported and discussed.

Is Kinect suitable for Ergonomic Evaluation?

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Motion Capture solutions are very expensive and Digital Human Model simulations are time consuming. Off the shelf solutions like Kinect show potential as a cheaper and more flexible method. By using both Kinect and DHM tools together, physical measurements can be produced and analyzed. This study was an investigation on how Motion Capture Technology can be used as an ergonomic assessment tool in the product development process of truck cabs. A literature study to assess relevant methods and tools led to the testing of several 3D camera and 3D manikin solutions. The results showed that the Kinect could be used together with IMMA software to measure truck driver's motions outside of the cab. This included the use of ergonomic assessment tools. Presently, the technology is limited and the software needs to be developed further but it shows much potential.

POSTERS

Driving and Attention Deficit Hyperactivity Disorder

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Adults with attention deficit hyperactivity disorder (ADHD) suffer from various impairments of cognitive, emotional and social functioning, which can have considerable consequences for daily living, e.g. driving a vehicle. Driving is an important activity of everyday life and requires an efficient interplay between multiple cognitive, perceptual, and motor skills. The current review seeks to answer whether individuals with ADHD show increased levels of unsafe driving behaviours, which cognitive (dys)functions of individuals with ADHD are related to driving difficulty, and whether pharmacological treatment significantly improves their driving behaviour. The available research provides convincing evidence that individuals with ADHD have different and more adverse driving outcomes than individuals without the condition. However, it appears that not all individuals with ADHD are affected uniformly. Despite various cognitive functions being related with driving difficulties, these functions do not appear helpful in detecting high risk drivers with ADHD, nor in predicting driving outcomes in individuals with ADHD, since impairments in these functions are defining criteria for the diagnoses of ADHD. Pharmacological treatment of ADHD appears to be beneficial to the driving difficulties of individuals with ADHD. However, additional research is needed that address the numerous methodological weaknesses of many of the previous studies.

Does shared space lead to more communication in cyclists?

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The present study investigated whether ‘the claim’ of Shared Space does make sense. Shared Space is a way of thinking about public spaces: no particular traffic mode should be better accommodated than others. Hence, traffic is no more regulated by traffic signs and traditional road lay-outs, but only by the courtesy of the traffic participants. The idea is that an environment in a town or village should be designed to be there and stay, not just to pass through. Shared-Space advocates claim that in a Shared-Space environment more communication between traffic participants will occur causing a more natural development of traffic flow.

We observed the behaviour of cyclists on three intersections; one regulated with priority signs, one without priority regulation but with a conventional lay-out, and one in a Shared-Space environment. The behaviours were categorized in various classes from which various communication possibilities were concluded. It was found that the cyclists in the Shared-Space environment showed more behaviours that may be useful in communicating intentions to others, than in the conventionally designed environments. Gender and age differences did not show behaviour differences. It is speculated to what extent the behaviours could be attributed completely to the Shared-Space environment.

Mental Workload Measurements through Low-Cost and Wearable Sensors: Insights in the Accuracy, Obtrusiveness and Research Usability of Three Instruments

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The availability of low-cost and wearable psychophysiological sensors has immensely increased over the past few years. In the current study, two sensors are assessed on their accuracy as a tool to measure heart rate variability (HRV): the E3 sensor from Empatica and HeartMath's EmWave Pro system. The BioPatch from Zephyr Technology is used as a gold standard to compare the data of the other two devices regarding their accuracy. The usability for research and obtrusiveness of the three sensors are also investigated to evaluate their suitability for deployment in research settings.

Difference in General Aviation accidents involving Male and Female Pilots

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Studies examining aviation accidents have not found differences in accident rates by gender though there may be gender differences in the type of accident. One older study examined accident rates of male and female private pilots and found that males were more likely to have accidents related to inattention or poor planning (e.g., ignoring weather conditions, taking unnecessary risks) while female pilots were more likely to have accidents due to mishandling the aircraft (e.g., panic manoeuvres, ignoring the kinetics of the aircraft). This research analysed the National Transportation Safety Board's accident database to examine severity of injury and aircraft damage in general aviation accidents by gender. The stereotypic beliefs that females are less capable than males at all levels do not appear to be supported by this research. Data analysis indicates that female pilots seem to have higher aircraft damage and personnel injury at lower levels of training and experience, but then have superior records as compared to male pilots at higher levels of experience.

The Simplification of Bus Stops to increase Mobility of People with Cognitive Disability

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Accessible, comfortable and safe mobility for everyone is a crucial theme of current society. The public transport (PT) can be regarded as an essential element to conquer space and participate in life. At that mobility can include numerous barriers at all levels of interaction with the complex (traffic) system. For people with physical limitations those barriers are broadly known, for people with cognitive impairments it is still investigating insufficiently. Performed preliminary study to determine the barriers to mobility of cognitively impaired people find many obstacles, which depict the complexity of using public transport. Either limited cognitive capacity substantiates the simplification of complexity in mobility. For accessible conducting of PT the bus stops occupy the key role and are to simplify. It is believed that the complexity of bus stops can be generated by static and dynamic features of local complexity and influence individual concentration by stimuli. Adapted to the theoretical model of simplification of the bus stops, the potential barriers will be measured with the help of methods of HF as simulations and CWA. A successful measurement will present objective criteria of accessibility, which form the basis for effective and safe programs of transport companies and software algorithms.

An Investigation into ATM's. A user centred study (of older adults) for the development of increased security & usability based on user behaviour

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M.A. Researcher

DesignCORE

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The purpose of this research project is to explore user behaviour specific to Automated Teller Machines and to develop an understanding of fraud and skimming techniques being used through user centred design research methodologies. The initial 'discovery' stage included a literature review and user observations by means of a pilot study. This was synthesised by an affinity diagram and an interview held with a lead member of An Garda Síochána (Irish Police Force - Fraud & ATM Crime Unit). This information will be converged and analysed with the use of 'layered validation'. Three graphical 'Layers' will be created; Behaviour, Usability and Security. These layers once compiled will show the interaction, relationship and effect they have upon each other and also the user of the ATM channel. One major finding from the initial 'discovery' stage was that physical crime and manipulation on older adults in Ireland at the ATM channel needed to be addressed by means of design intervention. The conclusion of the 'layered validation' is to ground the justification for further enquiry into the ATM channel with the aim of developing a viable design solution, a solution that increases security and product usability in the channel.

Eco-Pedaling – Examining a highly automated eco-assistance system for pedelecs from a user perspective

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Due to the high weight of motorised bicycles (i.e., pedelecs), running out of charge is an adverse event for users. We conducted a field study to examine an eco-assistance system for pedelecs which aimed to reduce the energy consumption by automatically changing between support levels. We investigated (1) users' evaluation of this system, (2) the comparison between manual cycling (i.e., without assistance) and cycling with the eco-assistance system as well as (3) possible influencing factors. The assessment involved subjective ratings of trust, acceptance and usability, which were supplemented by logger data (e.g., energy consumption, support level, velocity). A sample of 30 experienced pedelec users were instructed to drive a predefined test track as energy efficiently as possible. Applying a repeated-measures design, participants drove the test track twice, once with the eco-driving assistance system and once by manual cycling.

Results revealed lower ratings of trust, acceptance and usability for the eco-assistant, especially in comparison to manual cycling. Logger data showed significantly lower energy consumption in the manual cycling condition; no differences for velocity or travel time were observed. The high degree of automation of the system was perceived as a disadvantage by users as it was impossible to override the system.

Understanding the Potential of the PARO Robot as a Stress Reduction Tool for Older Adults

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Older adults' daily lives may be stressful for a variety of reasons, and if not properly managed, stress can have a negative impact on physical and mental health. Advances in the design of socially interactive robots give rise to the question of whether these technologies can be effective sources of stress-reduction. The robot seal, PARO, was designed with the goal of eliciting relaxation, and the results of previous studies suggest that it may indeed have the ability to achieve this goal. However, these findings are often confounded by social interaction with other people, failing to tease apart the unique effects of the robot on stress-reduction. The present study investigates PARO's capacity to reduce older adults' stress and cognitive load while they perform a stressful task on their own, and whether these potential effects are driven by the robot's interactivity (PARO powered on) or simply due to the robot's presence (PARO powered off). These data will provide valuable insights into the relative potential of the PARO robot as a stress reduction tool for older adults. As the proportion of older adults in the population increases, identifying new methods of diminishing stress is critical to the support of healthy ageing.

Safe Cycling – Cycling with a visual impairment

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Safe Cycling/Royal Dutch Visio/Project researcher
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In the Netherlands, the ability to cycle safely and responsibly is important for independent mobility across the lifespan. In addition, cycling can be important in maintaining physical health. But when can a visually challenged person use a bicycle safely? Opinions vary, but there are no reliable - let alone evidence-based - guidelines.

'Safe Cycling' is a research collaboration between the University of Groningen and two expertise centres for blind and partially sighted people; Royal Dutch Visio and Bartiméus. This project is aimed at providing an overview of cycling behaviour of visually impaired individuals. In that way, more scientific backing can be given for determining whether it is safe and responsible for them to (learn how to) cycle.

Firstly, essential factors that determine whether it is safe for a visually impaired person to cycle independently will be investigated through online questionnaires. Secondly, observing real world cycling behaviour will serve to explore how visually challenged cyclists compensate for loss of visual acuity or a reduced visual field. Finally, the cycling behaviour of visually challenged cyclists (65-75 years) on a regular bicycle and an E-bike will be compared.

Gaze Interaction Based on Smooth Pursuit Eye Movements

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Gaze interaction is an innovative form of human computer interaction that despite its potential is still not a widely-used interaction concept. The need for calibration, strenuousness for the eyes and the high number of unintended selections are limiting the practicability of gaze interaction for everyday human computer interaction.

In my presentation a novel form of gaze interaction will be presented that has great potential to overcome these barriers. This interaction is based on relatively slow and regular (“smooth”) movements of the eye that occur when a moving object is followed by the gaze.

The interaction concept was tested in two experiments using an exemplary PIN code entry scenario. The first experiment was conducted to learn more about users’ preferences regarding the speed and density of moving display buttons and to collect exemplary data for the development of an interactive system. In the second experiment, twelve conventionally calibrated participants interacted successfully with the PIN code entry system. For another group of twelve people the eye tracker was not calibrated individually, but on a third person. Results show that the overall rating of the user experience was positive; the interaction of both groups was possible without false alarms.

A case study to compare the advantages and limits of two accident causation models

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France

Despite its reactive nature, accident investigations still remain an important source of information to guide safety management priorities in risky systems. Understanding accident causation is therefore a critical activity to enhance safety. For many years, theoretical models developed in the field of human factors call for a “new view on human factors and system safety” (Reason, 1990; Rasmussen, 1997; Dekker, 2005) and insist on the need to shift from traditional sequential and epidemiological models of accident causation to systemic models (Hollnagel, 2004). But in practice, it still remains difficult for accident investigation boards to give up completely this traditional view. For instance, the French state aircraft accident board reports that, from 2003 to 2012, 80% of all identified causes are related to “human factors”, and among these, more than half are errors from front-line operators (BEAD-air, 2014). In this context, we describe the application of two theoretical frameworks - the Human Factors Classification and Analysis System (Shappell & Wiegmann, 2001) and the AcciMap model (Rasmussen, 1997; Svedung & Rasmussen, 2002) - to analyse a fighter aircraft accident that occurred in France in 2010. Based on this case study, we discuss the advantages and limits of these two frameworks.

Evaluation of an adaptive cruise control system in real traffic and in a driving simulator

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This study compares drivers' evaluation of an Adaptive Cruise Control (ACC) system in real traffic on the road and in a driving simulator with a 3D autostereoscopic visual system. The ACC automatically decelerates and accelerates the vehicle to maintain both the speed specified by the driver and the minimum separation from a forward driving vehicle. For our future studies in simulated dry and icy road conditions an estimation of the simulator-bias with regard to drivers' subjective evaluation of the ACC was necessary.

Twenty drivers (10 women) drove with two time gap settings of the ACC (1 and 1.8 seconds) in real traffic and in a driving simulator. For the ACC time gap of 1.8 seconds differences between the evaluation in reality and in the simulation did not reach statistical significance. Surprisingly, when using the ACC time gap of 1 second drivers' subjective ratings of safety, comfort and trust were significantly lower in the simulator than in reality for maneuvers such as vehicle-following at constant and variable speed and cut-in, but not for overtaking. There was no evidence that the drivers' subjective feelings of safety, comfort and trust in the ACC system were stronger in the simulator than in the reality.

Supervised experience of drunk driving: positive effects on driving under the influence in young drivers

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Driving under the influence of alcohol is an important risk factor for traffic safety. Since young drivers are especially vulnerable to being involved in alcohol related traffic accidents an intervention program was developed to prevent drunk driving in young drivers. The program consisted of three parts. In the first part awareness of the detrimental effects of alcohol on driving performance was raised by improving knowledge about the influence of alcohol on performance. Second, young drivers could experience these effects by driving first sober and later drunk under supervision on a closed circuit. In the third part the experience was evaluated group wise.

A previous evaluation of the program (Brookhuis et al. 2011) had shown that the program proved to be successful in decreasing the number of young men that were caught driving under the influence of alcohol, but it was not clear what caused this success. In the current study, therefore, we tried to explore this. We did this by questioning participants (n=205) in the program about their knowledge of the influence of alcohol on performance, their experience of driving under the influence and the evaluation of their performance while driving under the influence.

Identifying Barriers and Facilitators to Task Performance Among Older Adults in American and European Residential Environments: A Comparative Analysis

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Many older adults are aging with one or more age-related impairments (ARIs), and often face functional limitations in performing activities of daily living (ADLs). For this population, activity demand often exceeds capability, where multiple ARIs result in worse ADL performance outcomes compared to individual limitations. There is little known about the needs of this population, therefore this exploratory research study investigated differences in limitations and facilitators associated with bathroom-related tasks for older adults with various impairments. Older Dutch (N=30) and American (N=30) adults age 56-95 years (M=77.4, SD=9.55) with vision (n=38), hearing (n=18), and mobility (n=36) impairments simulated bathroom-related tasks during in-home observations in senior residential facilities. Overall, 'showering/bathing' was the most difficult task, especially among those with vision and mobility impairments. Most participants (n=43) compensated for bathing/showering limitations by avoiding and reducing baths, while only 26 participants utilized facilitators available. The most significant deficit in task performance was seen among those with multiple ARIs, primarily vision-mobility. Outcomes of this research indicate the need to focus solutions on specific functional limitations and co-morbidities, and to better design varying levels of intervention that enable independent task performance. Additionally, examining task limitations across different cultural settings can potentially lead to universal assistive solutions.

Validation of a real-time assessment tool for situation awareness in an air traffic control simulation

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Air traffic controllers are responsible for safety and efficiency in an ever growing traffic environment. To provide safe and efficient guidance they are required to overlook the ongoing situation and direct aircraft accordingly. Situation awareness is the most widely used criteria to evaluate if operators can handle such complex dynamic situations. In an earlier study, a real-time online probe technique has been developed to measure situation awareness in a high-fidelity real time simulator. The technique was designed to allow for the evaluation of situation awareness during the task instead of afterwards. The experiment presented in this paper was done to validate the developed technique. From the Technical University of Braunschweig, Germany, 99 non-expert subjects were recruited for this experiment. Participants took the role of approach air traffic controllers in the real time simulator NARSIM. Additionally, all subjects completed a battery of cognitive tests, including intelligence, working memory capacity and attention. Results support the validity of the presented measurement technique. In general, subjects with better cognitive performance showed better situation awareness throughout the scenarios. Using this technique, in the future it will be possible to determine if an operator's situation awareness is sufficient while the situation is still going.

Requirements for an aircraft maintenance technician headset

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Aircraft maintenance technicians work in a situation where the implementation and use of new technology is uncommon. This is so to reduce the risk for errors considered to be a result of design errors, of the system or tools used. Earlier studies have shown that more advanced equipment, such as, tablets, Personal Digital Assistants, etc. can be used to help reduce the number of manuals, amounts of paperwork, track actions better, and reduce the number of steps in the work process. To take this process a step further was the ISO 9241:210 standard followed, 10 technicians were interviewed, 6 separate observations were conducted, and the technicians were consulted in development of a design requirements for a headset to see in what way a aircraft maintenance technician daily maintenance operations can be improved. The resulted requirements were, a headset should be placed around the head over the forehead for a steady fit during the varied working positions of the aircraft technicians, it is to be made of lightweight and smooth fabric, which features elasticity and comfort for the skin, adaptability for different headsizes, the construction is made all in one piece to be simple yet robust to handle, the headset is to be placed/fit firmly onto the head during a working day, providing ability to access data and information effortlessly through the device which operates with augmented reality technology, an interactive way of handling data and information, information is to be visualized, and the information needed in the daily work is to be gathered and easily accessed in one place, which includes the channels for communication.

DriveLab — a new way to measure driver behaviour in a virtual environment

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Driving simulators provide an excellent way to monitor driver behaviour in controlled conditions. Multiple subjects can be tested with precisely the same road and traffic conditions so that the fitness of individual drivers can accurately be compared. Furthermore, in a simulator it is relatively easy to measure detailed information about the drivers' behaviour and performance using eye tracking, physiological data and similar measurements. However, in general these different sources of data are not synchronized and integrated, so that (for instance), if the simulator displays a pedestrian and the driver looks towards at that image, the system as a whole does not know that the driver is looking at the simulated pedestrian. Clearly this means that the potential of such a system is not fully reached.

In this presentation, we will describe DriveLab, a new system which integrates a driving simulator, physiological data and 3D eye tracking data to enable advanced analysis of drivers' behaviour because all the data streams are integrated and synchronized. The system has been developed in a cooperative project between Noldus Information Technology (integration and analysis), SmartEye (eye tracking) and GreenDino (driving simulation). It was designed in cooperation with Delft University and the HAN University of Applied Sciences (the Netherlands).

We will also present experimental data obtained with the new system, demonstrating a proof of concept and assess how useful the system is for studies of driver fitness.

AniSAM & AniAvatar – Animated visualizations of affective states

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Various tools have been developed that are aimed at an automated and continuous assessment of human emotions. Often, such tools provide a visual feedback about emotions to the user in the form of an avatar or emoticon. While a great deal of effort has been put so far into the reliable and accurate automated detection of emotions, only very little is known about how this information about affective states should be displayed in a comprehensible way to the user. In the present study, two animated feedback tools were evaluated. The tools were developed on the basis of existing non-verbal questionnaires to assess two dimensions of emotion (i.e. valence and arousal) based on the circumplex model of affect. A total number of 706 participants were tested, using different vignettes that describe situations with specific affective content using two newly developed affective feedback tools (AniSAM and AniAvatar). The ratings obtained were compared with ratings using the original SAM instrument, a well-established instrument to measure affect as a third, existing non-animated feedback-instrument. Results indicated that the animated feedback increased the accuracy of the arousal representation. Furthermore, valence feedback is more accurate when provided with an animated manikin-based tool rather than an avatar-based tool. This provides evidence for the usefulness of animated tools offering visual feedback on user emotion. AniSAM and AniAvatar can be downloaded for purposes of practical applications and further research.

Masking action relevant stimuli to determine information demand for dynamic displays - a MARS study

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The novel MARS (Masking Action Relevant Stimuli) method measures driver's information demand for dynamic stimuli in the driving environment. The action relevant stimulus is masked and the driver initiates a limited unmasking period for the stimulus by pressing a button. The button presses are interpreted in terms of information demand. The MARS method was applied to a dynamic HMI display of a traffic light assistant. In a driving simulator, drivers approached traffic light intersections with different traffic light phasing. Two different HMI concepts were compared. Drivers either drove in the test track with using the MARS method or without using the MARS method. The study had a full within subjects design and gaze behaviour was recorded in all conditions. The results showed that the MARS method could distinguish between conditions with high and low information demand. The information demand was higher with complex HMI version and with changing traffic lights compared to the simple HMI version or solid traffic light phasing. A comparison of button presses with gaze behaviour showed that one unmasking interval came along with one fixation to the display. The MARS method seems to be a promising tool for the evaluation of information processing in dynamic contexts.

Spatial distributed multimodal warning signals for LED Head-Up displays

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Spatial distributed warning signals are able to increase effectiveness of Advanced Driver Assistance Systems. They provide better performance regarding attention shifts towards critical objects and thus, lowering driver's reaction time and increase traffic safety.

The paper presents results of two driving simulator studies (each 30 participants) with spatial distributed warnings under investigation. The first study focused on visual warning using a novel LED head-up display mounted underneath the windscreen while the second study solely examined the impact of spatial auditory warnings on driver's reaction time. Both studies included a baseline without secondary task and warning signals. Afterwards, the subjects were confronted with 30 critical objects while performing a secondary task. The chronological order of warnings was randomly switched between spatial, non-spatial and no warning. Additional to reaction times eye-tracking-data was recorded and questionnaires were conducted.

Results of the studies show that visual spatial directed warnings are superior to non-spatial warnings especially in large distances but have problems in peripheral regions when the driver is distracted. The auditory signal is able to resolve this problem while the auditory spatial warning is not as efficient as theory would imply. Discussion and implications on ADAS with spatial warning signals will conclude the paper.

The WRS-pyramid – a Human Machine Interface facilitating resilience

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This paper introduces the Weak-Resilience-Signal (WRS)-pyramid - a human machine interface. It facilitates resilience of operators at a control room of a complex socio-technical system (STS), by making goal-relevant constraints explicit (Rasmussen, 1985). Resilience engineering investigates, among other aspects, the ability of an STS to reorganize and adapt to the unexpected and unforeseen (Hollnagel, Woods, & Leveson, 2006). However, the resilience doctrine is not yet sufficiently well developed for designing and achieving these goals (Madni & Jackson, 2009). An important step to account for the resilience of an STS is information on the functional properties of the system state, which we have termed its 'resilience state'. The WRS-pyramid was designed to present relative movements to a system's boundaries – safety, performance, and workload, which we modeled theoretically (Siegel & Schraagen, 2014). We have developed, for each boundary, an analysis mode to reach technical details within the IT-system that controls the operations. Operators in control rooms can reflect on the WRS-Pyramid, with its analysis functions, to make resilience-related knowledge explicit (Siegel & Schraagen, 2015). Generically, we show the relation to ecological interface design (Burns & Hajdukiewicz, 2004) using the abstraction hierarchy, and analyze different display combinations representing the resilience state. Specifically, we work out a case for the rail sector which we will use for verification and validation of the concept in real-life train operations.

A critical path modelling GOMS approach for decomposing lane changes on a two-lane highway

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Driving is a complex task requiring processing on psychomotor, perceptual and cognitive level. An intimate understanding of the occurrence and timing of the processing steps is necessary when modelling driver behaviour and intent in cognitive architectures (e.g., ACT-R, Anderson et al., 2004). However, until now, little research on the decomposition of the driving task into the involved operations has been conducted. The approach of Critical Path Modelling Goals Operators Methods Selection rules (CPM-GOMS, John & Kieras, 1996) provides a framework for describing motor, perceptual and cognitive operators of a task on a granular time level. Thus, we employed CPM-GOMS in order to analyse lane change manoeuvres accomplished on a two-lane highway in real traffic. Here, we present the decomposition of three different types of lane changes (merging to the highway, change from right to left lane, and back) based on video observation of driver and environment as well as driving data analysis of three participants driving on the German autobahn A39. The resulting model forms the basis for understanding the aspects of vehicle operations and serves the creation of cognitive models.

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What bridge teams do - an exhaustive coding manual for the assessment of team interactions in seafaring

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At the core of CRM research, training needs analysis, training delivery and evaluation is the observation of team interactions. Therefore, many rating systems have evolved that are designed to systematically guide the observation and evaluation of interactions and to be lean enough to allow for an online-assessment and immediate feedback during training delivery. For research, however, a more thorough observation system for the determination of frequencies of relevant behaviours is still missing.

In this paper, we present the content and the structure of an observation system for interaction behaviours in nautical teams, as well as first results of its application. The system was designed to be exhaustive, covering all possible team-related behaviours on a ship's bridge, and at the same time efficient, by composing these behaviours into a hierarchical structure that allows for quick and reliable mapping of observed behaviours to the categories of the system. Data from two observers that coded video recordings of 16 participants in a nautical simulator training showed that 94.4% of all interaction behaviours could be mapped to the categories of the system. The interrater-reliability was found to be .74. Possible measures to further increase reliability and exhaustivity of the coding manual will be discussed.

Field study investigating first time interaction with four automatic gear shifter concepts and their impact on safety

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The driving environment in cars has looked almost the same over the years, including a steering wheel, pedals and gear shifter. The low rate of change to the driving environment could partly be due to practical reasons. Traditionally, the mechanical gear shifter had to have a long lever arm – joystick – to enable an ergonomic change of gears. Today, shift-by-wire technology enables alternatives. Analyses of A2MAC1 gear shifter images, from car exhibitions over the world, showed that traditional joystick shifters still were the most common. However, the images also showed alternative shifter types as rotary shifters, stalk shifters, button shifters and touch pad shifters, the latter only in concept cars. In a field study, four cars with shift-by-wire technology and automatic gear shifters of either joystick, rotary, stalk, and button type, was investigated from a usability and safety perspective. Eight participants interacted with all four concepts in counterbalanced order without guidance, as in a car rental scenario. Since the cars and shifters differed in many aspects the confounding variables made quantitative analyses less interesting. Instead the focus was on understanding the underlying factors to perceived usefulness and errors. All shifter types had clear advantages and disadvantages, some that could impact safety.

Identifying the gaps in available assistive technologies to support healthy aging

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Older adults are living longer, in general, but specifically individuals with pre-existing disabilities (e.g., vision, hearing, mobility impairment) are living longer as well. Pre-existing physical and sensory impairments may affect the way older adults experience basic, instrumental, and enhanced activities of daily living, widening the gap between functional ability and environmental demand. Many older adults compensate for performance deficits by utilizing assistive equipment that is built to aid particular activities. There are traditional assistive technology devices intended to alleviate these challenges and support healthy aging, but it is unclear if they are effective. We conducted an archival analysis of survey data to assess use, nonuse, and abandonment of assistive technology devices by older adults. Results showed that many assistive devices are not successful due to inefficiency; lack of training, access, awareness; and poor usability. Moreover, the components of activity limitations that cause the most difficulty are underspecified. We will provide an overview of the general nature and frequency of challenges to guide design of assistive technologies. We also identify the acceptance of these technologies by older adults, major barriers to their usage, and discuss the potential of accessible everyday technologies to meet the needs of individuals aging with disability.

Study of the effects of the level of detail in safety rule descriptions on a psychological process of safety behaviours

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Safety rule expansion can cause side effects such as increasing workloads. Our previous study indicated the importance of mitigating the effects of disturbances on the components of the psychological processes of safety behaviours, and adjusting the level of detail in safety rule descriptions based on applicable conditions, for introducing effective safety rules. However, there is little research on the effects of the level of detail in safety rule descriptions on the psychological processes of safety behaviours. In order to investigate them, the present study conducted an experiment in which 40 participants completed a calculation task while following multiple safety rules with differing levels of detail in their description and answered a questionnaire of the psychological processes. Results suggested that 1) detailed rules describing "What", "When", and "How" should be limited to only when necessary, because, while they enhanced the awareness of the results of a safety behaviour, they also led to the supposition of decrease in work efficiency and increase in mental workload. 2) It might be better to add "How" or "When" description to "What" description, because just "What" description was not enough to enhance the awareness of usefulness of a safety behaviour and the confidence towards its result.

Organizational stress and its impact on the health of workers from a higher education institution

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Introduction: in the last decade, stress was considered one of the main illnesses affecting humanity, besides representing a high cost for public health and companies. The woman as object of study is recent, fact which has instigated investigation. The research is grounded on two theoretical models, Karasek (Job Stress Scale - Demand, Control and Social Support) which considers the environmental factors as determining in the process of stress, and Lipp (Inventory Stress Symptoms Adults), who defends that stress is composed by four stages: alert, resistance, almost-exhaustion and exhaustion. Objectives: establish the work factors predisposing of stress, asserting their impact on worker's psychological and physical health. Method: the research is an observational and cross-sectional. The sample was composed by 296 workers. The research instrument used was a self-applicable questionnaire. The Chi-square test and Fischer's exact test were applied. Results and Final Thoughts: in relation to the gender, in the teachers group, female was composed by 58,6% and male 41,1%; in the other professionals group, female was composed by 52,2% and male 47,8%. It became evident in both groups and genders, prevalence of high psychological demand, high control and high social support at work (Karasek); and prevalence of resistance stage stress (Lipp).

Association of Objective and Subjective Measures in Usability Evaluation of a Standard PC Mouse

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Digital devices permeate a great part of activities developed both as leisure or work. Musculoskeletal disorders are on the rise (Storheim & Zwart, 2014). Extended use of computer pointing devices is bound to endure in the future, because touch screens have so far not been able to replace the PC mouse, especially in professional applications (Lourenço et al., 2015). A subjective evaluation was carried out of a standard computer mouse, with 20 subjects (equally divided between sexes), while performing pointing, dragging and steering tasks in accordance with previous studies (Odell & Johnston, 2007). Subjects were given 3 scales, each one composed of several items: discomfort, ease of use and effort. Ratings were provided in 6-point Likert scales completed by the subjects. The session lasted between 10 and 12 minutes, depending on the duration of pauses the subject chose to undertake between tasks. Additionally errors and time to complete tasks were automatically recorded by a purpose built software. Subjective and objective measures related to usability are correlated in support of internal validation of the scales used. Efficiency and efficacy, calculated based on automatic data for several tasks are associated with subjective effort, discomfort and ease of use.

Autonomous Transport

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Aviation is a well-known domain with respect to the interaction between humans and automated systems. The domain yields potential lessons learned and best practices that can possibly be adopted in other transportation domains such as cars, trains and shipping. Like aircraft, cars, trains and ships are increasingly using automation to advance the performance and safety of their systems. Many believe that soon most vehicles will operate autonomously. Although research says we are not there yet. A topic that needs attention in this context is the transition of control, focusing on the switch in control from 'autonomous' to manual and vice versa. This paper focuses on transition of control in autonomous vehicles. A generic experimental environment (applicable for multiple transport domains) has been developed to study the human factor aspects involved in transition of control. A first experiment was conducted of which the results will be discussed.