Europe Chapter
Human Factors and Ergonomics Society

Annual Meeting 2014

Human Factors in high reliability industries

October 8-10, 2014

LISBON - PORTUGAL

BOOK OF ABSTRACTS

Europe Chapter
Human Factors and Ergonomics Society

Organization Committee 2014

ALEXANDRA FRANCO

INAC-Portuguese Civil Aviation Authority

KAREL BROOKHUIS

Delft University of Technology

DICK DE WAARD

University of Groningen

ANTONELLA TOFFETTI

Centro Ricerche FIAT

CLEMENS WEIKERT

Lund University

SESSION 1: HMI

Touchscreen or keyboard - the influence of participants' age in usability testing

Andreas Sonderegger, Sven Schmutz, Jürgen Sauer
*andreas.sonderegger*AT*unifr.ch*
University of Fribourg, Department of Psychology
Rue Faucigny 2
1700 Fribourg, Switzerland

The influence of participants' age in usability evaluation was examined in an experiment. Sixty users from two age groups (M = 23.0 yrs, M = 58.1 yrs) operated two technical devices (keyboard-based and touchscreen-based smartphones). As typical outcome measures of usability tests, various performance measures (e.g., task completion time, task completion rate) and several subjective measures were recorded (e.g., perceived usability, emotion, and workload). The results indicated better performance scores for younger adults than older adults for task completion time. For older adult users, a mismatch between usability ratings and task completion time was revealed, with higher ratings for the touchscreen device although performance was poorer compared to the keyboard-based device. This mismatch was neither shown for the link between usability ratings and task completion rate of older adult users nor for younger adult users in general. Such age-related differences in the importance of speed and accuracy in task completion point to the need to consider more strongly the factor user age in usability research and practice.

Human Factors Issues for Computerised Maintenance Management System

Phillip Tretten, Carl-Jörgen Normark, Ramin Karim
*phillip.tretten*AT*ltu.se*
Luleå University of Technology
97187 Luleå, Sweden

Maintenance software solutions are not designed for the users but instead for experts. Things are too complex and the available information is not applicable to the actual maintenance tasks to be conducted. Research has shown that there is need for easy to use tools that can assist in maintenance planning, maintenance actions, and maintenance reporting. Due the financial and time constraints placed the maintenance process need to become more effective and efficient. By taking a human factors perspective, actions can be taken to minimize human error in maintenance work as well as to allow for an effortless work that is accomplished in the proper way. The goal of this project was to find out what criteria are necessary, in a human factors perspective, to develop a mobile tool for maintenance personnel that will have the possibility to make the most out of maintenance planning, execution, and follow-up in an efficient and effective way that is adapted to the user of the tool. This resulted in a mobile application for maintenance technicians to increase maintenance efficiency, usability and user satisfaction.

Advantages of Magnetic Mice over Trackballs as Computer Input Devices on Moving Platforms

Stefan Röttger, Saskia Vetter, Sören Ollhoff
*stefanroettger*AT*bundeswehr.org*
German Naval Medical Institute, Dpt. for Naval Psychology and Ergonomics
Kopperpahler Allee 120
24119 Kronshagen, Germany

Although ergonomic studies show that cursor control with a computer mouse is faster and sometimes more accurate than cursor control with a trackball, trackballs are the standard input device for cursor movements on many moving platforms such as airplanes and ships. One reason for this is that trackballs can be fixed to the workstation, which prevents involuntary cursor movements that could otherwise be induced by movements of the platform. In this study, standard trackballs and computer mice with magnetic adhesion to the mouse pad were evaluated by 18 sailors of the German Navy after 26 days of computer operation on their moving ship. Results show that users of magnetic mice experience a higher performance and less muscular fatigue than trackball users. Thus, magnetic mice should be considered as the standard input device on moving platforms.

Note: This research has been previously presented at the 2013 conference of the International Traffic Medicine Association, but conference organizers failed to include the full paper in the conference proceedings, so this study has not been published before.

Investigation of Human Behaviour in Pushing and Pulling Tasks for Direct Manipulation of a Collaborative Robot

Jonas Schmidtler, Christina Harbauer, Klaus Bengler
*schmidtler*AT*lfe.mw.tum.de*
Institute of Ergonomics, Technische Universität München
Boltzmannstr. 15
85747 Garching, Germany

Cobots also known as Intelligent Assist Devices (IADs) are a class of handling systems that combine the characteristics of industrial robots and handheld manipulators, interacting in direct physical contact with the human worker. Cobots are used for strength amplification, inertia masking, and guidance via virtual surfaces. Therefore, sensing and understanding how the human reacts, what he actually senses, and what he is intended to do while pushing and pulling a collaborative robot is of central importance. This study is concerned with the human behaviour while pushing and pulling a trolley to get information about the characteristics of the human side of the physical human-robot-interaction. The trolley is laden with three different weights and three different object sizes that should separate the connection between estimated weight and exerted force. The subjects had to push and pull the trolley on a given path, similar to a real production scenario in automotive assembly lines. Twenty-two subjects participated and were monitored by a VICON motion tracking system and three GoPro cameras. The applied forces were gathered independently on each handle in three coordinates via a Kistler hand force measuring system. The subjective impressions were acquired through questionnaires.

SESSION 2: AUTOMATION

Does more complexity make decisions simpler? The influence of the number of stages of likelihood alarm systems on performance

Magali Balaud, Dietrich Manzey
*mbalaud*AT*zmms.tu-berlin.de*
Technische Universität Berlin
Zentrum Mensch-Maschine-Systeme
GRK prometei
Sekr. MAR 3-3
Marchstraße 23
10587 Berlin, Germany

Responses to alarms involve decisions under uncertainty. Operators do not know if an alarm is more likely to be a hit or a false alarm. Likelihood alarm systems (LAS) help reducing this uncertainty by providing information about the certainty of its diagnostic. Unlike traditional binary alarm systems, they have three or more stages: each one represents a different degree of likelihood that a critical event is really present. Consequently, the more stages, the more specific is the information provided by the alarm system to reduce uncertainty. A laboratory experiment with 48 participants was conducted to investigate the effect of specificity of information in LAS on performances and responding behaviours. Specifically, a three-stage, four-stage, and five-stage LAS were compared using a multi-tasking environment. Results show higher percentages of correct decisions in the alarm task when participants used the four- and five-stage LAS than the three-stage LAS but no significant differences were found between the four- and five-stage LAS. Interesting differences in response patterns were also observed. Participants complied differently to stages having the same degree of likelihood depending on whether this stage was part of the four-stage LAS or the five-stage LAS. These results and their practical applications will be discussed.

The predictive quality of retentivity for skill retention in a simulated process control tasks

Barbara Frank, Marcel Reefmann, Annette Kluge
*barbara.frank*AT*uni-due.de*
Business- and Organisational Psychology
Lotharstr. 65
LE 252
47057 Duisburg, Germany

As past studies have shown refresher interventions potential to mitigate skill decay in process control, current studies also indicate the predictive quality of retentivity as a person-related variable (Maafi, 2013). The present study investigated the impact of retentivity on non-routine tasks in the context of simulated continuous work experience. Based on a pre-study (N=18) a main study was designed (N=39). The pre-study compared four retentivity measures (Selective Reminding Test, WIT-2, I-S-T-2000R and Map-Learning) in a simulated process control task and showed significant high correlations between the target skill measured by production outcome and Map-Learning (ρ=.503) directly after training. The main study (EG n=19, CG n=20) investigated the retentivity constructs in the context of simulated work experience and comprised four parts: Initial training of the target skill (week 1),

ordinary work experience (target skill was not required; week 2 and 3) and the retention assessment of the target skill (week 4). The control group took part in initial training and retention assessment only. Results showed significant medium sized correlations between production outcome in retention assessment and Map-Learning (r=.382) and between production outcome in retention assessment and WIT-2 (r=.329). Derived from these findings memory constructs and practical implications will be discussed.

Driver behaviour during transitions in highly automated driving

Tyron Louw, Natasha Merat, Andrew Hamish Jamson
*t.l.louw*AT*leeds.ac.uk*
Institute for Transport Studies, University of Leeds
Leeds, UK LS2 9JT

This paper outlines the results of a driving simulator study designed to assess driver behaviour in during the take-over of control of a vehicle in a Highly Automated Driving (HAD) situation. Increasing levels of vehicle automation allows drivers to withdraw more attention from the driving task. In HAD it is possible that in the worst-case scenario drivers can lose all situation awareness of the driving scene. In such situations it is important to understand how to bring drivers back into the loop so that they can safely re-engage in manual driving. At present, there is little information on how drivers will behave during non-critical system-initiated transitions. It is not clear, for example, how different levels of drivers' situation awareness prior to a system-initiated take-over request will impact on reaction time. The paper reports on a study undertaken to assess drivers' behavioural responses to different sequences used during the transition from HAD to manual driving, in a non-critical situation. To investigate this issue, drivers were required to regain control of the driving task if the automated system had reached a limit. The paper will summarise the results of this study and discuss their implications on the design of future transition procedures.

Autonomous Vehicles: are we aware of them?

Francesco Biondi, David Strayer, Frank Drews
*francesco.biondi*AT*ymail.com*
University of Padova, University of Utah
Department of Social and Developmental Psychology, Via Venezia 15, Padova, Italy

Autonomous vehicles or fully-automated cars are vehicles capable of driving without the need by the driver to control them. This study aims to investigate the impact of autonomous vehicles on drivers' behaviour and, in particular, situational awareness. Three different experimental conditions were considered: control - participants drove a regular vehicle within a simulated environment, autonomous vehicle - participants were driven by an autonomous vehicle, and cellphone condition - participants were driven by an autonomous vehicle while talking on a cellphone. At the end of each experimental condition, participants were required to recognize the events they were exposed to within the simulated environment. When the autonomous vehicle was in charge of driving, compared to the control condition, a reduction in mental workload was found. Further, in the autonomous vehicle condition, participants showed a complete different recognition pattern compared to the condition in which they were driving the vehicle.

SESSION 3: SIMULATOR STUDIES AND SIMULATION

Is simulation (not) enough? Results of a validation study of an autonomous emergency braking system on a test track and in a static driving simulator

Martin Jentsch, Angelika C. Bullinger
*martin.jentsch*AT*mb.tu-chemnitz.de*
Technische Universität Chemnitz
Institut für Betriebswissenschaften und Fabriksysteme
Professur Arbeitswissenschaft und Innovations management
09107 Chemnitz, Germany

Comparison between data gathered with real vehicles and with a driving simulator is still heavily debated. This paper provides results of a validation study with two sets of 80 participants who tested an autonomous emergency braking system in both settings. Participants were similar concerning age and driving experience, experienced real driving on a test track and in a 180° FOV static driving simulator. Study design, scenarios and questionnaires to assess for example the drivers´ perceived danger of the situation and the usefulness of the system in each scenario as well as the overall acceptance were used in both set ups. Additionally, driving dynamics were recorded. Participants drove one of the six variants (three braking intensities with two different times for acoustical warnings each) of the system. Three traffic scenarios (e. g. distracted driver with sudden breaking of the leading vehicle) with a moving vehicle ahead and two scenarios with a stationary target (e. g. braking intervention while evading manoeuvre) were accomplished by each participant. Our data show that participant's reaction in the simulator is comparable to the reaction on the test track. The participants´ judgment on the system, situation and overall acceptance are almost the same.

Driving simulator study evaluating the distraction caused by projections on the windscreen

Ilja Feldstein, Klaus Bengler
feldstein*AT*lfe.mw.tum.de
Institute of Ergonomics, Technische Universität München
Boltzmannstr. 15
85748 Garching, Germany

In the future, advanced driver assistance systems could use the entire windscreen as an emissive projection display in order to pass visual information to the driver. This may enlarge the safety by fading in warnings in a contact analogue manner and helping the driver to keep his eyes on the road. The operation of information and communication systems, as for example audio and cell phone, may also be transferred onto the windscreen. In order to analyse the distraction effect on the driver caused by such visual popups on the windscreen, a study was carried out, testing the driving quality of the subjects. While performing a standardized lane change task, the subjects had to react and solve different kind of subsidiary tasks projected onto the windscreen. Objective data were recorded and analysed and subjective impressions by the participants were collected.

An Approach to Identify and Analyse the Most Significant Operator Tasks in a New Built Nuclear Power Plant

Christoph Jordi
*christoph.jordi*AT*areva.com*
AREVA GmbH
Paul-Gossen-Strasse 100

Nuclear power plants are generally large complex systems with a multitude of different operator tasks in various situations. These operator tasks are described in the operating manual by using event- and symptom-based procedures in order to direct the operators through a specific situation in normal as well as accident conditions. Due to the resulting enormous number of potential operator tasks, a detailed analysis of every task in its entirety is practically not possible in the frame of a project life span.

A methodical approach is necessary to screen and evaluate the operating tasks in order to define a representative set of tasks regarding the plant's safety and operational goals. By applying this method, the operating tasks are characterized along the criteria of safety relevance, plant availability, time criticality, task complexity and human reliability. Based on the results of this evaluation, the most significant operator tasks and scenarios are identified for further studies. These studies include the performance of paper-based walkthroughs and simulator studies to evaluate the adequacy of both the distribution of functions between human and machine and the capability of the operating personnel to perform the assigned tasks.

Event expectancy and inattentional blindness in advanced helmet-mounted display symbology

Patrizia Knabl, Sven Schmerwitz, Johannes Ernst
*patrizia.knabl*AT*dlr.de*
German Aerospace Center (DLR), Institute of Flight Guidance
Lilienthalplatz 7
38108 Braunschweig, Germany

In recent years helmet-mounted displays became increasingly important for rotary-wing aircraft. They provide pilots *with* relevant flight information by presenting symbology in the forward field-of-view. Therefore time-consuming scanning costs between instruments and outside environment can be reduced. This advantage is essential since maintaining constant visual contact with the environment is time-critical especially for low altitude flight and poor visibility conditions. Nevertheless, superimposed symbology may also pose a risk of obscuring objects in the environment, or overly capturing attention on the display. Hence an appropriate design is crucial to eventually enhance situation awareness and reduce workload. New symbology for en route and landing assistance as well as obstacle avoidance was developed recently at DLR Institute of Flight Guidance. The designs were tested in a simulator study with 18 civil and military pilots. Primarily attention distribution in terms of concurrent task performance was investigated as a function of display type, task complexity, expectancy and visibility. Objective flight and task performance as well as psychophysiological measures were recorded. The paper will provide details on the conducting of the study and discuss selected results, especially focusing on unexpected event detection.

SESSION 4: TRAINING

How to improve training programs for the management of complex and unforeseen situations?

Marie-Pierre Fornette, Françoise Darses, and Marthe Bourgy
*marie-pierre.fornette*AT*irba.fr*
Institut de Recherche Biomédicale des Armées
Département ACSO
B.P. 73
91223 BRETIGNY-SUR-ORGE CEDEX, France

Maintaining adequate performance in the face of complex and unforeseen situations is of fundamental importance in aeronautics. Such situations are often ill-defined. Therefore pilots must first determine which aspects of the situation are relevant to process and control. One major difficulty stems from the fact that this process of situation structuration must be performed on the basis of current constraints rather than preconceived knowledge. Thus, the key question is "What to process and control?" Currently, most unforeseen-situation management training programs do not help pilots to answer this question. Rather, by improving the ability to control the relevance of thought processes, they concentrate on another question "How to process and control?" Recent studies on thinking dispositions (Stanovich, 2011) and on mindfulness (Kabat-Zinn, 2003) are opening new avenues for training. By focusing on the development of openness and acceptance attitudes, these approaches could help pilots to efficiently structure complex and unforeseen situations. We present studies carried out in risky work environments, the results of which indicate that trainings that seeks to foster an open state of mind appear as a necessary complement to trainings centred on thought processes control, to improve pilots' ability to manage complex and unforeseen situations.

The Expanded Cognitive Task Load Index (NASA-TLX) applied to Team Decision-Making in Emergency Preparedness Simulation

Denis A. Coelho
*denis*AT*ubi.pt*
Universidade da Beira Interior
Dept. Electromechancial Eng.
6201-001 Covilhã, Portugal

The expanded version of the NASA-TLX instrument was used to assess cognitive load and team efficiency in a class setting. 30 students (6 female and 24 male) of an undergraduate human interface design class joined in teams of 2 to 5 people, solved the stop disasters game simulation (UNISDR – ONU), for the earthquake challenge (easy mode). Students had not previous contact with the simulation and all teams completed the game within the allotted 25 minutes. Mental (m=56; sd=19), physical (m=36; sd=19) and temporal (m=50; sd=16) demands, as well as performance (m=50; sd=22), effort (m=54; sd=20) and frustration (m=52; sd=25) are the scales that make up the NASA-TLX instrument. When applied to group activity, e.g. team decision-making, an expanded version of this instrument adds to the six afore-mentioned scales, another six scales: coordination (m=61; sd=19) and communication (m=64; sd=16) demands, as well as time sharing (m=54; sd=17), team effectiveness (m=54; sd=20), team support (m=64; sd=16) and team dissatisfaction (m=35; sd=22). Additionally 6 of the subjects (4 male and 2

female) reiterated the simulation with the same settings and reassessed their cognitive task load for mental (m=64; sd=12), physical (m=33; sd=21) and temporal (m=41; sd=11) demands, as well as performance (m=50; sd=28), effort (m=62; sd=22) and frustration (m=42; sd=30). Despite the increased physical and temporal demands of team work, self-assessed performance was on average unchanged and mental demands, effort and frustration increased.

Training design and highly automated systems

Juergen Sauer, Alain Chavaillaz, David Wastell
*juergen.sauer*AT*unifr.ch*
University of Fribourg
Department of Psychology
University of Fribourg
Rue de Faucigny 2
CH-1700 Fribourg, Switzerland

This paper examined the effectiveness of training to prepare operators for various types of automation failures. *Forty*-five participants took part in an experiment, in which they were trained for 3.5 hours on a simulated process control environment. During training, the reliability of an automatic fault repair system was manipulated. Participants either experienced no failure of the repair system (i.e. faults were detected and correctly diagnosed), a partial failure (i.e. faults were detected but not correctly diagnosed), or a total failure (i.e. faults were not detected). One week after training, participants were tested for 3 hours, during which they experienced a series of automation failures (e.g. false alarms, misdiagnoses). The results showed that participants who experienced total failures of automation during training were more complacent than those having experienced partial failures of automation. There was little difference between training groups with regard to performance and subjective measures. The differences in trust levels that were instilled by the different training methods had disappeared after exposure to the series of automation failures in the testing session. There are implications for training design in highly automated systems.

SESSION 5: MEDICINE

Evaluation of Crew Resource Management Interventions for Doctors-on-Call

Vera Hagemann, Clemens Kehren, Annette Kluge
*vera.hagemann*AT*uni-due.de*
University of Duisburg-Essen
IngWi, INKO
Business and Organizational Psychology
Lotharstr. 65 (LE 206)
47057 Duisburg, Germany

"Doctors-on-call" work in High Responsibility Teams, e.g. in hospitals or a helicopter emergency medical service (HEMS), so called High Reliability Organisations. Due to their complex and demanding work contexts, where errors lead to severe consequences, doctors-on-call are required to develop non-technical competencies. To support effective and reliable teamwork (anaesthesia) crisis resource management (ACRM) interventions have been implemented in initial training and further education more and more. The objective of this study is to evaluate the effectiveness of ACRM interventions in initial training as well as in combined recurrent HEMS trainings for pilots, paramedic and doctors-on-call. Two interventions for doctors-on-call in initial training (n=79) and five interventions in HEMS training (n=75) were evaluated. Results of the pre-post-test-design for ACRM for doctors-on-call initial training showed that the intervention was judged positively regarding usefulness (M=4.27, SD=0.79, α=.91) and learning (M=3.96, SD=0.79, α=.84). Safety-relevant attitudes changed significantly (p<.05, .13 <η²p< .32). The results for ACRM in HEMS training also demonstrated effectiveness regarding usefulness (M=4.91, SD=0.27, α=.73) and learning (M=4.63, SD=0.55, α=.91). Again, safety-relevant attitudes changed significantly (p<.05, .29 <η²p< .87). The importance of ACRM and implications for mandatory ACRM in training and education for doctors-on-call are discussed.

Do checklists influence anaesthetists' visual attention during anesthetization?

Antje Venjakob, Christian Reich, Wen Zhou, Benjamin Buchler
*antje.venjakob*AT*mms.tu-berlin.de*
Technische Universitaet Berlin
Department of Psychology and Ergonomics
Chair of Human-Machine Systems
Sekr. MAR 3-1
Marchstraße 23
10587 Berlin, Germany

Checklists are commonly used in Human Factors contexts such as aviation to increase safety, but have long been ignored in medicine. Anaesthesiology is similar to aviation in that a great number of checks are performed before the actual anesthetization starts. This study aimed at exploring possible benefits of checklists in anesthetizations and at ensuring that these do not result in a diversion of visual attention away from the patient. An auditory checklist was developed, but items could additionally be checked on a small screen. Twelve consultant anaesthesiologists were eye tracked while performing two anesthetizations without checklist (pre-baseline), two anesthetizations with

checklist (intervention) and again one anesthetization without checklist (post-baseline). The number of completed checks was significantly increased when checklists were used. The amount of visual attention that patients and vital monitors received did not differ between pre-baseline and intervention. In intervention trials gazes to the checklist were usually followed by gazes to monitors or the patient, indicating that a cross-check followed reading checklist items. The study indicates that anaesthesiologists can benefit from checklists while the present form of implementation does not seem to come at costs with regard to visual attention.

Improvement of surgical training through risk analysis – a new approach for spinal surgeons training

Norman Geissler, Andrej Machno, Luisa F. Sánchez-Peralta, J. Blas Pagador, Francisco M. Sánchez-Margallo, Werner Korb
*geissler*AT*istt.htwk-leipzig.de*
HTWK Leipzig - University of Applied Sciences; Innovative Surgical Training Technologies (ISTT)
Eilenburger Str.13
D-04317 Leipzig, Germany

Surgeons must know potential risks of the used medical devices to safely perform a surgery. Therefore a careful analysis based on Reason's Swiss Cheese Model of Accident Causation is necessary to improve the patient safety. The analysis of the causes of critical incidents and the risk-adjusted training can be relevant to avoid accidents. Thus an appropriate training concept is necessary to reduce the risk of accidents. Based on semi-structured interviews with surgeons (N=18), a training concept was developed. For validation, a multicentre approach was accomplished, including two Train-The-Trainer (TTT) courses with two German and three Spanish surgeons, respectively. The TTT courses were evaluated by a knowledge test, observations and the results of the performed risk analysis with the software CARAD on a surgical microscope (Zeiss). Additionally, each surgeon led a workshop with two surgical trainees, where they had to adapt the results of the risk analysis in the introduction of the microscope. The trainees (N=10) and scientific observers (N=4) evaluated the trainer performance. As control group, two non-trained surgeons led another surgical course. This TTT methodology provides a new approach for surgical training, which might improve patient safety by reducing the risk of accidents in the operating room.

Prepared motor responses are differentially modulated by somatosensory stimuli according to intensity and functional task

Juan M. Castellote, M. Kofler
*Juan.M.Castellote*AT*uv.es*
National School of Occupational Medicine, Instituto de Salud Carlos III, Madrid, Spain
C/Sinesio Delgado 6
Madrid, Spain

In certain industrial contexts, e.g. chemical industry, workers may suffer from damaged skin nerve terminations. Hence, fast motor responses may be compromised in a reaction time (RT) paradigm following somatosensory stimuli (SS). Auditory and visual stimuli are well known to modulate motor responses depending on their intensity. Respective data are scarce for SS. Our aim was to assess whether RT is influenced by SS intensity, and whether RT varies according to the type of prepared motor response. Eight subjects performed one of three types of fast motor responses in a RT paradigm with the right upper limb: index finger-thumb pinching, raising the arm, or simultaneous pinching-raising. Electrical stimuli of varying intensity at the left index finger served as imperative signal. A mean of

92 responses were obtained in each subject. Motor response latencies shortened progressively and significantly with increasing SS intensity, being shortest with SS intensities near pain threshold and longest near sensory threshold in all three tasks ($p<0.05$). Notably, latencies were significantly shorter in trials including a startle reaction, irrespective of actual SS intensity ($p<0.05$). Prepared movement latencies depend on the intensity of imperative somatosensory stimuli, and are maximally shortened in a startle reaction.

Preventing common medical device design flaws

Jonathan Kendler
*jonathan.kendler*AT*ul.com*
UL - Life & Health Human Factors Engineering
Arthur van Schendelstraat 630 3511 MK Utrecht, The Netherlands

Over the past few years, international regulations and standards have called upon medical device manufacturers to apply a systematic human factors engineering process when developing new medical devices. For most medical device manufacturers, this process culminates with a validation usability test in which they must demonstrate that users can operate the evaluated medical device safely and effectively. As many human factors professionals recognize, usability tests routinely reveal interaction problems resulting from user interface design flaws. In the context of medical device use, such interaction problems (i.e., use errors) can lead to patient injury or death. As such, medical device manufacturers face the challenge of developing user interface design solutions that mitigate dangerous use errors both in the context of usability tests and real-world use. This presentation will highlight common user interface design flaws that have repeatedly lead medical device manufacturers to “fail” their validation usability tests or discover dangerous use errors in post-market surveillance activities. Using examples drawn from hundreds of usability tests and experience designing multiple medical device user interfaces, the presentation will also describe practical design solutions and strategies that can be used to prevent such user interface design flaws.

SESSION 6: AVIATION

A novel Human Machine Interaction (HMI) design/evaluation approach supporting the advancement of improved automation concepts to enhance flight safety

Joan Cahill, Tiziana C. Callari
*cahilljo*AT*tcd.ie*
Centre for Innovative Human Systems (CIHS), School of Psychology
Trinity College Dublin (TCD)
Dublin 2, Ireland

This paper presents a novel Human Machine Interaction (HMI) design/evaluation methodology, supporting the specification and evaluation of a new adaptive automation concept, from both a functional and an operational/safety perspective. This methodology has been advanced as part of the work requirements for the Applying Pilot Models for Safety Aircraft (A-PiMod) project, funded by the European Commission. Critically, this methodology integrates/combines formal HMI design/evaluation approaches (i.e. user interviews and simulator evaluation) with an integrated stakeholder approach to evaluation. The objective of this paper is to highlight (1) what is new in this overall approach (i.e. integration of formal HMI approaches such as simulator evaluation with stakeholder evaluation approaches, decomposition of project goals to project objectives, evaluation objectives and key performance indicators); (2) what is new in the specific stakeholder approach to evaluation (i.e. the set-up) of a Community of Practice involving both internal and external stakeholders, and the integration of this methodology with wider HMI evaluation activities); and (3) what the methodology delivers in terms of ensuring improved levels of safety and reliability for the aviation sector. The evaluation of this methodology will be based on an analysis of project outcomes to date.

Option Generation in simulated conflict scenarios in approach air traffic control

Jan Kraemer, Heinz-Martin Süß
*jan.kraemer*AT*dlr.de*
DLR Braunschweig
Institute of Flight Guidance
Lilienthalplatz 7
38100 Braunschweig, Germany

Approach air traffic controllers provide safe guidance of aircraft approaching an airport from different arrival routes. Handling traffic and preventing separation loss between aircraft requires controllers to maintain situation awareness at all times. In case an incident is foreseen, guidance options must be acquired to deal with it. As expert controllers are expected to come up with the best options from experience immediately, option generation ability has often been neglected in situation awareness research so far. The fact that incidents still happen in air traffic control shows that this might be unjustified.

To verify this assumption, seven expert air traffic controllers completed an online-survey consisting of videos and screenshots captured from three real-time simulations of approach scenarios on Düsseldorf airport, Germany. Every

scenario was designed to end in separation loss of two aircraft. In each scenario, subjects were asked to provide as many options to deal with the situation one minute prior to the incident as possible.
Results show differences between experts regarding the quality and quantity of options successfully preventing separation loss given in the scenarios, indicating different strategies of dealing with conflict situations among subjects. Option generation ability as part of situation awareness is discussed.

The Operational Potential of an SVS for En Route Weather Hazards Management: An Explorative Human-in-the-Loop Simulation

Simone Rozzi, Stefano Bonelli, Ana Ferreira, Linda Napolitano, Loic Becouarn
*simone.rozzi*AT*dblue.it*
Deep Blue s.r.l., Thales Avionics
P.zza Buenos Aires 20,
0198 Rome, Italy

This study investigates the operational potential of an In-Flight Weather Awareness system displaying weather hazard cues that are either invisible (i.e. Clear Air Turbulence and Icing) or visible only during clear visibility operation (i.e. Cumulonimbi, and Volcanic Ash). The study focuses on investigating (i) the operational potential of the display, (ii) on its usability deficiencies, and (iii) on its potential for pilot's error. Methodology: A small-scale human-in-the-loop simulation coupled with expert observations, followed by a questionnaire and in-depth interviews. A total of 14 professional aviation pilots flew several scenarios using the evaluated display to plan route changes free of whether conflict. Results: The display exhibits the potential to shift weather management from a tactical (5-10 minutes) to a strategic level (up to 1h earlier than today); Cluttering due to multiple overlapping weather areas was the main usability deficiency; Mode error could occur due to poor indication of weather hazard status, and when using the proposed display in less modern airspaces than Europe and US. Value: These findings are relevant for Human Factors and Safety specialists and researchers involved in the development, evaluation, purchase and certification of aviation weather display.

Innovative multi-sensors device deployment for fighter pilots activity study in a highly realistic Rafale simulator

Julie Lassalle, Philippe Rauffet, Baptiste Leroy, Laurent Guillet, Christine Chauvin and Gilles Coppin
*julielassalle84*AT*gmail.com*
University of South Brittany
Centre de recherche
rue de Saint Maudé
BP 92116
56321 LORIENT Cedex, France

Cardiac and respiration activities are relatively easy to measure and widely used to monitor pilot workload during simulated or real flight. Few studies include electrodermal and pupil diameter measurements probably due to strong operational constraints. These measures are though well-known for being sensitive to mental workload. In a flight framework, the addition of electrodermal activity sensors does not complicate the experimental protocol (wristband wearing) however pupillary diameter recording requires a much sizeable device (eye tracker utilization). In the experiment presented in this paper, heart rate, respiratory rate, skin conductance and pupil diameter were collected

during simulated tactical flights. The main novelty of the proposed experimental design relates to eye-tracking device integration into a highly realistic flight simulation. To cover entire pilot visual field and prevent measurements loss, a double tracking design was tested (i.e. combination of two optical pairs). Preliminary analysis overall confirmed the reliability of this experimental setup showing a high quality of measures. Nevertheless, extra care should be taken for skin conductance signal that seems particularly sensitive to movement artefacts. Owing to observed reliability of data acquisition from eye tracker it may be possible to widen proposed device to ocular behaviour measure (scanpaths) in highly realistic flight simulation.

SESSION 7: TESTING AND EVALUATION

Influence of head mounted display hardware on performance and strain

Matthias Wille, Sascha Wischniewski
*dr.matthias.wille*AT*gmail.com*
Federal Institute for Occupational Safety and Health, Unit Ergonomics, human factors
Friedrich-Henkel-Weg 1-25
44149 Dortmund, Germany

Head mounted displays (HMDs) may support workers in high reliable industries. Especially if mobility is needed, like in maintenance or some fields of medicine, HMDs can display critical information directly within the field of view. However, in a study presented on last year's conference of HFES-Europe we showed that participants react less accurate to a monitoring task presented on a HMD compared to a Tablet-PC, although the information was displayed always within their sight. These results might be based partially on performance decrements caused by the additional strain from handling the uncomfortable and heavy industrial HMD. In a new study we replicated the experiment with the new, lighter and more comfortable consumer HMD Google Glass to investigate the influence of hardware on performance and strain. Results show some significant improvements in HMD technology regarding reported comfort: visual fatigue items were rated lower and less headache and neck pain were caused by the HMD. But the performance in an assembling task and parallel monitoring task still is worth on HMD compared to Tablet-PC. This implicates that displaying critical information on a HMD might not help to draw the user's attention.

A case based exploration into heuristics for developing "cool" products

Jettie Hoonhout
*jettie.hoonhout*AT*philips.com*
Philips Research
High Tech Campus 34
5656 AE Eindhoven, The Netherlands

Increasingly, products need to be 'cool', rather than merely being 'functional'. This implies different user / product requirements than before – it is about playfulness rather than efficiency, being engaged rather than minimizing effort, more about addressing the affective needs of users. Question now is how to incorporate these new requirements right from the start of a new product development process. Although some general models and heuristics are described in literature, these tend to be so general that these appear not satisfactory to guide the development process. One way to obtain more targeted guidelines is through analysing successful products, and through this derive heuristics that can support development of products in a more tangible way than currently is possible. In a workshop 10 wow products were analysed, looking at what makes the product appealing. The analysis was used to come to a set of factors that could lead to more concrete heuristics than what is currently found in literature. Some examples of the factors that were seen as relevant for creating a cool product are bonding, memorability, customization, creation, promotes discovery, mastery, facilitates storytelling, and movement. In the presentation these and other identified factors will be discussed in more detail.

Can we remove the human factor from usability research to save time and money?

Andreas Espinoza, Johan Gretland
*andreas.espinoza*AT*sonymobile.com*
SONY / Lund University
Sony Mobile Communications
c/o Andreas Espinoza, UXV
Mobilvägen 10
22363 Lund, Sweden

In today's corporate climate, managers look for different ways to cut corners. In such an attempt, this current research empirically evaluates the impact of taking the human factor out of usability research. We present a study looking at whether expert users and functional performance (simple reduction of time and steps) can be of equal benefit to the usability refinement of a system compared to analysing real (novice) user performance.
We examined four use cases in the area of NFC device connections. For the novice performance we asked 48 users to attempt the 4 different use cases. We measured completion time, completion steps, user satisfaction ratings and user difficulty ratings. The functional testing was an activity where system performance was objectively measured along with the performance of the optimal routes for each use case.
The results indicate that a simple reduction in functional time and steps does not benefit the usability of the system and may actually be detrimental. While satisfaction and difficulty ratings correlate inversely with fewer steps and time, this primarily points to areas of necessary system design improvements indicated by human factors.

Human Error: Not a Cause But A Confusion of Normative and Descriptive Accounts of Performance

Kjell I. Øvergård
*koe*AT*hbv.no*
Prof. Dr. Kjell Ivar Øvergård
Department of Maritime Technology and Innovation,
Buskerud and Vestfold University College
Postboks 4, 3199 Borre, Norway

That human errors can cause accidents is a core assumption of classical safety management systems, which aims to reduce the occurrence and consequences of human errors. This paper will present two interconnected lines of arguments that are contrary to the classical assumptions of causality and focus on human error. First it identifies challenges to the assumed causal connection between human error and accidents by discussing selection bias, lack of statistical contrasts between accidents and non-accidents, lack of predictive, convergent and discriminant validity with respect to human error and accidents, as well as the challenge of causal inferences for N=1 cases. The second line of arguments involves the conflation of normative and descriptive accounts of performance and how this hinders a structured and scientific approach to system performance. The paper ends with a definition of “human error” that requires a pre hoc identification of behaviours that deviate from performance standard. This definition allows for practitioner acceptance of performance standards, a just evaluation of performance, as well as enabling proactive safety management by requiring that errors must be identified prior to performance.

SESSION 8: HMI IN TRAFFIC

Anger and bother experience when driving with a traffic light assistant: A multi-driver simulator study

Lena Rittger, Dominik Muehlbacher, Christian Maag, Andrea Kiesel
*lena.rittger*AT*de.opel.com*
Adam Opel AG
IPC S4-01, Bahnhofsplatz
65423 Rüsselsheim, Germany

Drivers evaluated their interaction with others when driving with a traffic light assistant. In a multi-driver simulator setting, four drivers drove at the same time in the same virtual environment. Two drivers were equipped with a traffic light assistant that recommended driving speed and required action, e.g. “brake to 30 km/h”. Additionally, the position of the drivers in the column, the distance to the traffic light at which the recommendations started, and the instruction whether drivers “can” or “must” follow the recommendations were varied. Drivers with assistant pressed a button at the steering wheel to indicate their feeling of bothering others. They did so most often when the assistant recommended low speeds at far distances to the traffic light, especially when drivers were driving in the front positions of the column and when the instruction was that they “can” follow the recommendations. Drivers without assistant pressed the button at the steering wheel to indicate their anger about others. They did so only when they were following drivers with traffic light assistant. The results will help to parameterise the traffic light assistant regarding how and when to recommend.

Visual driver warnings in urban areas

Susann Winkler, Juela Kazazi, Mark Vollrath
*susann.winkler*AT*tu-bs.de*
Technical University of Braunschweig, Institute of Psychology, Dept. of Engineering and Traffic Psychology
Gaussstr. 23
38106 Braunschweig, Germany

In urban areas drivers are confronted with numerous distracting stimuli, high information density and small decision times, making these situations highly challenging. As part of the joined research project UR:BAN, driver warning concepts are developed for these situations to reduce accidents. Visual warnings might also contribute to the high workload of the drivers though. In a first driving simulator study the driving and gaze behaviour of 24 subjects was collected to explore requirements for urban driver warnings. According to these results, a further study with 60 subjects compared four different warning concepts (+ control group, between-subject design) presented in a head-up display for eight different urban scenarios. The scenarios varied regarding the critical locations (e. g. intersections, straight road), as well as the critical objects (pedestrian, bicyclist, lead vehicle, hay bale) and their behaviour. The data shows most accidents occurred in scenarios with a pedestrian crossing. When drivers were warned this number was greatly reduced. Especially a generic action-oriented concept showed significant positive effects over no warning. The results of these studies are used to develop an integrated user oriented warning system for urban areas.

FORWARN: Detecting driver distraction from eye-movement and steering patterns

Georgios Kountouriotis, Derek Magee, Oliver Carsten, Natasha Merat
*g.kountouriotis*AT*leeds.ac.uk*
University of Leeds
Institute for Transport Studies
34-40 University Road
Leeds LS2 9JT, United Kingdom

According to a large naturalistic driving study conducted in North America (100-Car Naturalistic Driving Study; Klauer *et* al. (2006)) driver inattention and distraction contributed to 78% of the identified car crashes and near misses. Identifying distracted drivers is therefore of paramount importance, especially as the rate of interaction with distracting tasks and activities is on the increase given the technology which allows for it. We present data from two experiments which used the University of Leeds Driving Simulator to examine the patterns of steering and eye-movements under baseline conditions and conditions of cognitive and visual load. The visual load condition was a visual search task with arrows, while the cognitive load condition was a count back in sevens task. Our results indicate that under conditions of cognitive load, participants scanned the scene less compared to baseline, as indicated by a reduction in lateral eye-movements. Steering was also less variable in these conditions but contained more high-frequency components. However, the effects of steering were mediated by the driving environment, i.e. straight or curved sections of the road. Both eye-movements and steering performance are shown to provide useful metrics for identifying driver distraction in these experiments.

Validation of a Telephone Manager for stressful driving situations

Linda Köhler, K. Bengler, C. Mergl, K. Maier, D. Blaese
*linda.koehler*AT*audi.de*
AUDI AG
I/EB-112
85045 Ingolstadt, Germany

Today we face highly complex urban driving situations including high information density, short decision times and a variety of stimuli acting. Crossing an intersection where drivers have to give way to cross traffic has been identified as an example for such stressful situations. By reference to several studies it can be shown that telephone calls while driving affect various aspects of driving performance and additional stress for the driver is assumed. In order to pursue the aim of allowing comfortable and secure driving with a minimum strain even in complex situations, a suitable user interface solution including a telephone manager seems to be crucial. Therefore a driving study was conducted with 27 participants validating a telephone manager suppressing incoming calls in stressful driving situations. Both the driving situation (crossing an intersection vs. going straight on) and the telephone call (being delivered vs. being suppressed) were tested concerning perceived driver's mental workload, driving performance and acceptance. The results show a higher stress level for the driver in intersection situations. Furthermore it validated that phone calls lead to additional strain which can be reduced by call suppression in stressful situations. Moreover the questionnaires confirmed that the telephone manager is highly accepted.

KEYNOTE

Accelerating Complex Skill Acquisition: Neuroergonomic Studies

Raja Parasuraman
George Mason University

Developing expertise in complex work-related tasks typically requires extensive practice. Many training techniques have been developed and evaluated by researchers in human factors and related disciplines, but they are often slow, costly, or based on old theories. Are there newer theory-based methods for accelerating skill acquisition? Neuroergonomics can offer an answer, by capitalizing on recent theoretical advances in our understanding of brain plasticity and by providing new methods to study humans at work (Parasuraman, 2011; Posner, 2012). Two such new methods are molecular genetics and non-invasive brain stimulation. I first describe studies showing how normal variations in dopaminergic genes interact with practice and with specific training methods to account for individual differences in the rate of acquisition of multi-tasking skill during supervisory control. I then show how a form of non-invasive brain stimulation—transcranial Direct Current Stimulation—can be used to accelerate skill development in complex detection tasks and enhance multi-tasking performance. Other methods that promote brain plasticity, such as cognitive training, may act synergistically with these techniques, thus opening up new vistas for accelerating complex skill acquisition (Parasuraman & McKinley, 2014).

SESSION 9: TRANSPORT

Success factors for navigational assistance

Linda de Vries
*linda.de.vries*AT*chalmers.se*
Chalmers University of Technology
Department of Shipping and marine technology
41296 Gothenburg, Sweden

The maritime domain is under pressure from changing economic, political and environmental factors. Technological advancements facilitate increased monitoring and control from land. By viewing the maritime domain as a complex socio-technical system, the importance of understanding the role of the on board and shore-side operator in maintaining safety and efficiency of navigation becomes apparent, particularly when introducing new technology. This paper looks at the success factors for navigational assistance, as currently performed by maritime pilots and Vessel Traffic Service operators (VTSOs), aiming to identify issues worth consideration in future navigational assistance services. One focus group and one combined workshop/focus group were held with three pilots and two VTSOs respectively. The first looked at the prerequisites for successful navigational assistance from the perspective of the pilot. Using a grounded theory approach, a hypothesis was created that success depends on the integration of preparation, local knowledge and foresight into the ship-shore system and that good communication is vital to achieving this. Testing this, the second study considered the role of communication in enabling the VTSO to support the pilot; it confirmed the results of the first study, emphasising the importance of communication when working both with on board and shore-based pilots.

Can weak-resilience-signals (WRS) reveal obstacles compromising system resilience? - A study of a socio-technical rail system

Willy Siegel, Jan Maarten Schraagen
*Willy.Siegel*AT*UTwente.nl*
University of Twente/GW/CPE
Cubicus kamer B316
Vakgroep Cognitieve Psychologie & Ergonomie
Faculteit Gedragswetenschappen
Postbus 217
7500 AE Enschede, The Netherlands

Analysis of accidents in socio-technical systems frequently reveals unnoticed obstacles, which have grown to become the main cause of incubation and surprise at failure (Dekker, 2011). Thus far, it has proven to be a challenge to identify those unnoticed obstacles upfront among the tremendous number of events occurring during normal operations. In this presentation, we will report on the development and usage of weak resilience signals (WRS) (Siegel & Schraagen, 2014), at a rail control post, to reveal obstacles compromising the resilience state of the system. Resilience is defined as the ability of a complex socio-technical system to cope with unexpected and unforeseen disruptions (Hollnagel, Woods, & Leveson, 2006). The WRSs are developed around three system boundaries: safety, performance and workload. We will discuss, using cases from rail operations, the method, real-time tooling, WRS

representation and analysis used to reveal some unnoticed obstacles. By making WRSs explicit to rail traffic controllers, these signals are expected to contribute to a higher rail operation reliability.

Introducing EV-based mobility solutions – impact of user expectations to long and short term usage

Andre Dettmann, Dorothea Langer, Martin Jentsch; Angelika C. Bullinger; Josef F. Krems
*andre.dettmann*AT*mb.tu-chemnitz.de*
Technische Universität Chemnitz
Chair for Ergonomics and Innovation Management
Erfenschlager Straße 73, Gebäude C/F
09125 Chemnitz, Saxony, Germany

When introducing innovative technologies, it is crucial that they comply with certain user needs or help fulfilling certain tasks. Beliefs that the innovation can meet those requirements can be described as positive user expectations. Knowing user needs and expectations allows developing a system that motivates high usage and acceptance.

The paper presents results of a field study investigating the introduction of a mobility service based on electric vehicles with 120 participants. While introducing the service, user needs and expectations were examined using a semi-structured guided telephone interview and two questionnaires. After launching the service, the actual usage of the system by the users´ is tracked by collecting system data and conducting ongoing questionnaires.
Results of the interview and questionnaire show that user's expectations split primarily into two groups. One group perceives the introduced mobility service as a flexible and quick solution to optimize their mobility needs. The second, technology driven group is highly interested in the electric vehicles.
System data shows how both groups perform over time to answer questions if usage meets the expectations of both groups and how they influence their overall short and long term acceptance. Results can be integrated to better address users' needs.

Are globality and locality related to driver's hazard perception abilities?

Shani Avnieli, Tal Oron-Gilad,Yisrael Parmet & Avinoam Borowsky
*shaniavnieli18*AT*gmail.com*
Ben-Gurion University of the Negev, Israel
95 Hashikma,st. Ashkelon, Israel
Zip code 78413

Driving requires various skills, amongst them only hazard perception has been directly linked to being involved in traffic accidents. Navon-type tasks may provide a framework for understanding perceptual processing and logical reasoning. Yet, limited attempts were made to formulate associations between globality and locality in visual processing and perception of real world stimuli like hazards while driving. A study aimed to link Navon-type tasks with hazard perception abilities of drivers was conducted. A sample of 39 novice drivers (ages 17-18), 62 students (ages 23-29) and 21 adults (ages 40-60) completed two types of Navon tasks and then performed a hazard perception test, in which they observed video-based traffic-scenes and were asked to press a response button each time they detected a hazard, as well as classification and rating of hazardous scenes. While there is a known statistically significant effect for experience, results reveal significant ties between global perception and hazard perception. The significant effect of the global scores in the Navon test on classification and ratings of real-world

traffic situations suggests that the Navon test may be useful in predicting performance in real world complex situations such as driving.

SESSION 10: PERFORMANCE

The Effect of Computerized Detection System on Human Target Search Behaviour

Assaf Botzer, Joachim Meyer, Avinoam Borowsky
*assafbo*AT*ariel.ac.il*
Department of Industrial Engineering
Ariel University, Ariel, 44837, Israel

Target search tasks are very prevalent in many domains, for example, in medicine, where a target may be a tumour in mammography. To aid humans in such tasks, image processing algorithms are used to locate possible targets. These algorithms may not always be correct and targets may be falsely announced, or alternatively, entirely missed. Yet, humans may over-rely on such aids. We investigated whether humans tend not to inspect sub-areas in images, when these sub-areas are not indicated as targets. Participants performed a simulated target search task in images that were divided to sub-areas. In half the experimental blocks they were aided by an imperfect detection system that marked black frames around sub-areas, to indicate possible targets. We used eye tracking to detect participants' fixation points. On average, participants inspected more than 80% of the marked areas, but only 60% of the unmarked areas in the images. They seemed to employ no rule to decide which of the unmarked areas to skip. We therefore recommend not just to either mark or not mark areas, but to use colours to code probability for targets. This way, if humans skip areas, they at least skip those with the lowest probability for targets.

Cycling under the influence of alcohol

Dick de Waard, Sjoerd Houwing
*d.de.waard*AT*rug.nl*
University of Groningen
Grote Kruisstraat 2/1
9712 TS Groningen, The Netherlands

Accident statistics suggest that alcohol plays an important role in fatal accidents of bicycle riders. However, with which Blood Alcohol Concentration (BAC) cyclists ride their bike is not known. In particular on nights out cycling under influence of alcohol seems common. To evaluate prevalence of cycling under influence of alcohol, BAC of cyclists was measured with a Breathalyzer on four nights out; two Thursday nights, typical nights for going out clubbing in student cities, and on two Saturday nights. Breath samples of 687 bicyclists were taken from 5 PM till 8 AM in two Dutch cities, a city with a high proportion of students: Groningen, and a large city with a moderate student population: The Hague. Apart from the difference in proportion students, another difference between the two cities is that pubs do not have closing times in Groningen, while most pubs close 2 AM in The Hague. Results show an increase over the night in percentage of cyclists who have alcohol in their blood; at 6 PM 7.7 % had a BAC above zero, but after 1 AM this percentage had risen to 89. At that time 68 % had an in the Netherlands illegal BAC above 0.5‰. The average BAC of all cyclists with a BAC above zero was 0.79‰. Differences between the two cities and two days of the week were found to be very limited. The conclusion is that cycling under the influence of alcohol is very common on nights out in the Netherlands.

Olfaction influences steering behaviour: Why smelly cars are better

Stefan Brandenburg, Anna Katharina Trapp, Nils Backhaus
*stefan.brandenburg*AT*tu-berlin.de*
Technische Universität Berlin
Department of Psychology and Ergonomics
Chair of Cognitive Psychology and Cognitive Ergonomics
sec. MAR 3-2
Marchstr. 23
10587 Berlin, Germany

Having longitudinal and lateral control over the vehicle is extremely safety relevant in car driving. Traffic psychology research examined many factors influencing both control domains. Studies mainly focused on visual, acoustic, tactile modalities and higher cognitive factors. However, research barely examined olfactory stimuli and their influence on driving performance. There is some evidence that these factors influence drivers' information processing in a way that is relevant for their driving performance. Therefore an experiment was conducted in which 24 adolescent subjects were exposed to either pleasant (e. g. pine tree) or unpleasant odours (e. g. cold cigarette). After being exposed to either one of both odours, participants rated their emotional status and completed the lane change task. Results showed that unpleasant odours significantly affected both, participants' emotional affect and driving performance. Subjects felt significantly less positive after being exposed to unpleasant odours. Moreover, they performed significantly better in the lane change task when being exposed to unpleasant odours.

It can be concluded that unpleasant odours induced negative affect and influenced driving behaviour. Taking into account that this study was conducted using adolescents, future research needs to address real drivers. Moreover these findings should be replicated in more realistic driving scenarios.

Implementing dynamic changes in automation support using ocular-based metrics of mental workload: a laboratory study

Serena Proietti Colonna, Claudio Capobianco, Simon Mastrangelo, Francesco Di Nocera
*dinocera*AT*uniroma1.it*
Department of Psychology, Sapienza University of Rome
Via dei Marsi 78 - 00185, Rome, Italy

Adaptive Automation has been often invoked as a remedy to indiscriminate introduction of automation support. However, this form of automation is difficult to implement without a sensitive and reliable index of the Operator Functional State. In a series of studies we have showed the usefulness of the distribution of eye fixations as an index of mental workload to be used as a trigger of automation. Particularly, the distribution pattern computed using the Nearest Neighbour Index (NNI) was found to be sensitive to taskload variations and types, thus making it very appealing for designing adaptive systems. Sensitivity of the index has been investigated using different tasks from arcade games to flight simulations, but the Tetris game has been extensively used as a testbed for the NNI studies given the possibilities it offers to impose both visuo-spatial and temporal demands. The present study also employs this task and the NNI was computed in real-time throughout the gaming session. The NNI values were then used for triggering the automation support during game: a projection of the falling block (tetromino) that facilitated its correct placement. The workload-matched automation showed beneficial effect for performance and workload. Implications for the "out-of-the-loop" phenomenon will be discussed.

POSTERS

A Comparison of Head-Up and Head-Down Displays for Different Types of Information Driving in an Urban Setting

Martin Götze, Klaus Bengler
goetze@lfe.mw.tum.de
Technische Universität München
Lehrstuhl für Ergonomie
Boltzmannstraße 15
85747 Garching, Germany

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. Furthermore, the way information and warnings are currently presented will need to change due to new technologies such as the head-up display (HUD) or a programmable head-down display (HDD). Multiple displays, however, will provoke more saccades, gaze shifts, and visual scanning, which will potentially result in prolonged distraction from the road. In order to prevent this, the aim should be to choose the right display for the different types of information. This study compared the information categories: Continuous information, conditional information, action directives, situational information and attention control. For this experiment, 32 participants performed a driving task in a simulated urban environment and operated either a HUD or HDD. Statistical tests were performed to examine differences in the reaction time to warnings and the standard deviation of the time-to-line-crossing in general. No significant differences were found. In contrast, measures from the NASA-TLX showed significantly higher workload for the HDD. In sum, this paper shows the favoured display for various types of presented information in the car.

Comfortable Driving and Good Mood: Implications for Driving Safety

Tatjana Zimasa
*tstz*AT*leeds.ac.uk*
University of Leeds,
Institute for Transport Studies,
Leeds, United Kingdom, LS2 9JT

Previous research shows that negative emotions have a detrimental effect on cognitive processes in general and on driving safety in particular. However, no research to date has investigated the impact that positive affect might have on driving safety. According to Carver (2003) positive affect broadens attentional focus, thus a wider view can be processed. This research aims to examine this theory in a driving environment, using a hazard perception test and an eye tracker. Participants' psychological mood (affect) will be manipulated along with their physical comfort in a repeated measures design. They will be asked to watch short video clips containing a number of potentially hazardous situations, and respond in an accurate and timely manner. Response times and eye fixations will be measured. This method will evaluate whether positive affect (physical and/or psychological) increases the detection of hazards in the periphery and/or has an impact on attentional reaction times. The research has potential

implications for car manufacturing and design in aspects that facilitating positive mood in the driver environment could increase safety.

Representation of anticipated alarm sounds in satellite control rooms

Reinier J. Jansen, René van Egmond, Huib de Ridder
*r.j.jansen*AT*tudelft.nl*
Faculty of Industrial Design Engineering, Delft University of Technology
Landbergstraat 15
2628CE Delft, The Netherlands

Alarm sounds in control rooms assist operators by signifying unexpected dangerous system state changes, requiring immediate response. However, anticipated alarms due to known malfunctions and planned state changes may occur, which contribute to operator alarm fatigue and desensitization. Although standards on alarm management lifecycles advocate regular assessment, proposed methods in literature fail to address contextual influences on how operators experience alarms. The goal of this study is to assess the functionality of a satellite control room alarm design, by examining the context in which operators take action upon hearing an alarm. Four space controllers in three ESOC satellite control rooms were observed during their shift. The method of contextual inquiry was used to collect 6.5 hours of data. Transitional journey map workflow visualizations were used to construct a state transition diagram with four activity states. Projecting the alarms on this diagram showed that only two of the 117 recorded alarms initiated a transition to a problem solving state, which identified the remaining 115 as anticipated alarms. Contextual influences on alarm experience were retraced and illustrated the co-occurrence of operators' high expertise level and co-workers' discomfort. Implications for future alarm designs are discussed from a functional and an experiential perspective.

Modulation of internally generated and externally triggered programmed movements in tasks that require accuracy

Juan M. Castellote, J. Valls-Solé
*Juan.M.Castellote*AT*uv.es*
National School of Occupational Medicine, Instituto de Salud Carlos III
C/Sinesio Delgado 6
Madrid, Spain

Skilful control of movements implies the integration of reflex reactions in internally generated actions. This is specifically the case in some occupations, such as when drivers have to redirect their car to avoid collision. Reaction time tasks are speeded up when a startle stimulus is unexpectedly applied. We wanted to know how this effect modified the normal flow of action-reaction tasks. Ten subjects, confronted in pairs, performed each an accurate wrist extension between two spots placed at a fixed angular distance. They should either generate the task (Action trials) or in case the opponent already started, use this as trigger to respond (Reaction trials). In some trials a startling auditory stimulus was delivered to influence movement (Startle+ trials). There were no significant differences between Startle+ and control trials in the general outline of the movement ($p>0.05$). However, the amount of activity in the first agonist burst was higher ($p<0.001$), and reaction movements occurred earlier, in Startle+ than in control trials. Although movement duration of Reaction trials was shorter than Action trials ($p<0.05$), there was not an advantage in terms of full task execution.

Changes in operators' attention allocation patterns due to the presence of alerts and their reliability

Liat Shiran, Avinoam Borowsky, Yisrael Parmet and Tal Oron-Gilad
*liats56*AT*gmail.com*
Ben Gurion University, Department of Industrial Engineering and Management
Moreshet, Misgav, 20186, Israel

This study examined eye scanning patterns of operators performing detection and identification surveillance tasks in a military context. Alerts with varying level of reliability were present in the interface (100%, high level, low level and no alerts) to convey the occurrence of events that required operators' immediate attention. It was hypothesized that the level of reliability and not merely the presence of an alert will determine the way participants scanned the information. In four scenarios, forty participants, all infantry soldiers with combat experience, were asked to detect and identify suspicious vehicles entering and leaving a hostile building via an interface that presented video feeds derived from unmanned ground and aerial views simultaneously. Eye tracking was used to examine scanning patterns. Interestingly, for the low level of reliability, participants' average dwell duration on the aerial view was significantly shorter than any other group. This pattern indicates upon a lack of focus and less use of the most effective information (i.e., the aerial video source), thus reducing the overall efficiency of the surveillance, in contrast to participants using alerts with high levels of reliability or no alerts. Implications for design of alerts are discussed.

Development and test of a smooth-pursuit based gaze speller

Stefan Ruff, Otto Hans-Martin Lutz; Matthias Roetting
*sru*AT*mms.tu-berlin*
Chair of Human-Machine Systems / Technische Universitaet Berlin
Marchstrasse 23, 10587 Berlin, Germany

Gaze-based text spellers have proved useful for people with severe motor diseases but lack acceptance in general human computer interaction. Traditional dwell- and blink-based selections have major drawbacks like the need for calibration and high false alarm rates. To tackle these problems we developed the first gaze system that explicitly utilizes smooth-pursuit eye movements and achieves sufficient accuracy with a one-point calibration. The interface of the speller consists of six clusters of characters that are arranged in a hexagonal shape. In a first selection phase the clusters move away from the centre. The user's gaze follows the cluster that displays the character of interest. In a second phase the characters of the cluster move away from each other. As each element has a unique track, gaze following this track can be detected by a simple algorithm that does not rely on the exact gaze coordinates. In a user study 24 participants tested four speed-levels of moving elements to determine an optimal interaction speed regarding acceptance and performance. At 300 px/s users showed highest overall performance. Subjective ratings support the finding that this pace is superior. Future work will expand the functionality of the speller and improve the interaction concept.

Wearable devices as assistive tools in car assembly: a usability comparison

Nele M. Fischer, Michael Unger (1), Robert Brauer (1), Sebastian Pannasch (2), Gesine Grande (3)
*nele.fischer*AT*htwk-leipzig.de*
1: University of Applied Sciences Leipzig, 2: Technische Universitaet Dresden, 3: University of Bremen
HTWK Leipzig - University of Applied Sciences
Postfach 30 11 66
D-04251 Leipzig, Germany

Objective: We evaluated the usability of two wearable devices (WDs) when used as assistance tools in a car assembly task and examined their impact on mental workload. Background: Additional task-relevant information that is often presented on stationary displays can be occluded or hidden due to the task constraints (i.e. when workers move themselves or change their position). Therefore, WDs were evaluated as an alternative form of information presentation. Methods: While performing an assembly task (requiring movements on a car body under time pressure), workers received task-relevant information either via smart glasses, smartwatch or written on paper. We measured the user's workload, effectiveness and efficiency in task performance as well as how satisfied they were with their own performance. Results: Both WDs improved task performance (i.e. decreased processing time and error rate) and revealed a more satisfying task performance, with marginal differences between the devices. Mental workload was only slightly increased compared to the paper condition. Conclusion: According to the obtained results, WDs seem to be suitable assistance tools for tasks such as car body assembly. Application: Based on our findings we consider WDs as alternative method for information presentation and discuss long-term perspectives.

Insights Into Senior Citizens' Attitude Towards Gamification

Juliane Bürglen, Dietlind Helene Cymek, Franziska Adler, Josephine Grauert, Sophie Neef, Michael Minge
*juliane.buerglen*AT*tu-berlin.de*
Berlin University of Technology, Cognitive Psychology and Cognitive Ergonomics
Sekr. MAR 3-2
Marchstraße 23
D-10587 Berlin, Germany

Up to now, interaction with information and communication technology (ICT) is not as common in senior citizens as in younger generations. Usage frequency is often low and perceived interaction barriers are numerous due to former frustrating interaction experiences with maldesigned ICT. Thus many senior citizens miss out on the advantages of useful devices and applications. For instance, having few shared communication channels with other generations reinforces social isolation with greater age. To counteract this trend, our research focuses on making interaction with technology more pleasurable for senior citizens - with the help of gamification. Using game elements allows for continuous feedback, positive experiences and enhancement of system exploration spirit. In preceding qualitative interviews and focus groups with senior citizens, their needs and attitudes towards games and specific game elements were assessed. On this basis, we developed software prototypes that enable users to learn computer skills autonomously. The prototypes differed in number of game elements. A user study with 48 participants (aged 60 to 80 years) was conducted. We evaluated whether adding specific game elements can solve motivational problems and overcome barriers that hinder technology usage.

Implementation strategies of cooperative robots via acceptance manipulation

Robert R. Brauer, Nele Fischer; Gesine Grande
*robert.brauer*AT*htwk-leipzig.de*
HTWK Leipzig
Forschungszentrum
Eilenburger Straße 13
04317 Leipzig, Germany

Background: Cooperative robots are unlike fully automated systems not integrated in the automobile industry yet. Besides the given technological readiness, the employees' acceptance is a crucial factor for success. We hypothesized to enhance the acceptance of a cooperative robot by manipulating the manner of introducing it. Method: Applying the „unified theory of acceptance and use of technology" (Venkatesh, Morris, Davis, & Davis, 2003) we conducted a three groups design with a convenient sample (N = 90). Every group was presented a picture of the robot and a short text describing the robot. A questionnaire with respect to attitude and trust towards the cooperative robot was delivered. Results: No differences between the groups that gat the short text with either a task-oriented or user centred perspective were found. The third group that watched an additional video visualizing the robot working differed significantly in their level of acceptance. The theory of Venkatesh et al. (2003) was stretched with respect to affective factors like trust and attitude towards the robot which had a significant impact on the acceptance, too. Discussion: For a successful rollout of cooperative robots affective factors and the way the new technology is introduced seem to have a strong impact.

What robots can learn from human haptic interaction: A Literature Review

Ekaterina Ivanova, Henning Schmidt, Jörg Krüger
*eivanova*AT*zmms.tu-berlin.de*
Technische Universität Berlin
Sekr. PTZ5, Raum PTZ 405, Pascalstr. 8-9, 10587 Berlin, Germany

There are a lot of cooperative tasks that humans and robots can perform together, i.e. welding, moving and carrying objects. Our area of interest is robotic based rehabilitation after stroke, where patients can be assisted by therapeutic robotic devices during high intensity repetitive movement training for an optimal motor learning effect. In this case the robotic assistance should be adapted to patient's abilities to give only the necessary amount of support ("assist-as-needed") and at the same time to maximize patient's effort so that the haptic human-robot interaction becomes optimal for motor learning. One possible way to guarantee a safe and natural human-machine-interaction is to program the robotic control to react and move in the way humans do in such type of tasks. To summarize the findings on haptic human-human-interaction we systematically reviewed experimental psychology and interactive robotics studies. The purpose of this study is (i) to present a survey of research findings on haptic human-human interaction which are directly relevant for research in human-robot-interaction, (ii) to detect which benefits of modelling of haptic human-human-interaction can be transferred to human-robot-interaction, (iii) and to analyse how these findings could be applied to human-robot-interaction to optimize patients learning effects during robot based rehabilitation.

Implementing a cognitive factor as an individual constituent in a driver model by inference from multiplicatory relationships between cognitive sub-factors

Firas Lethaus, Robert Kaul
*firas.lethaus*AT*dlr.de*
Institute of Transportation Systems, German Aerospace Center (DLR)
Lilienthalplatz 7
D-38108 Braunschweig, Germany

The ability to model the mental processes behind the execution of complex driving tasks allows the development of driver assistance systems to be accelerated, by reducing the number of time-consuming and expensive studies required, and the improvement of holistic assistance strategies containing knowledge about driver behaviour. The production of a suitable model entails describing these mental processes such that the key characteristics of the driver behaviour being considered are captured. The description must comprise constituents which allow it to be expressed formally. In order to achieve this goal, the first task is to identify and model the cognitive factors, which are crucial when describing driver behaviour. A resulting single cognitive factor, which is composed of the mental sub-factors (SF) expectation, distraction, stress, and strain, has been developed and forms an essential constituent of our driver model. The cognitive factor has been defined such that, the individual SF are in multiplicatory relationship with one another. Each of these SF represents the visual, auditory, tactile-kinetic, and verbal information channel in each case. This results in a lattice-like network of relationships, which can be expanded modularly in horizontal (SF) and vertical (information channels) directions. The topology of this multiplicatory cognitive factor is presented.

A human factors approach to speed presentation and its impact on eco-driving

Prasannah Prabhakharan, Catherine Harvey
*lpzpp*AT*nottingham.ac.uk*
School of Psychology
University of Nottingham
Nottingham, UK
NG7 2RD

'Eco-driving' is an emerging trend in the automotive domain, aiming to not only reduce the economic costs associated with driving but to reduce greenhouse gas emissions (Barkenbus, 2010). Critical to eco-driving is feedback in the form of a speedometer display; fundamental in second-to-second control of a vehicle's speed. There is substantial literature which suggests that design and engineering aspects of the presentation of speed information (such as whether a speed display is analogue or digital) can have significant cognitive and behavioural effects on driving (Castro and Horberry, 2004). However, the findings have not unanimously supported either analogue or digital presentation in terms of performance, safety and user preference. Through an interdisciplinary approach, the study investigated the psychological factors which mediate efficient cognitive processing of information (e.g. attention, speed of processing) whilst manipulating the ergonomics of the user interface and aimed to investigate the effect of speed presentation on driving, with a targeted focus on eco-driving. The study employed a 2 x 2 factorial design, and compared speed presentation type (analogue and digital) with eco-driver training (eco-driving trained vs untrained). In addition, eye tracking data and subjective assessments from users was collected. This multi-method approach provided quantitative and qualitative data regarding drivers' responses to speed feedback and any consequences for eco-driving behaviours. Results are discussed from a theoretical and practical human factors perspective with direct implications for future instrument cluster design.

Study on assessment method using tracking task as subsidiary probe task to estimate the demand of operating an in-vehicle information device

Hiroshi Uno, Yukinobu Nakamura
*huno*AT*jari.or.jp*
Japan Automobile Research Institute
2530 Karima, Tsukuba, Ibaraki 305-0822, Japan

This study examined the utility of a continuous tracking task as a subsidiary probe task and clarified appropriate task properties to assess driver distraction caused by in-vehicle information device operation. Four tracking tasks were prepared by combining the visual cue (presence/absence) for future movement of a target and the operation modality (steering wheel/accelerator pedal). In experiment I, each tracking task was executed concurrently with two assessment tasks of device operations that induced a clear difference in the variability of the vehicle's lateral position and headway in actual driving. The results of tracking performance indicated that the absence of a visual cue for oncoming target movement in a tracking task was useful for duplicating the driving impact of assessment tasks. Though results indicated that pedal tracking (PT) was more sensitive than steering tracking (ST), the contribution of the operation modality was less important than the absence of a visual cue. In experiment II, PT without a visual cue for future movement (e.g., headway distance control by accelerator manipulation) was used as the probe task, and the demands of seven assessment tasks were estimated. The results indicated correspondence between the assessment task distributions of tracking performances and the driving impact indexes.

ADAS: redundant warnings speed up drivers' reaction

Francesco Biondi, David Strayer, Massimiliano Gastaldi, Riccardo Rossi, Claudio Mulatti
*francesco.biondi*AT*ymail.com*
Department of Developmental and Social Psychology, University of Padova, Italy
Via Venezia 15, 35100, Padova

Advanced Driver Assistance Systems or ADAS are designed to assist the driver in the process of controlling a vehicle. When the driving conditions become unsafe (e.g., maintained speed it too high), warnings are emitted to inform the driver that given manoeuvres (e.g., adjusting the speed) have to be executed in order to avoid accidents. As a consequence, the prompter the reaction of the driver to the warning, the more effective is the warning. In the experiments here reported, participants drove a driving simulator equipped with a rear-end collision avoidance system and were presented with three types of warnings: auditory, tactile and multimodal (i.e., tactile + auditory). Results showed that the presentation of multimodal, redundant warnings, compared to presenting auditory and tactile warnings separately, produced faster responses in both dual-task and high-traffic density driving conditions. These findings are of the utmost importance for car manufacturers interested in designing safer and more effective assistance systems.

How environmental features in urban areas affect the perceived risk of children pedestrians

Hagai Tapiro, Tal Oron-Gilad; Yisrael Parmet
*tapiroh*AT*post.bgu.ac.il*
Ben-Gurion University of the Negev
P.O.B. 653 Beer-Sheva 8410501, Israel

When having to decide whether to cross or not to cross the road, one is first required to judge if the crossing place is 'safe'; this decision is based upon experience, current situation and the anticipated conditions. Young children have impoverished crossing skills. The aim of this study was to identify the environmental features that make children think a place is safe or dangerous for crossing. A sample of 24 young participants (ages 7-13) and 12 adults observed 40 different real-world road-crossing scenarios on a large screen. Each participant was asked to assess how safe the situation was for crossing, using a slide bar. Results showed that children and adults use different strategies in order to estimate the safety of a certain place for crossing. Children estimated places mainly based on "obvious" conspicuous features in the environment, like crosswalks, which they used as an anchor for their decision; but were indifferent to less conspicuous relevant factors. Adults based their estimation on more subtle but still significant features, like the number of road lanes. The results indicate that children often rely on the fact that a place is designed for crossing as a guaranty for their safety, unlike experienced adults.

The influence of sensation seeking on task pacing in secondary tasks while driving

Katja Karrer-Gauss, Jonas Thielmann
*karrer*AT*mms.tu-berlin.de*
Technische Universität Berlin
Fachgebiet Mensch-Maschine-Systeme, Sekr. MAR 3-1
Marchstr. 23
D-10587 Berlin, Germany

Cognitive demands on attentional resources of drivers interacting with voice-command based infotainment systems affect the primary task of driving. At the same time, drivers are capable of handling difficult driving situations despite numerous secondary tasks, with studies on risk behavior of drivers indicating that drivers with high values in sensation seeking (HSS) tend to perform more secondary tasks while driving. Infotainment systems should hence be optimized to human information processing. We therefore focus on drivers' ability to control the timing of task processing (task pacing). In our experiment, 40 drivers performed the Paced Auditory Serial Addition Test while driving in a simulator. We compared set- and self-paced interaction and found no differences in subjective workload, but more collisions and higher reaction times within the set-paced condition. Furthermore, HSS chose a higher pace in the secondary task, a higher driving speed and shorter distance to the vehicle ahead than drivers with low values in sensation seeking (LSS) did. Collision numbers did not differ significantly. Self-pacing in secondary tasks seems to be beneficial regarding driving performance, with HSS opting for a higher pace.

Substituting the Bots – Effects of Human-Human Interaction in Urban Driver-Pedestrian Scenarios using a Connected Simulator Environment

Christian Lehsing, Ilja Feldstein, Klaus Bengler
*lehsing*AT*lfe.mw.tum.de*
Institute of Ergonomics, Technische Universität München
Boltzmannstr. 15
85748 Garching, Germany

In nowadays driving simulation research, the interaction between one participant of a study and more or less smart programmed agents (bots) under specific experimental conditions is the common approach. While human interaction, especially in short-timed and complex situation like urban traffic, is a broad facetted and multidirectional construct, the programmable traffic participants run into constraints. This paper presents an approach where the narrow spectrum of human-bot interaction is broken up. Setting up a multi-participant driving simulator consisting of a car driver in a driving simulator and a pedestrian in a second simulator meeting in the same simulated environment, fosters the aspect of a more human behaviour or human-human- interaction in this synthetic setting. Effects of the aforementioned approach can be found in eye-tracking, driving and subjective data and reveal the potential of this method.

Using the Method of Limits to Assess Comfortable Time Headways in Adaptive Cruise Control

Felix Siebert, Michael Oehl, Hans-Rüdiger Pfister
*felix.siebert*AT*uni.leuphana.de*
Institute of Experimental Industrial Psychology, Leuphana University Lüneburg
Wilschenbrucher Weg 84a,
21335 Lüneburg, Germany

There is disagreement in driver behaviour modelling on the relationship between subjective variables and driving parameters. In this experimental study, the distance kept by the driver when trailing another vehicle was examined in a driving simulator. Earlier studies indicate a threshold relationship between distance (measured as time headway) and the subjective experience of comfort of the driver. To expand on these findings, we presented participants with systematically varied time headways at different speeds. Analogue to Fechner's psychophysical method of limits, participants were first presented either a large time headway of 4.0 seconds that decreased in 0.5 second increments, or a small time headway of 0.5 seconds that increased in 0.5 second increments. With this kind of measuring approach that is comparable to Fechner's idea, we pursued a deeper insight in the linear or threshold relation between subjective variables and driving parameters. In both measuring conditions (increasing vs. decreasing time headways), participants rated their subjective experience of comfort for each subsequent time headway. Results of our psychophysical approach support earlier findings of a threshold effect for the relation between comfort and time headway, and will be discussed in terms of their impact on adaptive cruise control and theoretical issues.

Experimental study of ship navigator's mental workload

Hongtae Kim, Seung-bin OH, Jun-Hyuk JANG
*hongtae.kim*AT*kriso.re.kr*
Korea Research Institute of Ships & Ocean engineering/ KIOST
171, Jang-Dong, Yuseong, Daejeon, 305-343, South Korea

The aim of this paper is to evaluate the ship navigator¡¯s mental workload. We compared the variation of physiology signals according to the Operational Environments. The experiment was carried out in the KMOU training ship. The participants in this study were the captain, officer, and quarter master. We measured the ship navigator¡¯s mental workload/performance based on ECG (Electrocardiogram), PVT (Psychomotor Vigilance Test), and NASA-TLX. The selected scenarios are arrival & departure between the ports of Busan and Ulsan. The results from ECG, PVT, and NASA-TLX analysis showed differences for arrival and departure. In the case of the captain, the results showed that the workload of arrival was higher than that of departure. In the case of the officer and quarter master, the results showed that the workload of departure was higher than that of arrival. Based on the results of this study, it will be possible to evaluate the workload under various conditions using a simulator.

Construction of drivers' spatial representations of traffic elements at signalised intersections in urban areas

Firas Lethaus, Robert Kaul, Uwe Drewitz, Meike Jipp
*firas.lethaus*AT*dlr.de*
Institute of Transportation Systems, German Aerospace Center (DLR)
Lilienthalplatz 7
D-38108 Braunschweig, Germany

During left- and right-turns with oncoming traffic at urban intersections, a correct mental representation of the spatial positions of surrounding traffic elements (e.g. cars, cyclists, and pedestrians) is needed. If the traffic elements are not represented correctly in drivers' mental models, the probability of an accident occurring increases. An inadequate allocation of cognitive resources while approaching intersections may result in an impaired mental representation of the spatial positions of other traffic elements. In turn, impaired mental representations may lead to inadequate driving decisions. A dual-task experiment was conducted in order to investigate the impact of the allocation of cognitive resources on the construction of spatial representations at intersections. While approaching a signalised intersection, participants had to: (i) construct a spatial representation of the surrounding traffic elements and (ii) react to a spatially demanding secondary task. While solving the secondary tasks drivers shifted cognitive resources away from the first task. The response times and the quality of the responses were recorded. The results show, that the construction of spatial representations is a function of the allocation of cognitive resources and the distance-to-stop-line. The results presented form the basis for a cognitive driver model, supporting the development of Intersection-Assistance systems.

Drivers' cognitive retrieval of traffic participants at intersections during automated driving: The empirical impact on Intersection-Assistance systems development

Robert Kaul, Firas Lethaus, Uwe Drewitz, Meike Jipp
*robert.kaul*AT*dlr.de*
Institute of Transportation Systems, German Aerospace Center (DLR)
Lilienthalplatz 7
D-38108 Braunschweig, Germany

A correct spatial representation of traffic participants surrounding the driver is an essential part of drivers' mental models. Adequate situation models are required at complex intersections to support adequate driver responses. When approaching an intersection, attentional resources are needed for the correct construction of spatial representations. These resources play a major role in encoding and retrieval of correct traffic configurations from working memory. During left- and right-turns with crossing traffic, cognitive load can be high, binding attentional resources. Bound attentional resources may impair the retrieval of spatial representations, resulting in incompletely updated situation models. An experiment was conducted in order to investigate the cognitive processes involved in the retrieval of spatial intersection information and the subsequent update of drivers' mental representations. In an automated-driving scenario the participants were approaching urban intersections, while solving demanding secondary tasks. After reaching the intersection, participants had to retrieve their spatial representation and recall the traffic participants surrounding their car. The results show that the quality of retrieval is a function of the distance-to-stop-line, the drivers' angle of view, and cognitive load. The results of the experiment and a first concept of an Intersection-Assistance system, supporting the driver at complex intersections, are presented.

An Approach to a Head Tracking Method in Vehicles

Ilja Feldstein, Alexander Guentner, Daniel Bacara, Georgica Iacobescu, Klaus Bengler
*feldstein*AT*lfe.mw.tum.de*
Institute of Ergonomics
Technische Universität München
Boltzmannstr. 15
85747 Garching, Germany

In the future, assistance systems in vehicles will use data containing live 3D positions of the driver's head and eyes in order to display information in a contact analogue way. This should help increase the driver's (and other traffic participants') safety and comfort. For this, a study with 15 participants was launched to examine typical head movements of the driver while driving, showing only slight longitudinal and transversal movements of the head. Based on these results a head tracking method was developed, implying blob detection algorithms and 2D to 3D conversion while using only one thermographic camera. Reducing the system to one camera cuts the expenses significantly, inducing however, small deviations in the 3D detection. Thermal image processing allows the images to be treated independently of external light conditions, which makes the system reliable and suitable for night-time driving.

Human factors engineering to improve the effectiveness of surgical training

Sonja Buzink, Jonathan Kendler
*sonja.pausbuzink*AT*ul.com*
UL-Wiklund R&D
Arthur van Schendelstraat 630
3511 MJ Utrecht, The Netherlands

About two-third of adverse events in the operating room are caused by human error. Comprehensive surgical training is key to safeguard patient safety. The advent of new image-based techniques, like laparoscopy, expanded the skills set surgical trainees need to acquire. Simultaneously, the time available for training decreased due to new working time directives and clinical training lost acceptance due to medico-legal and economic considerations. A paradigm shift occurred in surgical training: training of basic surgical skills moved out of the operating room. Preclinical training using surgical simulators is well accepted nowadays. Yet, the tools commonly used for training and skills assessment hardly evolved since the shift started. Virtual reality simulation tools emerged, but did not live up their prospects so far. We will explain how lack of user-centred design early on, can long term impair the application and acceptance of high potential products like virtual reality surgical simulators. We will also discuss the human factors of influence on the effectiveness of preclinical and clinical surgical training. Our presentation will highlight the importance of comprehensive task analysis, but also explain how consultation of expert users can backfire during the design and product validation process for this type of medical tools.

The impact of different degrees of automation on surgeon performance consequences

Maria Luz, Dietrich Manzey
*mluz*AT*zmms.tu-berlin.de*
Technische Universität Berlin
Institut für Psychologie und Arbeitswissenschaft
Fachgebiet Arbeits-, Ingenieur- und Organisationspsychologie
Sekretariat F 7
Marchstr. 12
D-10587 Berlin

This laboratory study investigates which cognitive functions should be automated in a surgical context in order to gain the best results possible for both patients and surgeons. For this purpose, 18 otolaryngologists performed three simulated surgeries of the ear: one without any automation support (control) and two with image-guided navigation (IGN) systems. The first IGN system supports surgeons in information acquisition and analysis. The second IGN system additionally assists the surgeon in decision selection and action implementation. Performance was measured by the surgery duration and the number of risk structure injuries. We measured subjective workload, physiological effort, and secondary task performance as workload variables. We also measured participant's situation awareness. Results show that both IGN systems provide performance benefits in terms of higher patient safety and lower physiological effort for surgeons. However, the system with the lower degree of automation caused fewer negative effects with respect to surgery duration and subjective workload of surgeons in comparison to the more automated IGN system. This study provides evidence that a high degree of automation is not always the best approach and that a moderate degree of automation can have a more positive overall impact surgeon performance consequences.

The effects of Medicinal THC on simulator driving performance taking into account cannabis use history

Janet Veldstra, Karel Brookhuis, Dick de Waard
*j.l.veldstra*AT*rug.nl*
University of Groningen
Grote Kruisstraat 2/1
9712 TS, Groningen, The Netherlands

Rationale: The objective of the current study was to assess driver impairment following medicinal THC administration on both control level and tactical level driving skills for both regular and occasional users some time after THC had peaked in blood. Methods: Twenty-four participants were treated with a low (10 mg), high (20mg) dose oral THC (Marinol®) and a placebo. Between four to five hours after drug administration participants performed driving tasks in a driving simulator. Main measures in the driving tasks were: standard deviation of the lateral position (SDLP) and time to speed adaptation to a lead car. Results: a low dose of THC (10mg) had no effect on performance but the higher dose (20mg) affected SDLP comparable to driving under the influence of a BAC of 0.5‰ or more irrespective of cannabis use history. The reaction time to speed changes of a lead car was increased after the high THC dose, but only for occasional cannabis users. Conclusion: 20 mg medicinal THC impairs driving performance even if THC in blood is over its peak in blood in both occasional and regular cannabis users but more so for occasional users.

Fitness to drive measures for chronic users of ICADTS category III drugs; 'do not drive'. Advise them to drive if they are fit for it

Chris Dijksterhuis, Janet Veldstra, Dick de Waard, Karel Brookhuis
*c.dijksterhuis*AT*rug.nl*
University of Groningen, Neuropsychology
Grote Kruisstraat 2/1
9712 TS Groningen, The Netherlands

The International Council on Alcohol, Drugs, and Traffic Safety (ICADTS) classifies the impairing properties of medicinal drugs on driving performance into one of three categories; presumed safe (I), moderate adverse effects (II), and potentially dangerous (III). In the Netherlands for example, the percentage of chronic ICADTS III users in the population is estimated to be around 6% for sleeping medication and 10% for antidepressants, and increases with age. However, the classification is largely based on pharmacological studies of brief drug use on healthy subjects. Not enough is known about the impairing effects on chronic drug users who may develop a tolerance for side effects and thus could be fit to drive. The primary goal the current research is to determine if fitness to drive can be assessed from (1) a highway ride focusing on lane keeping performance, (2) a neurological test battery focusing on perceptual functioning, executive functions, and vigilance, and (3) a driving simulator ride focusing on navigating intersections, merging on the motorway, and lane keeping performance. For this, 120 chronic ICADTSIII drug users will be recruited and compared to a matched control group. The fitness to drive norms may be used to individualise driving advice for patients.

Rule-related behaviour in the safety context: The unjust disparagement of the violator

Sebastian Brandhorst, Annette Kluge
*sebastian.brandhorst*AT*uni-due.de*
Wirtschafts- und Organisationspsychologie / Universität Duisburg-Essen
LE 245
Lotharstraße
47057 Duisburg, Germany

Violations are often associated with rule-breaking and unsafe behaviour even if violations are not necessarily malevolent (Alper & Karsh, 2009). The positive outcomes of a rule improving character of violations has been mentioned (Desai, 2010), but lacks empirical evidence. Observations and log file analyses of previous studies revealed a broad range of violation-types and led assume the beneficial potential of violations. Therefore, different types of operators and their rule-related behaviour in a simulated process control task were analysed empirically. The regarded task consists of handling a waste water purification plant for 36 production weeks. By conducting a cluster-analysis including 152 participants and their 5472 decisions about how to start-up the plant in each simulated week, three variables were considered: the violations severity, number of times participants changed their rule-related strategy and the extend of failure/success of these strategies. Five rule-related behaviour-types were extracted, e.g. the rule compliant but inefficient group of operators (15%, called “The resigned executors”) versus the successfully optimizing ones (13%, called “The optimizers”). The results are discussed with respect to reinforcement, prevention or intervention of the particular behaviour in order to suggest a combined person- and system-orientated view on violations.

Design and Evaluation of the Mission Readiness Training (MRT) for Eurofighter Pilots

Helmut Blaschke, Annette Kluge
*helmut.blaschke*AT*asta.de*
GFD/Hohn, Airbus Defense & Space /University of Duisburg-Essen, Germany

With the introduction of Eurofighter Aircraft, the Luftwaffe was fitted with the high - fidelity simulation system ASTA (Aircrew Synthetic Training Aids) which allows implementing innovative training such as the Mission Readiness Training (MRT). MRT includes a team task analysis (to derive task and team work related knowledge, skills, favourable attitudes, required experiences), training design (centred around required and substantial experiences) and training/ transfer performance assessments. Additionally, MRT captures possible HF/CRM and safety threats which are assessed based on the HFACS categories by the civil instructors. The MRT that will be presented included 4 training missions with 33 experiences (applied skills and knowledge) to be made and 14 required attitudes to be demonstrated. All together 46 pilots were trained in 99 missions. Results showed that MRT missions were perceived as with a high cognitive/ action fidelity and usefulness: 81 % of the trained experiences were encountered during the deployment. Additionally, pilots could be made aware of HF/CRM and safety threats by experiencing the danger of channelized attention (34%), complacency (18%), task saturation (18%) and distraction by lower priority tasks (15%). It will be discussed how MRT contributes to making complex missions safer and more efficient.

Visual scanning in an air traffic control tower – A simulation study

Peer Manske, Christoph Moehlenbrink
*peer.manske*AT*dlr.de*
DLR - German Aerospace Center
Institute of Flight Guidance
Lilienthalplatz 7
D-38108 Braunschweig, Germany

Air traffic controllers at an airport tower ensure for safe and efficient movements of aircraft at the airport and its vicinity. Their decisions always depend on the current situation. To assess the relevant situational aspects information is mostly acquired visually. While take-off and landing in particular a sufficient picture of the situation is crucial to safe decision making. Situations in which the runway is used by several aircraft after each other in a close temporal proximity are considered to be more complex. It is assumed that also more scans of more crucial areas are required in complex than in simple situations to clear aircraft to use the runway.

Therefore an eye tracking study was conducted in a high fidelity tower simulator. Six air traffic controllers handled IFR traffic at a local airport with simple as well as more complex situations. Their scanning behaviour was assessed while giving take-off- and landing-clearances.
Results show similarities among participants and situations regarding visual movements while delivering clearances. Slightly more scans were made in complex than in simple situations. The attended areas indicate highly trained behaviour of the controllers. Eye tracking as a tool to detect inattentiveness in air traffic control is discussed.

HMI design approach for the future flight deck

Ana Ferreira, Jelena Dokic, Linda Napoletano, Stefano Bonelli
*ana.ferreira*AT*dblue.it*
Deep Blue s.r.l.
Piazza Buenos Aires 20, Roma, Italy

Current methods for introducing innovation and automation in safety critical domains like aviation, move from the tendency to reallocate the activities that are currently performed by the crewmembers to the automation. The increment in the level of automation will translate, among other things, into new tasks and responsibilities for the pilots, and for this reason it is of great importance to assure the support of pilots' performance as a way to increase safety and efficiency of operations.

The proposed approach supports both design and evaluation of HMI of the new technologies as a way to achieve integrated solutions for a modern and more efficient flight deck. The advantage is to steer the HMI design in early phases of the design lifecycle, when the degree of freedom for the definition of the interface is high and the early identification of HMI design issues can be a real cost saver.
This approach is presented in the perspective of HMI design in two different large R&D projects, ALICIA and ACROSS, both envisaging the development of airborne technologies where consistency plays an important role.

Task analysis from the expert point of view: a prerequisite condition to analyse physiological activity of fighter pilot aircraft

Clément Guerin, Baptiste Leroy, Christine Chauvin, Gilles Coppin
*Clement.Guerin*AT*univ-ubs.fr*
Lab-STICC
ENSIBS
17 Bd Flandres-Dunkerque
BP 92116
56321 Lorient Cedex, France

This paper presents a task analysis description, as a preliminary step of the TAPAS project. The objective of this project is to understand the impact of quality of collaboration on the physiological state of the fighter aircraft pilot. In order to analyse physiological signals in terms of mental workload, we conducted interviews with an operational expert from the French Air Force. We used the allo-confrontation technique to identify collaborative tasks between pilot and co-workers. This technique was implemented by confronting an expert to the recording of an air defence mission performed by another pilot. The expert was led to reconstruct collaborative goals and tasks involved in this type of mission. We identify collaborative tasks in terms of significant communications sequences: target assignment, self-protection, take-off, etc. This division into sequences is necessary to analyse physiological signals recorded during a mission. We conclude about the importance of adopting this complementary approach, i.e. task analysis and physiological activity analysis, to investigate pilot mental workload. We suggest that confrontation techniques are more relevant data collection method for expert's knowledge elicitation than interviews without traces of one's activity.

Enriching the primary flight display: Support of power control during manual flying by means of energy management indicators

Simon Müller, Dietrich Manzey, Karolin Schreiter
*simon.mueller*AT*tu-berlin.de*
Technische Universität Berlin / Department of Psychology and Ergonomics / Work, Engineering and Organisational Psychology
Marchstrasse 12, F7
D-10587 Berlin, Germany

To select a desired power setting in manual flight, pilots nowadays use memorized pitch and power values. These power settings depend on the aircraft's altitude, speed, mass and configuration and can therefore change within a stationary flight phase. However, it is impossible for pilots to remember every exact combination of pitch and power setting for each flight state. Thus, pilots often need to interpolate the required power setting based on values they remind. These interpolations then are optimized on a trial-and-error basis by closely monitoring and cross-checking power, pitch, speed and altitude. This makes pitch and power flying cognitively and perceptually demanding, particularly in non-routine situations. A new graphical concept to support the pilot in choosing and maintaining the accurate power settings will be presented. The concept takes advantage of the proximity compatibility principle and directly displays the needed information in an integrated format within the PFD. It is hypothesized that this will enable more precise manual flying by at the same time reduced workload and unchanged situation awareness. Currently, the new concept is empirically evaluated in a simulator study with twelve airline pilots. Results of this research with respect to performance, workload and situation awareness will be presented and discussed.

MoodRadar-DAVID: Providing Caretakers With Real-Time, Personalized Insight in Electrodermal Activity of Clients Who Show Severely Challenging Behaviour

Matthijs L. Noordzij, Marleen Laroy-Noordzij
*m.l.noordzij*AT*utwente.nl*
Department of Cognitive Psychology & Ergonomics,
University of Twente
Cubicus, Room B333
P.O. Box 217
7500 AE Enschede, The Netherlands

In our project we focused on measuring changes in skin conductance of people with severe mental disabilities, who also consistently showed challenging behaviour such as aggressive acts and self-injurious behaviour. Caretakers often report being surprised by these outbursts and explicitly express a need for additional tools to gain insight in the arousal levels of their clients. The aim of our project was to investigate the potential value of ambulatory physiological measurements in bringing this insight to the caretakers. The MoodRadar-DAVID project is a design and research project consisting of the following stages: (1) we established that skin conductance of the clients could reliably be measured for long periods of times (weeks) during their normal lives, and that relevant parameters could be extracted. (2) We investigated whether the introduction of the wearable technology would not distress the clients even more, making the project immediately counter-productive relative to its aims. (3) We created a suitable algorithm for aggregating and visualizing the skin conductance data. (4) We built a first prototype following User-Centred Design principles. (5) We are carrying out a first implementation study on the effectiveness of the system to alleviate the problems that lay at the foundation of the project.

Detection of pleasant and unpleasant emotion evoked by visual stimuli using Neural Network

Akinori Hirano:Graduate school of Nihon University, Shuuichi Yamamoto:Graduate school of Nihon University, Hitoshi Tsunashima, Kazuki Yanagisawa: Nihon University
*ciak13033*AT*g.nihon-u.ac.jp*
Department of Mechanical Engineering
College of Industrial Technology
Nihon University
1-2-1 Izumi-cho, Narashino-shi, Chiba 275-8575, Japan

Detection and isolation of human emotion from brain activities has been attracted in various research fields such as neuromarketing. A relation between a level of brain activity and pleasant and unpleasant emotions has been studied using Near-infrared Spectroscopy (NIRS). This non-invasive technique uses near-infrared light to evaluate increases or decreases in oxygenated hemoglobin or deoxygenated hemoglobin in tissues below the body surface. However, it is difficult to find out the difference between the pleasant and unpleasant emotion on the brain activity because the different stimuli were used in the experiments in previous studies. In this study, the relation between the brain activity and the pleasant and unpleasant emotions was evaluated using International Affective Picture System (IAPS) and NIRS. Based on the NIRS recording for 21 participants, the effect of pleasant and unpleasant emotion on the brain activity is studied first. Then, detection of pleasant and unpleasant emotion from NIRS signal was conducted using Neural Network. Results showed that a significant difference in the brain activity can be appeared in the central part of the frontal lobe. It is also shown that the pleasant and unpleasant emotion can be detected with the accuracy of 96% (the highest) and 70% (average).

Multi-objective and Systematic Performance Analysis of Industrial Operators

Salman Nazir, Davide Manca, Kjell Ivar Øvergård
*salman.nazir*AT*polimi.it*
PSE-Lab, Process Systems Engineering Laboratory, Politecnico di Milano, Buskerud and Vestfold University College
Piazza Leonardo da Vinci, 32, Milan, Italy

The process industry comprises rather complex chemical processes and industrial operators. The decisions made by operators during normal and abnormal situations play a crucial role in a process plant. In order to prepare operators to perform their tasks, various training methods and tools have been deployed, but not much is known about the peculiarities of operator training's evaluation. Conventional methods (by which performance, as an outcome of training, is evaluated) might be limited/invalid. Particularly, performance evaluation of operators based on a single objective, such as measurable production outcome, is questionable. In the present work, a Multi-objective and Systematic Performance Analysis (MASPA) based on Key Performance Indicators (KPIs) and Operator Performance Indicators (OPIs) is developed and compared with conventional single objective performance analysis. Specifically KPIs, such as operating conditions, safety constraints, production goals, etc. and OPIs such as precision, communication, cognitive demands, skills, etc. are integrated into MASPA. The performance of operators in two distinct experiments (n = 24) based on an immersive virtual environment, featuring a real chemical plant, is measured by comparing the MASPA and a single objective method. It is found that MASPA produces an accurate and consistent performance assessment. Implications for further training evaluations are also discussed.

Novice and Young Drivers' Driving Behaviour in a Positive versus Negative Affective State

Michael Oehl, Felix W. Siebert
*oehl*AT*uni.leuphana.de*
Leuphana University Lueneburg
Institute of Experimental Industrial Psychology
Wilschenbrucher Weg 84a
D-21335 Lueneburg, Germany

The percentage of novice and young car drivers involved in heavy car accidents is still remaining dramatically high in the European Union. Traffic psychological research shows that maladjusted driving behaviour caused by affective states is a main contributor to traffic accidents. However, while there has been much research on especially anger as a negative affective state, maladjusted driving, and accident risk, very little attention has been paid to positive affective states and their impact on driving behaviour. Therefore, our current experimental study analyses this influence of different affective states on driving performance with regard to novice and young drivers. In an experimental scenario affective states (positive vs. negative valence) were induced in participants and subjects were then asked to drive predefined routes in a driving simulator. In order to test a wide range of environmental influences, drivers had to complete different routes in an inner city, a country road as well as a motorway setting. Results indicated that novice and young drivers drove significantly faster in a positive affective state. This effect was pronounced by trend for novice drivers. Implications for further research as well as for applied issues, e.g., in terms of trainings, will be discussed and outlined.

Acoustic Speech Features and Affective States in Human Computer Interaction: Additional Insights from Think-aloud Protocols

Nils Backhaus, Julien Tanardi, Jarek Krajewski, Sebastian Schnieder
*nils.backhaus*AT*tu-berlin.de*
Techinsche Universität Berlin, Cognitive Psychology and Cognitive Ergonomics
Secretariat MAR 3-2
Marchstr. 23
10587 Berlin, Germany

Think-aloud protocol (TAP) is a prevalent and long-known evaluation method in HCI settings. Most of the time, TAPs are analysed qualitatively, i.e. on the level of comments and verbal behaviour. The examination of vocal correlates may add value towards a more in-depth analysis of recorded TAPs. Acoustic features of produced speech—like respiration, prosody, shimmer, articulation—may reflect underlying affective states which are closely related to the subjective experience (user experience) in the HCI setting. In order to unravel the potential of acoustic speech analysis in HCI evaluation we conducted a study (N = 20) using two different Websites (high vs. low usability, between-subject). TAP has been recorded and voice characteristics have been assessed as well as subjective affective and user experience measures. The two groups differed in terms of acoustic features and subjective measures. These results imply that acoustic features bear the potential to reflect the users' affective states in HCI. Therefore we highly recommend analysing TAP protocols on an acoustic level. These methods are highly applicable to a lot of HCI settings in laboratory and field and offer a quick, quantitative, and highly dynamical complement to qualitative TAP evaluation.

Simulation sickness on a large concave screen during a virtual environment walking surveillance task in a village

Adi Ronen, Tal Oron-Gilad
*adiro*AT*bgu.ac.il*
Dept. Industrial Engineering and Management
Ben Gurion University of the Negev
Beer Sheva 84105, Israel

The use of simulated environments for research and training is common as simulation technology became more widespread, thus enabling its use in transportation, medicine, military and even industrial settings. One of the major challenges while using these types of systems is reducing the stimuli conflict effect that is known as simulation sickness or motion sickness. In the present study a unique system, built as a dome screen that consists of a 180 degrees concave screen was used for a surveillance mission in a small virtual village in which participants were asked to detect target barrels while moving with a joystick under two different conditions: no time pressure static objects located in the scenario (low rate) and a time pressure scenario with moving objects (high rate). Twenty participated in the study with each performing the detection task (low rate task followed by the high rate task or in the reverse order). Results indicated that simulation sickness was significantly higher while performing first the high rate task. Primary exposure to the task played a major role of reducing simulation sickness while using this setup. Heart rate indicated a reduction of physiological strain during the entire period of the experiment.

Product personality assignment versus Jung and Briggs Myers personality types of the raters

Denis A. Coelho
*denis*AT*ubi.pt*
Dept. Electromechancial Eng.
Universidade da Beira interior
6201-001 Covilhã, Portugal

Product personality assignment was proposed by Patrick W. Jordan, in the shape of a subjective evaluation scale using 17 personality pairs, as a means to enable companies to get to know the anthropomorphic positioning of their products as well as their intended new product offerings, in view of maintaining competitiveness in the market and aiming at customer satisfaction. The personality pairs included are: kind – unkind, honest - dishonest, serious minded – light hearted, light – dim, stable – instable, narcissistic – humble, flexible – inflexible, authoritarian – liberal, driven by values – not driven by values, extrovert – introvert, naïve – cynical, excessive – moderate, conformist – rebel, energetic – non energetic, violent – gentle, complex – simple and pessimist – optimist. In a class setting, 30 students of an undergraduate human interface design course rated three sets of competing electric appliances using the 17 aforementioned pairs on a 5 point Likert scale. Subjects were asked to choose their favourite product from each set and to state whether this product mirrored or complemented or was in opposition to their own personality. Additionally subjects were asked to complete a free online personality test (humanmetrics.com) and report their test results on the questionnaire form. These results are given in 4 scales: Introversion – Extroversion, Sensing – Intuition, Thinking – Feeling, Judging – Perceiving. These results were compared. The data analysis which is ongoing is aimed at verifying whether particular personality types are more inclined to choosing certain product personality profiles that allegedly complement, mirror or stand in opposition to their own personality.

Monotony in automated driving can elicit passive fatigue

Moritz Körber, Andrea Cingel, Markus Zimmermann, Klaus Bengler
*koerber*AT*lfe.mw.tum.de*
Institute of Ergonomics
Boltzmannstraße 15
85747 Garching, Germany

Besides resource depletion caused by active task engagement, there are several indices that monotony and passive fatigue can also induce vigilance decrement. Partially automated driving represents such a passive situation as the driver's only task is to monitor the system. In this work we investigate the decrement of vigilance during a partially automated highway drive. Used indicators for vigilance state and fatigue were a reaction time task, eye tracking and a mind wandering questionnaire. We found no significant effects on the reaction times, but significant effects on eye tracking parameters (blink frequency, blink duration, pupil diameter) and increased mind wandering.

Effects of trust training and system reliability on operator performance, trust, and use of automation

Alain Chavaillaz, Juergen Sauer, David Wastell
*alain.chavaillaz*AT*unifr.ch*
Department of Psychology
Cognitive Ergonomics and Occupational Psychology
University of Fribourg
Rue de Faucigny 2
1700 Fribourg – Switzerland

Trust in automation is one important factor that influences operator performance and use of automation in complex work environments. The present study aimed to investigate the impact of trust training and system reliability on performance. Forty operators were tested when managing a simulation of a highly automated process control task. When a fault occurred, operators were assisted by an adaptable support system which allowed them to choose from six levels of automation ranging from full manual control to an automatic implementation of the fault repair procedure. Four experimental groups were formed on the basis of the system reliability (60% or 100%) and trust training (high or low). In the high-trust condition, operators experienced no system failure during training whereas in the low-trust condition half of automation recommendations were incorrect. The results showed that performance and trust in automation were affected by system reliability while the influence of trust training was negligible. Furthermore, the use of automation and subjective workload were not affected system reliability. The findings suggest limitations of trust training as a means to prepare operators for managing unreliable systems.

Effects of system characteristics and context factors on operator decision-making with alarm systems

Rebecca Wiczorek, Torsten Günzler, Joachim Meyer
*rwi*AT*zmms.tu-berlin.de*
Tel Aviv University
Dep. Industrial Engineering
Wolfson 414
Ramat Aviv 69978
Tel Aviv – Jaffa, Israel

Recent findings regarding operators' decision-making with alarm systems show complex response patterns to imperfect decision aids. Responses may not only depend on the statistical properties of the aid and additional information, but also on the way the aid and decision task are described. We report preliminary results from a study investigating effects of different risk framings on responses to alerts. Therefore we compared an alarm system, which was diagnosing cancer to a decision aid classifying tissue samples. A laboratory experiment was conducted with 72 participants, using a binary image classification simulation. Participants worked with one of three systems that differed with regard to their characteristics (miss-prone, false alarm-prone, neutral) under either of the two scenario descriptions of high vs. low risk. They could check raw data to validate the system diagnose. It was found that participants checked the raw data more often, when being faced with the high risk scenario compared to the low risk framing. This differentiation was particularly large when the system was false alarm-prone. Moreover, participants check frequencies were higher, when the system indicated that there was no problem. We suggest some theoretical and practical implications from these findings.

Research Development to define shared usability in product design for older adults

Linda Shore, P. J. White, H. Dempsey
*linda.shore*AT*itcarlow.ie*
DesignCore
Dept. of Humanities
Institute of Technology
Kilkenny Rd.
Carlow, Ireland

It is predicted that our global population will grow to 9.6 Billion by 2050 (United Nations). Statistically, adults aged 60 years and older will make up 33% in Developed regions (United Nations). This is acknowledged as a concern for global economies, considering also that by 2050, children will make up just 15% (United Nations).

It is in addition, a design challenge. Products and Services are necessary to support and assist our various day to day activities. However as we age, there is also the consideration due to cognitive and physical decline that we may need assistance, in order to use and enjoy products and services and remain empowered and independent.
Fieldwork is on-going at present and methodologies to disseminate qualitative results include: Informal Interviews and observation sessions, Cultural probes, and Participatory Individual/group sessions.
There will be pilot based study involving three types of participant, older adult, Stakeholder, and joint older adult and stakeholder session. This will assist with design consideration and process to understand how best to develop the shared usability concept.
The concept of shared usability is being developed and anticipated to ensure empowerment and independence of older adults through the assistance or support of other stakeholders.
It works on the basis of 'mutual' agreed support levels of control in product and service use. It is anticipated that the concept of shared usability through the design process will be exemplified as an artefact (product or service) to better understand and share its potential benefit to the older adult.

Barrier-free web design and non-disabled users

Sven Schmutz, Andreas Sonderegger, Jürgen Sauer
*sven.schmutz*AT*unifr.ch*
Psychology/University of Fribourg
Departement of Psychology
University of Fribourg
Rue Faucigny 2
1700 Fribourg, Switzerland

An experiment examined the influence of implementing design principles of barrier-free web design on performance and user experience for non-disabled users. A local government website was manipulated to model different quality levels of the web content accessibility guidelines 2.0. 60 participants worked on a series of tasks under three levels of web accessibility (high, medium, low). Various performance measures (e.g. click rate, task completion rate) and a range of user experience variables were collected (e.g. website credibility, perceived aesthetics). The results showed benefits for high web accessibility compared to medium or low web accessibility. This applied to subjective experience ratings (i.e. usability, trust and aesthetics) as well as to objective performance measures (i.e. task completion time). The findings suggest that meeting the requirements of accessibility guidelines provides advantages for non-disabled users, too.

A framework to assess cognition in different types of gaming simulations

Julia Lo, Sebastiaan Meijer
j.c.lo*AT*tudelft.nl
Delft University of Technology
Jaffalaan 5, 2628 BX, Delft, The Netherlands

Over the past years, a multitude of gaming simulations has been applied to test and research innovations at the Dutch railways. Gaming simulations can be defined as a simulation of a system, in which humans take part through game methods and elements. Game environments vary in their representation from high-tech (human-in-the-loop simulators) to low-tech (table-top games). They can be used for different purposes, i.e. research, design, training and policy making. Mental models and situation awareness have been identified as key concepts, as the cognition of railway traffic operators in the simulated environment is seen as an important indicator for their decision-making quality and performance in the real work environment. Extending the current use of gaming simulations from a research purpose to other purposes, e.g. to design new railway infrastructure at stations, timetables etc., and using certain game design criteria, e.g. a step-wise instead of a continuous game flow, impact the cognition in terms of mental models and situation awareness differently. This poster presents a framework for the extent in which mental models and situation awareness can be measured at operators, given different purposes and gaming simulation design choices.

'Beam me up, Scotty!' Evaluation of the Beam's Effectiveness in a face-to-face meeting scenario

Mathis Lauckner, Dejan Pangercic, Serkan Türker
*mathis.lauckner*AT*gmail.com*
Robert Bosch GmbH
Schwarzer Weg 4
23972 Dorf Mecklenburg

Despite the increased popularity and availability of telepresence systems during the last four years, there has been little research that systematically compares these systems against more traditional systems such as teleconference systems which are for data security and price reasons commonly used in large companies. In this work, we present a 40 person user study in a simulated face-to-face meeting scenario. In a between subject design participants performed the Desert Survival Task with an unknown examiner's confederate either calling in using a phone or beaming in using Beam (Suitable Technologies). The study simulated typical meeting disturbances such as connectivity issues. Several aspects of the discussion's effectiveness were assessed (e.g. task performance, strangeness, problem solving, ease of collaboration) by using questionnaires as well as video recordings/observations. Our findings consistently corroborate a significantly more effective, natural and likeable interaction when the Beam was used. Nonetheless, a potentially exceeding performance of Beam compared to conventional video conference tools needs to be a subject of further investigation.

Incorporation of Electrophysiology in Task Analysis processes

Evanthia Giagloglou, Pavle Mijovic, Christos Tsiafis, Ivan Macuzic, Peter Todorovic and Ivan Gligorijevic
University of Kragujevac
Sestre Janjic 6 Str
34000 Kragujevack, Serbia

Human Factors (HF) are important for every modern industry, however, until now it was difficult to incorporate quantifiable and measured cognitive factors into HF techniques. Thanks to the new discipline of Neuroergonomics, tools and methods of neurosciences can be used in order to study the workers' brain, behaviour and cognition. The current paper presents a further step of applied Neuroergonomics by using mobile electrophysiological devices in real working environment. Mobile electrodermal activity (EDA) and mobile electroencephalography (EEG) will be used in order to measure and evaluate the operators' brain and cognitive factors during their tasks. Furthermore the study presents an attempt of incorporating electrophysiology into classic HF approaches as Task Analysis.