

Ergonomics– rok 2012, ročník 55

Číslo 7



Andreas Sonderegger, Gerold Zbinden, Andreas Uebelbacher & Juergen Sauer. *The influence of product aesthetics and usability over the course of time: a longitudinal field experiment.* Pages 713-730.

A longitudinal field experiment was carried out over a period of 2 weeks to examine the influence of product aesthetics and inherent product usability. A $2 \times 2 \times 3$ mixed design was used in the study, with product aesthetics (high/low) and usability (high/low) being manipulated as between-subjects variables and exposure time as a repeated-measures variable (three levels). A sample of 60 mobile phone users was tested during a multiple-session usability test. A range of outcome variables was measured, including performance, perceived usability, perceived aesthetics and emotion. A major finding was that the positive effect of an aesthetically appealing product on perceived usability, reported in many previous studies, began to wane with increasing exposure time. The data provided similar evidence for emotion, which also showed changes as a function of exposure time. The study has methodological implications for the future design of usability tests, notably suggesting the need for longitudinal approaches in usability research.

Practitioner Summary: This study indicates that product aesthetics influences perceived usability considerably in one-off usability tests but this influence wanes over time. When completing a usability test it is therefore advisable to adopt a longitudinal multiple-session approach to reduce the possibly undesirable influence of aesthetics on usability ratings.

- **Keywords:** usability, aesthetics, longitudinal evaluation, field study, user experience

Meinald T. Thielsch & Gerrit Hirschfeld. *Spatial frequencies in aesthetic website evaluations – explaining how ultra-rapid evaluations are formed.* Pages 731-742.

This study investigates how aesthetic website evaluations, especially those formed after very brief presentations, depend on visual information that is encoded in low- or high-spatial frequencies. A total of 92 participants took part in the experiment. The study used a 3×3 mixed design in which presentation time (50, 500 and 10000 ms) and spatial filtering (low-pass filtered, high-pass filtered and unfiltered stimuli) were manipulated. First, we replicate prior results from online studies of high- and low-spatial frequencies.

Second, we confirm a prediction from neurocognitive models that only low-spatial frequencies are relevant to aesthetic judgements in ultra-rapid presentation modes. Third, we demonstrate that stimulus repetitions lead to an overestimation of the importance of ultra-rapid stimulus presentations. Taken together, our results highlight the utility of neurocognitive models of visual processing to explain the rapid aesthetic evaluation of websites.

Practitioner Summary: Using neurocognitive models we present an approach to explain how aesthetic impressions are formed. We show that ultra-rapid judgements are connected with low- but not with high-spatial frequencies, which are neurologically processed in different visual pathways. Furthermore we identify possible methodological problems in previous studies of ultra-rapid website perception.

- **Keywords:** aesthetics, first impression, spatial frequency, repetition priming, website evaluation, website perception

Hiroyuki Sakai, Duk Shin, Takeshi Kohama & Yuji Uchiyama. *Attentional effects on gaze preference for salient loci in traffic scenes. Pages 743-751.*

Alerting drivers for self-regulation of attention might decrease crash risks attributable to absent-minded driving. However, no reliable method exists for monitoring driver attention. Therefore, we examined attentional effects on gaze preference for salient loci (GPS) in traffic scenes. In an active viewing (AV) condition requiring endogenous attention for traffic scene comprehension, participants identified appropriate speeds for driving in presented traffic scene images. In a passive viewing (PV) condition requiring no endogenous attention, participants passively viewed traffic scene images. GPS was quantified by the mean saliency value averaged across fixation locations. Results show that GPS was less during AV than during PV. Additionally, gaze dwell time on signboards was shorter for AV than for PV. These results suggest that, in the absence of endogenous attention for traffic scene comprehension, gaze tends to concentrate on irrelevant salient loci in a traffic environment. Therefore, increased GPS can indicate absent-minded driving.

Practitioner Summary: The present study demonstrated that, without endogenous attention for traffic scene comprehension, gaze tends to concentrate on irrelevant salient loci in a traffic environment. This result suggests that increased gaze preference for salient loci indicates absent-minded driving, which is otherwise difficult to detect.

- **Keywords:** gaze, attention, saliency, traffic scene comprehension, absent-minded driving

Enid Montague & Onur Asan. *Trust in technology-mediated collaborative health encounters: Constructing trust in passive user interactions with technologies. Pages 752-761.*

The present study investigated factors that explain patient trust in health technology and the relationship between patient trust in technology and trust in their care provider. Sociotechnical systems theory states that changes in one part of the system are likely related to other parts of the system. Therefore, attitudes about technologies, like trust, are likely related to other aspects of the system. Contributing to appropriate trust at the technological, interpersonal, and system levels can potentially lead to positive health outcomes. The study described in this manuscript used data collected from 101 patients with a Trust in Medical Technology instrument. The instrument measured patients' trust in (1) their providers, (2) the technology, and (3) how their providers used the

technology. Measure 3 was positively associated with measures 1 and 2, while measures 1 and 2 were not positively or negatively associated with one another. These results may indicate that patient assessments of the trustworthiness of care providers and technologies are based on their observations of how providers use technologies.

Practitioner Summary: Though patients are not active users of technologies in health care, the results of this study show that their perceptions of how providers use technology are related to their trust in both technology and the care provider. Study findings have implications for how trust is conceptualised and measured in interpersonal relationships and in technologies.

- **Keywords:** trust, sociotechnical systems, health care, health technology

Marie B. Jørgensen, Anne Faber, Tobias Jespersen, Klaus Hansen, John Ektor-Andersen, Jørgen V. Hansen, Andreas Holtermann & Karen Sjøgaard. *Implementation of physical coordination training and cognitive behavioural training interventions at cleaning workplaces – secondary analyses of a randomised controlled trial. Pages 762-772.*

This study evaluates the implementation of physical coordination training (PCT) and cognitive behavioural training (CBTr) interventions in a randomised controlled trial at nine cleaners' workplaces. Female cleaners ($n = 294$) were randomised into a PCT, a CBTr or a reference (REF) group. Both 12-week interventions were performed in groups guided by an instructor. Records were kept on intervention dose (adherence) unanticipated events at the work place (context) and quality of intervention delivery (fidelity). Participant adherence was 37% in the PCT and 49% in the CBTr interventions. Optimal implementation was reached by only 6% in PCT and 42% in the CBTr. Analysis of the barriers to successful implementation indicated that the intervention process is sensitive to unanticipated events. In order to succeed in improving the health of high-risk populations such as cleaners and to correctly interpret intervention effects, more research on implementation is needed. Trial registration: ISRCTN96241850.

Practitioner Summary: Both physical coordination training and cognitive behavioural training are potential effective workplace interventions among low educated job groups with high physical work demands. However, thorough consideration should be given to feasibility in the design of interventions. The optimal intervention should be tailored to closely match the implementation context and be robust and flexible to minimise susceptibility to changes in work organisation.

- **Keywords:** context, feasibility, fidelity, adherence, participation

J. Theurel, A. Theurel & R. Lepers. *Physiological and cognitive responses when riding an electrically assisted bicycle versus a classical bicycle. Pages 773-781.*

The present study compared the physiological responses and the subsequent cognitive performance when riding an electrically assisted (EB) versus a classical (CB) bicycle. Oxygen uptake, heart rate and leg extensor muscles electromyographic (EMG) activity were recorded in 10 subjects during a 30-min intermittent cycling exercise performed with EB versus CB. Cognitive performance was evaluated by a mail sorting test, performed at rest and after each cycling session. Averaged oxygen uptake and heart rate were significantly ($P < 0.05$) lower during EB cycling than during CB cycling. The EMG activities of the vastus lateralis, rectus femoris and gastrocnemius medialis muscles were significantly ($P < 0.001$) greater during CB cycling than during EB cycling. The time to complete the mail sorting test was significantly ($P < 0.05$) shorter after EB cycling than

after CB cycling. Because EB cycling reduced muscle strains and physiological stress, it might offer benefits for those using bicycles in their work, such as postal workers and police officers.

Statement of Relevance: This study compared physiological and cognitive responses when riding an electrically assisted versus a classical bicycle. The results showed that the electrically assisted bicycle led to reduced muscle strains and physiological stress and, therefore, might offer benefits for those using bicycles in their work, such as postal workers and police officers.

- **Keywords:** oxygen uptake, heart rate, EMG, work

Ilham Bakri, Joo-Young Lee, Kouhei Nakao, Hitoshi Wakabayashi & Yutaka Tochihara. *Effects of firefighters' self-contained breathing apparatus' weight and its harness design on the physiological and subjective responses.* Pages 782-791.

To examine the effects of firefighters' self-contained breathing apparatus' (SCBA) weight and its harness design on the physiological and subjective responses, eight male students performed treadmill exercise under four conditions: the 8 kg firefighter protective clothing (PC) (Control), the PC + an 11 kg SCBA with an old harness (Test A), the PC + a 6.4 kg SCBA with an old harness (Test B) and the PC + a 6.4 kg SCBA with a new harness (Test C), at ambient temperatures (T_a) of 22°C and 32°C. Besides highlighting the fact that a heavy SCBA had a significant effect on the oxygen consumption and metabolic rate, this experiment also found that in a T_a of 32°C, in particular, the combined effect of 4.7 kg lighter SCBA and new harness design could reduce metabolic rate and improved subjective muscle fatigue and thermal discomfort.

Practitioner Summary: An effort to alleviate the physiological and subjective burden of firefighters by reducing the weight of SCBA and by using the new harness design has provided satisfactory results in reduced oxygen consumption and in improved subjective responses in a hot air environment.

- **Keywords:** firefighter, personal protective equipment (PPE), self-contained breathing apparatus (SCBA), harness

Matthew D. Muller, John Gunstad, Michael L. Alosco, Lindsay A. Miller, John Updegraff, Mary Beth Spitznagel & Ellen L. Glickman. *Acute cold exposure and cognitive function: evidence for sustained impairment.* Pages 792-798.

Several industries experience periods of cold exposure and rewarming throughout the workday but mental performance under these conditions is unknown. A better understanding of cognition during the rewarming phase after cold exposure may help reduce accidents and improve performance. Ten young men (wearing ~0.1 clo) underwent three consecutive mornings trials where they were exposed to cold air (10°C) and then subsequently rewarmed (25°C air). A computerised test battery was administered during each stage of the protocol to determine working memory, choice reaction time, executive function and maze navigation. Rectal and skin temperature, oxygen consumption and thermal sensation were also measured throughout and showed a typical response. Relative to baseline performance, working memory, choice reaction time and executive function declined during exposure to 10°C, and these impairments persisted 60 min into the recovery period (i.e. once physiological parameters had returned to baseline). Further work is needed to develop countermeasures to this predicament.

Practitioner Summary: This study showed that working memory, choice reaction time and executive function declined during exposure to 10°C air, and these impairments persisted 60 min into the rewarming period (i.e. once measurable physiological parameters had returned to normal). Individuals may be at risk for injury after removal from a cold environment.

- **Keywords:** cognition, thermoregulation, shivering, thermal sensation

Faming Wang, Simona del Ferraro, Li-Yen Lin, Tiago Sotto Mayor, Vincenzo Molinaro, Miguel Ribeiro, Chuansi Gao, Kalev Kuklane & Ingvar Holmér. *Localised boundary air layer and clothing evaporative resistances for individual body segments. Pages 799-812.*

Evaporative resistance is an important parameter to characterise clothing thermal comfort. However, previous work has focused mainly on either total static or dynamic evaporative resistance. There is a lack of investigation of localised clothing evaporative resistance. The objective of this study was to study localised evaporative resistance using sweating thermal manikins. The individual and interaction effects of air and body movements on localised resultant evaporative resistance were examined in a strict protocol. The boundary air layer's localised evaporative resistance was investigated on nude sweating manikins at three different air velocity levels (0.18, 0.48 and 0.78 m/s) and three different walking speeds (0, 0.96 and 1.17 m/s). Similarly, localised clothing evaporative resistance was measured on sweating manikins at three different air velocities (0.13, 0.48 and 0.70 m/s) and three walking speeds (0, 0.96 and 1.17 m/s). Results showed that the wind speed has distinct effects on local body segments. In contrast, walking speed brought much more effect on the limbs, such as thigh and forearm, than on body torso, such as back and waist. In addition, the combined effect of body and air movement on localised evaporative resistance demonstrated that the walking effect has more influence on the extremities than on the torso. Therefore, localised evaporative resistance values should be provided when reporting test results in order to clearly describe clothing local moisture transfer characteristics.

Practitioner Summary: Localised boundary air layer and clothing evaporative resistances are essential data for clothing design and assessment of thermal comfort. A comprehensive understanding of the effects of air and body movement on localised evaporative resistance is also necessary by both textile and apparel researchers and industry.

- **Keywords:** localised evaporative resistance, sweating thermal manikin, clothing ensemble, boundary air layer, reduction factor

Peter J. Keir & Melissa M. Brown. *Force, frequency and gripping alter upper extremity muscle activity during a cyclic push task. Pages 813-824.*

Factors, such as high repetition, high force and gripping play a role in the development of upper extremity work-related musculoskeletal disorders. The purpose of this study was to systematically examine the effects of push load and frequency on muscle activity with and without concurrent gripping. A total of 10 men and 10 women performed a cyclic bimanual pushing task. All combinations of three push loads (1 kg, 2 kg, 4 kg), three frequencies (4/min, 8/min, 16/min) and two grip conditions (no required grip and 30% of maximum grip force) were performed in randomised order. The muscle activity of the upper arm and shoulder complex reflected both frequency and load, often with significant interactions, thus may be better described by workload, the product of force and

frequency. In the forearm, muscle activities were generally low but adding a submaximal grip superseded the effects of push load, with the activity reflecting frequency and grip.

Practitioner Summary: Force and frequency are important risk factors for upper extremity disorders. We found that upper extremity muscle activity responds to workload (force × frequency) in a complex way which may be superseded if a grip is present. This electromyographic study provides physiological insights to muscular loading as basis for a variety of workplace disorders.

- **Keywords:** upper extremity, shoulder, gripping, electromyography, force, frequency, workload