

Ergonomics– rok 2011, ročník 54

Číslo 4



Paul Schepers; Berry den Brinker. What do cyclists need to see to avoid single-bicycle crashes? Pages 315 – 327.

The number of single-bicycle crash victims is substantial in countries with high levels of cycling. To study the role of visual characteristics of the infrastructure, such as pavement markings, in single-bicycle crashes, a study in two steps was conducted. In Study 1, a questionnaire study was conducted among bicycle crash victims ($n = 734$). Logistic regression was used to study the relationship between the crashes and age, light condition, alcohol use, gaze direction and familiarity with the crash scene. In Study 2, the image degrading and edge detection method (IDED-method) was used to investigate the visual characteristics of 21 of the crash scenes. The results of the studies indicate that crashes, in which the cyclist collided with a bollard or road narrowing or rode off the road, were related to the visual characteristics of bicycle facilities. Edge markings, especially in curves of bicycle tracks, and improved conspicuity of bollards are recommended. **Statement of Relevance:** Elevated single-bicycle crash numbers are common in countries with high levels of cycling. No research has been conducted on what cyclists need to see to avoid this type of crash. The IDED-method to investigate crash scenes is new and proves to be a powerful tool to quantify 'visual accessibility'.

- **Keywords:** visual accessibility; perception; bicycle facilities; cyclist safety; single-bicycle crashes

Carryl L. Baldwin. Verbal collision avoidance messages during simulated driving : perceived urgency, alerting effectiveness and annoyance. Pages 328 – 337.

Matching the perceived urgency of an alert with the relative hazard level of the situation is critical for effective alarm response. Two experiments describe the impact of acoustic and semantic parameters on ratings of perceived urgency, annoyance and alerting effectiveness and on alarm response speed. Within a simulated driving context, participants rated and responded to collision avoidance system (CAS) messages spoken by a female or male voice (experiments 1 and 2, respectively). Results indicated greater perceived urgency and faster alarm response times as intensity increased from -2 dB signal to noise (S/N) ratio to +10 dB S/N, although annoyance ratings increased as well. CAS semantic content interacted with alarm intensity, indicating that at lower intensity levels participants paid more attention to the semantic content. Results indicate that both

acoustic and semantic parameters independently and interactively impact CAS alert perceptions in divided attention conditions and this work can inform auditory alarm design for effective hazard matching. Matching the perceived urgency of an alert with the relative hazard level of the situation is critical for effective alarm response. Here, both acoustic and semantic parameters independently and interactively impacted CAS alert perceptions in divided attention conditions. This work can inform auditory alarm design for effective hazard matching. **Statement of Relevance:** Results indicate that both acoustic parameters and semantic content can be used to design collision warnings with a range of urgency levels. Further, these results indicate that verbal warnings tailored to a specific hazard situation may improve hazard-matching capabilities without substantial trade-offs in perceived annoyance.

- **Keywords:** acoustics; auditory warnings; collision warnings; perceived urgency

Louise Humphreys; Sebastiano Giudice; Paul Jennings; Rebecca Cain; Wookeun Song; Garry Dunne. *The influence of company identity on the perception of vehicle sounds.* Pages 338 – 346.

In order to determine how the interior of a car should sound, automotive manufacturers often rely on obtaining data from individual evaluations of vehicle sounds. Company identity could play a role in these appraisals, particularly when individuals are comparing cars from opposite ends of the performance spectrum. This research addressed the question: does company identity influence the evaluation of automotive sounds belonging to cars of a similar performance level and from the same market segment? Participants listened to car sounds from two competing manufacturers, together with control sounds. Before listening to each sound, participants were presented with the correct company identity for that sound, the incorrect identity or were given no information about the identity of the sound. The results showed that company identity did not influence appraisals of high performance cars belonging to different manufacturers. These results have positive implications for methodologies employed to capture the perceptions of individuals. **Statement of Relevance:** A challenge in automotive design is to set appropriate targets for vehicle sounds, relying on understanding subjective reactions of individuals to such sounds. This paper assesses the role of company identity in influencing these subjective reactions and will guide sound evaluation studies, in which the manufacturer is often apparent.

- **Keywords:** decision making; sound; vehicle ergonomics

Marek Bekier; Brett R. C. Molesworth; Ann Williamson. *Defining the drivers for accepting decision making automation in air traffic management.* Pages 347 – 356.

Air Traffic Management (ATM) operators are under increasing pressure to improve the efficiency of their operation to cater for forecasted increases in air traffic movements. One solution involves increasing the utilisation of automation within the ATM system. The success of this approach is contingent on Air Traffic Control Operators' (ATCOs) willingness to accept increased levels of automation. The main aim of the present research was to examine the drivers underpinning ATCOs' willingness to accept increased utilisation of automation within their role. Two fictitious scenarios involving the application of two new automated decision-making tools were created. The results of an online survey revealed traditional predictors of automation acceptance such as age, trust and job satisfaction explain between 4 and 7% of the variance. Furthermore, these predictors varied depending on the purpose in which the automation was to be employed. These results are discussed from an applied and theoretical perspective. **Statement of Relevance:** Efficiency improvements in ATM are required to cater for forecasted increases in air traffic movements. One solution is to increase the utilisation of automation within Air Traffic Control. The present research examines the drivers

underpinning air traffic controllers' willingness to accept increased levels of automation in their role.

- **Keywords:** age; air traffic control; air traffic management; automation acceptance; decision making; job satisfaction; trust; liability

I. -L. Engkvist; R. Svensson; J. Eklund. *Reported occupational injuries at Swedish recycling centres : based on official statistics. Pages 357 – 366.*

Swedish recycling centres are manned facilities for waste collection. There is no special category in the official injury statistics for employees at recycling centres, which precludes a straightforward analysis of reported occupational injuries. This study aimed at identifying the frequency of reported accidents and diseases and the type of events that contribute to such injuries at recycling centres, based on official injury statistics. The employees were identified as being affected by more than three to five times as many accidents compared with the total workforce in Sweden. The reported accidents had occurred during a wide range of situations, but most frequently during manual handling of waste. Reported work-related diseases were mostly associated with musculoskeletal disorders, mainly due to heavy lifting. A more detailed classification of sanitation professions and workplaces in the official injury statistics would facilitate future studies of injuries in a specific professional category, e.g. employees at recycling centres. Suggestions for prevention are given. **Statement of Relevance:** The present article describes all reported work accidents and diseases among employees at recycling centres from 1992 to February 2005. It also highlights the problem of identifying new working groups in the official statistics and gives advice for a detailed classification to facilitate such future studies of injuries.

- **Keywords:** accident; disease; insurance; waste; work-related

John Z. Wu; John R. Powers; James R. Harris; Christopher S. Pan. *Estimation of the kinetic energy dissipation in fall-arrest system and manikin during fall impact. Pages 367 – 379.*

Fall-arrest systems (FASs) have been widely applied to provide a safe stop during fall incidents for occupational activities. The mechanical interaction and kinetic energy exchange between the human body and the fall-arrest system during fall impact is one of the most important factors in FAS ergonomic design. In the current study, we developed a systematic approach to evaluate the energy dissipated in the energy absorbing lanyard (EAL) and in the harness/manikin during fall impact. The kinematics of the manikin and EAL during the impact were derived using the arrest-force time histories that were measured experimentally. We applied the proposed method to analyse the experimental data of drop tests at heights of 1.83 and 3.35 m. Our preliminary results indicate that approximately 84-92% of the kinetic energy is dissipated in the EAL system and the remainder is dissipated in the harness/manikin during fall impact. The proposed approach would be useful for the ergonomic design and performance evaluation of an FAS. **Statement of Relevance:** Mechanical interaction, especially kinetic energy exchange, between the human body and the fall-arrest system during fall impact is one of the most important factors in the ergonomic design of a fall-arrest system. In the current study, we propose an approach to quantify the kinetic energy dissipated in the energy absorbing lanyard and in the harness/body system during fall impact.

- **Keywords:** fall-arrest equipment; energy; impact; drop test; lanyard

R. Lloyd; B. Parr; S. Davies; C. Cooke. *A kinetic comparison of back-loading and head-loading in Xhosa women. Pages 380 – 391.*

The purpose of this study was to compare the kinetic responses associated with ground reaction force measurements to both head-loading and back-loading in a group of Xhosa women. Altogether, 16 women were divided into two groups based on their experience of head-loading. They walked over a force plate in three conditions: unloaded or carrying 20 kg in either a backpack or on their head. The most striking finding was that there was no difference in kinetic response to head-loading as a consequence of previous experience. Considering the differences between the load carriage methods, most changes were consistent with increasing load. Head-loading was, however, associated with a shorter contact time, smaller thrust maximum and greater vertical force minimum than back-loading. Both loading conditions differed from unloaded walking for a number of temporal variables associated with the ground contact phase, e.g. vertical impact peak was delayed whilst vertical thrust maximum occurred earlier. **Statement of Relevance:** Consideration of the kinetics of head and back load carriage in African women is important from a health and safety perspective, providing an understanding of the mechanical adaptations associated with both forms of load carriage for a group of people for whom such load carriage is a daily necessity.

- **Keywords:** African women; back-loading; head-loading; kinetics; load carriage

Erin M. Sadler; Ryan B. Graham; Joan M. Stevenson. *The personal lift-assist device and lifting technique : a principal component analysis. Pages 392 – 402.*

The personal lift-assist device (PLAD) is a non-motorised, on-body device that acts as an external force generator using the concept of stored elastic energy. In this study, the effect of the PLAD on the lifting kinematics of male and female lifters was investigated using principal component analysis. Joint kinematic data of 15 males and 15 females were collected using an opto-electronic system during a freestyle, symmetrical-lifting protocol with and without wearing the PLAD. Of the 31 Principal Components (PCs) retained in the models, eight scores were significantly different between the PLAD and no-PLAD conditions. There were no main effects for gender and no significant interactions. Results indicated that the PLAD similarly affected the lifting kinematics of males and females; demonstrating significantly less lumbar and thoracic flexion and significantly greater hip and ankle flexion when wearing the PLAD. These findings add to the body of work that suggest the PLAD may be a safe and effective ergonomic aid. **Statement of Relevance:** The PLAD is an ergonomic aid that has been shown to be effective at reducing low back demands during manual materials handling tasks. This body of work establishes that the PLAD encourages safe lifting practices without adversely affecting lifting technique.

- **Keywords:** gender; kinematics; lifting; PLAD; principal component analysis

Chupo Ho; Jintu Fan; Edward Newton; Raymond Au. *The effect of added fullness and ventilation holes in T-shirt design on thermal comfort. Pages 403 – 410.*

This paper reports on an experimental investigation on the effect of added fullness and ventilation holes in T-shirt design on clothing comfort measured in terms of thermal insulation and moisture vapour resistance. Four T-shirts in four different sizes (S, M, L, XL) were cut under the traditional sizing method while another (F-1) was cut with specially added fullness to create a 'flared' drape. A thermal manikin 'Walter' was used to measure the thermal insulation and moisture vapour resistance of the T-shirts in a chamber with controlled temperature, relative humidity and air velocity. The tests included four conditions: manikin standing still in the no-wind and windy conditions and walking in the no-wind and windy condition. It was found that adding fullness in the T-shirt design (F-1) to create the 'flared' drape can significantly reduce the T-shirt's thermal insulation and moisture vapour resistance under walking or windy conditions.

Heat and moisture transmission through the T-shirt can be further enhanced by creating small apertures on the front and back of the T-shirt with specially added fullness. **Statement of Relevance:** The thermal comfort of the human body is one of the key issues in the study of ergonomics. When doing exercise, a human body will generate heat, which will eventually result in sweating. If heat and moisture are not released effectively from the body, heat stress may occur and the person's performance will be negatively affected. Therefore, contemporary athletic T-shirts are designed to improve the heat and moisture transfer from the wearer. Through special cutting, such athletic T-shirts can be designed to improve the ventilation of the wearer.

- **Keywords:** cutting; design; thermal comfort; T-shirt; ventilation