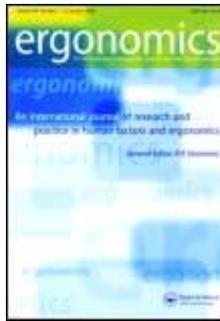


Ergonomics– rok 2007, ročník 50

Číslo 2



T. Bosch; M. P. de Looze; J. H. van Dieën. Development of fatigue and discomfort in the upper trapezius muscle during light manual work. S. 161–177.

Optimization of the temporal aspects of task design requires a better understanding of the development of muscle fatigue in the neck and shoulder region over time. The objective of the study was to investigate this in two production companies and to determine the relationship between objective and subjective estimates of fatigue. Indicators of fatigue were obtained through electromyography (EMG) during test contractions and ratings of perceived discomfort. EMG amplitude increased during the day in both case studies while mean power frequency decreased only in one case. In both cases, a more detailed frequency analysis of the EMG signals showed an increase in lower frequency power accompanied by a decrease in higher frequency power. Local perceived discomfort in the neck and shoulder increased over the course of the day in both cases. However, no clear relationship between perceived discomfort and objective indicators of fatigue was found. Obtaining sufficient sensitivity to detect effects of temporal aspects of task design probably requires complementary or more refined methods (e.g. EMG arrays, mechanomyography).

- **Keywords:** Muscle fatigue; Light manual work; Electromyography

H. P. Slijper; J. M. Richter; J. B. J. Smeets; M. A. Frens. The effects of pause software on the temporal characteristics of computer use. S. 178–191.

The study investigated the natural work-pause pattern of computer users and the possible effects of imposing pause regimes on this pattern. Hereto, the precise timing of computer events was recorded across a large number of days. It was found that the distribution of the pause durations was extremely skewed and that pauses with twice the duration are twice less likely to occur. The effects of imposing pause regimes were studied by performing a simulation of commercially available pause software. It was found that depending on the duration of the introduced pause, the software added 25–57% of the pauses taken naturally. Analysis of the timing of the introduced pauses revealed that a large number of spontaneous pauses were taken close to the inserted pause. Considering the disappointing results of studies investigating the effects of introducing (active) pauses during computer work, this study has cast doubt on the usefulness of introducing short duration pauses.

- **Keywords:** Computer use; Pause software; Exposure variability; Work-pause pattern

A. Godwin; T. Eger; A. Salmoni; S. Grenier; P. Dunn. Postural implications of obtaining line-of-sight for seated operators of underground mining load-haul-dump vehicles. S. 192–207.

Operators of load-haul-dump (LHD) vehicles use awkward postures that may be held statically and at extreme ranges of motion for long shift periods to spot hazards in underground mining. This study examined postural variables associated with three amounts of seat rotation intended to maximize line-of-sight during forward driving. Three different models, representing the 1st, 50th and 99th percentile male for height and weight, were positioned with appropriate hand and foot constraints in the virtual LHD cab modelled in Classic JACK v4.0. A total of 15 virtual movement strategies were developed to model the postural behaviour of typical workers and each virtual subject was tested, first with the seat in a neutral 0° position and then with it rotated counter-clockwise to 20° and 45°. Results revealed that reductions in trunk rotation, trunk lateral bend and neck rotation were associated with the seat rotation intervention. The general relationship observed was that as seat rotation increased, view of critical visual attention locations and visible line-of-sight area increased while postural load variables decreased. For the most part, 20° of seat rotation was beneficial but 45° produced significantly greater changes to postural load and visible visual attention locations.

- **Keywords:** Seat rotation; Computer-aided design; Line-of-sight; Awkward posture; Jack

J. N. A. Brown; W. J. Albert; J. Croll. A new input device: comparison to three commercially available Mouse. S. 208–227.

This study was conducted to simultaneously compare the postural demands and performance of a new human-centred computer input device to three devices currently on the market. It was hypothesized that the new device would perform as well as the commercial devices while requiring less postural strain. A total of 24 experienced computer users performed a series of modified Steering and Fitts' Law Tests while their postural behaviour was captured using an opto-electric system. Analysis of the postural data revealed strong similarities between the new device and the commercially available devices, including some similarities that are not suggested in the literature. Analysis of the performance data reveals no significant difference between the new device and most commercial devices and suggests further examination of the difference between familiarity and mastery. This study has shown that it is possible to use the new device in a relaxed posture and yet achieve the same accuracy as commercial devices at no more postural risk than when the traditional mouse is used at a customized, ergonomic workstation.

- **Keywords:** Computer input devices; Fitts' Law; Posture; Ergonomics

G. E. Conway; J. L. Szalma; P. A. Hancock. A quantitative meta-analytic examination of whole-body vibration effects on human performance. S. 228–245.

Whole-body vibration exerts a substantive influence in many work environments. The primary objective for this work was to quantify such effects by identifying those moderating variables that influence the degree to which performance is affected. To achieve this, a comprehensive meta-analysis was conducted, which synthesized the existing research evidence. A total of 224 papers and reports were identified and, from these 115 effect sizes were derived from 13 experiments that survived the screening procedure. Results indicate that vibration acts to degrade the majority of goal-related activities, especially those with high demands on visual perception and fine motor control. Gaps in the current research literature are identified and suggestions offered

with regard to a more theoretically-driven approach to testing vibration effects on human performance.

- **Keywords:** Whole-body vibration; Human performance; Stress; Meta-analysis

T. Manser; P. Dieckmann; T. Wehner; M. Rall. Comparison of anaesthetists' activity patterns in the operating room and during simulation. S. 246–260.

This study investigated the behavioural aspects of ecological validity of anaesthesia simulation environments using a task analysis approach. Six anaesthesiologists were observed during two cases performed in the operating room (OR), one routine and two critical incident simulation scenarios. A two-way MANOVA for repeated measures was performed with the independent variables Case (OR/SIM-R/SIM-CI) and Phase Induction/Maintenance (Emergence), the latter being a repeated measure. Dependent variables were the proportion of each phase spent on each of the observation categories. Statistically significant main effects for Phase concerning communication, monitoring, manual tasks and documentation, for Case concerning communication and documentation, and a significant interaction effect for Phase × Case concerning manual tasks and other were found. Increased action density (i.e. amount of co-occurring activities) was observed during Induction, Emergence and the Management of simulated critical events. The similarities and differences in anaesthetists' activity patterns identified in this study will help to further improve the ecological validity of simulation environments as research settings.

- **Keywords:** Anaesthesiology; Behavioural realism; Ecological validity; Operating room; Simulation environments; Task analysis

Laura E. Hughes; Kari Babski-Reeves; Tonya Smith-Jackson. Effects of psychosocial and individual factors on physiological risk factors for upper extremity musculoskeletal disorders while Tylin. S. 261–274.

Psychosocial factors are hypothesized to contribute to work-related musculoskeletal disorder (WMSD) development, although previous research has been largely epidemiological or has focused primarily on the shoulders, back and neck. The objective of this study was to quantify the effects of mental workload and time pressure on perceived workload and physiological responses of the distal upper extremity. A total of 18 typists completed nine 5-min typing sessions representing three levels of time pressure and mental workload. Levels were manipulated by adjusting typing speed and by requiring participants to perform arithmetic tasks while typing. Outcomes were measured in muscle activation levels, wrist postures and movements, key strike force and subjective assessments of workload. In general, increased time pressure increased muscle activation, key strike force and wrist deviations; and increased mental workload increased key strike force. Mental workload and time pressure mediated physical risk factors during typing to increase WMSD risk for the distal upper extremity.

- **Keywords:** Psychosocial factors; Typing; Electromyography; Mental workload; Key strike force; Data entry tasks

Stephen S. Cheung; David A. Westwood; Matthew K. Knox. Mild body cooling impairs attention via distraction from skin cooling. S. 275–288.

Many contemporary workers are routinely exposed to mild cold stress, which may compromise mental function and lead to accidents. A study investigated the effect of mild body cooling of 1.0°C rectal temperature (T_{re}) on vigilance (i.e. sustained attention) and the orienting of spatial attention (i.e. spatially selective processing of visual information). Vigilance and spatial attention tests were administered to 14 healthy males and six females at four stages (pre-immersion, $\Delta T_{re} = 0, -0.5$ and -1.0°C) of a gradual, head-out

immersion cooling session (18-25°C water), and in four time-matched stages of a contrast session, in which participants sat in an empty tub and no cooling took place. In the spatial attention test, target discrimination times were similar for all stages of the contrast session, but increased significantly in the cooling phase upon immersion ($\Delta T_{re} = 0^\circ\text{C}$), with no further increases at $\Delta T_{re} = -0.5$ and -1.0°C . Despite global response slowing, cooling did not affect the normal pattern of spatial orienting. In the vigilance test, the variability of detection time was adversely affected in the cooling but not the contrast trials: variability increased at immersion but did not increase further with additional cooling. These findings suggest that attentional impairments are more closely linked to the distracting effects of cold skin temperature than decreases in body core temperature.

- **Keywords:** Spatial attention; Vigilance; Cognition; Skin temperature; Core temperature; Thermal strain

Alan H. S. Chan; Natalie Y. W. Tang. Visual lobe shape and search performance for targets of different difficulty. S. 289–318.

In quantitative models of visual search it has usually been assumed that visual lobe area shape was sufficiently regular to be approximated by a circle or ellipse. However, the irregularities in visual lobe shapes that have been found in studies involving extensive lobe mapping have suggested that lobe shape may have important implications for visual search performance and for the accuracy of mathematical models used for performance prediction. However, no systematic research on the relationship between the shape aspect of visual lobes and search performance seems to have been carried out and no comparisons of visual lobe shape characteristics under the effect of target difficulty have been reported. The current study was conducted to achieve two major objectives in two experiments. Experiment 1 used two different targets (letter 'O' and letter 'Y') to map the visual lobes of subjects in order to provide a systematic and quantitative comparison of lobe shape characteristics and experiment 2 was to investigate the correlation of visual lobe shape characteristics with visual search time under the effect of target difficulty. The visual lobes of 28 subjects were mapped on 24 imaginary and regularly spaced meridians originating from the centre of the visual field to resemble the full field mapping situation. Five categories of shape indices, viz. roundness, boundary smoothness, symmetry, elongation and shape regularity were investigated. The results of this study demonstrated that the visual lobe shapes of subjects elongate horizontally with medium level of roundness, high levels of boundary smoothness, symmetry and regularity for an easy target (O) against a homogeneous background of 'X's. When a difficult target (Y) was used, the visual lobes of the subjects were still elongated horizontally but to a smaller extent and with a low level of roundness, medium level of boundary smoothness and regularity and a similar high level of symmetry to the easy target. Moreover, significant correlations between shape indices and visual search time were found, suggesting mathematical models for predicting search time should not merely rely on area but also should consider visual lobe shape indices. Finally, a universal mathematical model containing several visual lobe shape indices was developed, which was applicable in the prediction of visual search time for a range of similar search tasks.

- **Keywords:** Visual lobe; Shape index; Visual search; Visual inspection