Ergonomics– rok 2011, ročník 54

Číslo 6

Addie Johnson, Ari Widyanti. *Cultural influences on the measurement of subjective mental workload*. Pages 509-518.

Cognitive ergonomics is well entrenched in North American and most European work environments, where systems and products are designed with the capabilities and limitations of the user in mind. A prominent technique for analysing task demands is subjective mental workload measurement. Subjective ratings of mental workload have been shown—in North American and European populations—to be reliable and sensitive to changes in mental workload. However, there is reason to think that cultural differences may affect subjective ratings. This study compared the performance and subjective mental workload ratings of Indonesian (n = 87) and Dutch (n = 88) students in the context of a hybrid memory/visual search task. Performance was comparable for the two groups, but the sensitivity of the subjective workload measures was better in the Dutch than in the Indonesian group. The results are interpreted in light of social axioms and cultural values. **Statement of Relevance:** Now more than ever ergonomists must think beyond national borders in improving work processes. Globalisation requires that cultural differences be taken into account in developing and applying ergonomic techniques. This paper presents empirical work showing that cultural differences seriously impact the sensitivity of mental workload measures.

- **Keywords:** cross-cultural, mental workload, subjective measures, values

Errol R. Hoffmann. *Capture of shrinking targets*. Pages 519-530.

'Shrinking targets' are targets whose size diminishes with time. The task studied is a modification of Fitts' (19547. Fitts , P. M. 1954 . The information capacity of the human motor system in controlling the amplitude of movement . Journal of Experimental Psychology , 67 (6) : 381 – 391 . View all references) paradigm, with the difference that, as soon as the movement is started, the target size reduces at a constant rate until it finally vanishes. Very little research has been reported on this problem apart from Johnson and Hart (198720. Johnson , W. W. and Hart , S. G. Step tracking shrinking targets . Proceedings of the Human Factors Society 31st annual meeting . October 1987 , New York City. pp. 248 – 252 . Santa Monica, CA : HFES . View all references) and Hancock and Caird (199311. Hancock , P. A. and Caird , J. K. 1993 . Experimental

evaluation of a model of mental workload . Human Factors , 35 (3) : 413 – 429 . Two experiments are reported aimed at determining the parameters that affect the movement time and the probability of capturing a target when there are different amplitudes of movement, target widths and shrink rates. A multiplicative model is required to describe movement time data, which is dependent on Fitts' Index of Difficulty, the shrink rate and the product of these two variables. An alternative model describes the critical movement time, for a specified probability of target capture, in a modified form of Fitts' Law. **Statement of Relevance:** Modifications of Fitts' Law have been developed for many different movement tasks. Shrinking targets occur in circumstances such as gunnery and in computer games, where a target is moving away from the person. An expression is developed for the critical time to capture the target in terms of a modified form of Fitts' Law.

- **Keywords:** Fitts' Law, shrinking targets, movement time

Cormac G. Ryan, Philippa M. Dall, Malcolm H. Granat & P. Margaret Grant. *Sitting patterns at work : objective measurement of adherence to current recommendations*. Pages 531-538.

Long uninterrupted sedentary periods, independent of total sedentary time, are risk factors for poor health. There is little objective data relating to workplace sedentary behaviour and adherence to current recommendations. The sitting behaviour of office workers (n = 83) was quantified objectively using body-worn accelerometers (activPAL™) over a working week. Adherence to three different recommendations (maximum length of a sitting event of: 20 min; 30 min; 55 min) were assessed. Participants were seated at work for 5.3 ± 1.0 h/d (mean ± 1 SD), equivalent to 66 ± 12% of the working day, accrued in 27 ± 7events/d individual sitting events. Dependent on the recommendation applied, 5–20% of sitting events and 25–67% of time was accumulated in sitting events longer than current guidelines. No participants met the 20 or 30 min recommendations on every working day but seven (8%) participants met the 55 min recommendation. In conclusion, office workers spend a considerable period of their day sitting, accumulated in uninterrupted sitting events longer than current recommendations. **Statement of Relevance:** Emerging evidence suggests prolonged sitting has negative health effects. In this study of office workers, 25–67% of time sitting was accumulated in events longer than minimum recommended durations. Adverse sitting behaviour is prevalent in the office, making it an appropriate setting to target the reduction of this behaviour.

- **Keywords:** activPAL™, adherence, behaviour, sedentary, sitting

Leon M. Straker, Anne J. Smith, Natasha Bear, Peter B. O'Sullivan & Nicholas H. de Klerk. *Neck/shoulder pain, habitual spinal posture and computer use in adolescents: the importance of tender*. Pages 539-546.

Neck/shoulder pain is a common complaint, with evidence suggesting rates in adolescence have increased in line with increased computer use. The study aimed to examine the influence of gender on relationships between computer use, habitual posture and neck/shoulder pain. Adolescents (n = 1483) participating in the 14 year follow-up of the Raine Study cohort were surveyed for computer use, habitual sitting posture and neck/shoulder pain. Females used computers less than males (52% vs. 45% used for up to 7 h per week). Females sat much more upright than males with greater anterior pelvic tilt (9.4° vs. 0.4°). Females reported a higher 1 month prevalence of neck/shoulder pain (34.7%) than males (23.1%). A multivariate model showed neck/shoulder pain risk was increased in females (OR 2.61, 95% CI 1.70–4.00) and with computer use (OR 1.19, CI 1.01–1.40). Computer use is related to neck/shoulder pain and posture in adolescents but this relationship is different in boys and girls. **Statement of Relevance:** This study showed the confounding effect of gender on the relationships among computer use,

posture and neck/shoulder pain and thus the need to consider genders separately in research and practice aiming to optimise young people's use of computers.

- **Keywords:** computer use, gender, neck pain, posture, Raine Study

Emily M. Miller, Sara L. Matrangola & Michael L. Madigan. *Effects of obesity on balance recovery from small postural perturbations*. Pages 547-554.

Obesity is a major and growing health concern associated with a risk of falls. While obese individuals exhibit increased sway during quiet standing, most falls result from some type of postural perturbation. This study investigated effects of obesity on balance recovery from small forward postural perturbations. Altogether, 20 males, 10 normal weight (BMI: 21.9 ± 1.4) and 10 obese (BMI: 33.2 ± 2.3), received force (pendulum) and position (release from a static lean angle) perturbations. Obese individuals showed less centre of mass (COM) displacements and slower COM velocities than normal weight individuals following force perturbations. However, when force was normalised by body weight, and when released from identical lean angles, no differences in COM performance were found. Despite differences in quiet standing due to obesity in the absence of any externally applied perturbations, these results show no differences in balance recovery from small externally applied perturbations. Additional research is needed to determine the source of increased fall risk in the obese. **Statement of Relevance:** Obesity is associated with an increased risk of falls. Understanding how obesity affects balance is important for designing safe workplace environments and tasks. Despite prior research showing poorer balance in the obese during quiet standing, these results show no negative effects of obesity on balance recovery after small postural perturbations.

- **Keywords:** balance, biomechanics, obesity, perturbations, recovery

A.I. Bennett, J. Hanley, P. Buckle & R.S. Bridger. *Work demands during firefighting training: does age matter?* Pages 555-564.

Firefighting is known to be demanding, but low retirement age in this field means the capacity of the older worker to fight fires is less understood. In the Royal Fleet Auxiliary (RFA), firefighting is a critical secondary task that all personnel must be capable of. Heart rate (HR), work ability index and subjective work demand were obtained from 48 RFA personnel (18–58 years) during compulsory training. Measures of stature, mass, waist circumference (WC) and self-reported regular physical exercise were taken. The aim was to determine if cardiovascular responses were affected by age. Both cardiovascular and self-reported work demand scores were high but there was no evidence of any age-related increase in cardiovascular responses. Participation in extra-mural exercise and WC accounted for significant variance in both age-corrected HR and HR recovery. Results suggest that, in this sample, self-reported exercise and WC are more important determinants of HR response to fighting fires than age. Some limitations of the study are briefly discussed. **Statement of Relevance:** There is renewed interest in the work capacity of older people, particularly in demanding tasks such as firefighting. The findings suggest that factors such as self-reported regular exercise and measures of overweight/obesity are more important determinants of cardiovascular responses to high physical demands than age in firefighters up to the age of 58 years.

- **Keywords:** ageing workforce, firefighting, heart rate, physical demands

Robert W. Bender, Thad E. Wilson, Richard L. Hoffman & Brian C. Clark. *Passive-heat stress does not induce muscle fatigue, central activation failure or changes in intracortical properties of wrist flexors*. Pages 565-575.

This study evaluated the effect of passive-heat stress on the neuromuscular properties of the wrist flexor muscles, which are commonly used in manual labour hand tasks. A combination of techniques were utilised, involving nerve stimulation and paired-pulse transcranial magnetic stimulation to assess changes in muscle strength, contractile properties, fatigue-resistance and central activation as well as indices of intracortical excitability in 10healthy humans who were exposed to a passive heat stress protocol as well as a normothermia control protocol. Passive-heat stress increased core body temperature ~1°C (37.2 ± 0.4 to 38.2 ± 0.4°C ; $p < 0.01$), mean skin temperature (34.5 ± 0.7°C to 37.3 ± 1.1°C; $p < 0.01$), and heart rate (79.5 ± 20.0 to 110.0 ± 23.0 beats/min; $p = 0.04$). No effect was observed on muscle strength, contractile properties, muscle fatigability, central activation orindices of intracortical excitability ($p > 0.05$). These data indicate that allowing internal temperatures of workers to increase ≤1.0°C does not affect neuromuscular properties of the wrist flexors. **Statement of Relevance:** Exercise-heat stress has been shown to reduce human performance and exacerbate muscle fatigue. However, lessis known about passive-heat stress, especially during milder heat stress encountered in many occupational settings. Accordingly, the effect of occupationally relevant passive-heat stress on the neuromuscular properties of thewristflexors was examined.

- **Keywords:** central activation, heating, transcranial magnetic stimulation

Eunkyung Jeon, Shinjung Yoo & Eunae Kim. *Psychophysical determination of moisture perception in high-performance shirt fabrics in relationtosweating level*. Pages 576-586.

Perceived moisture in shirt fabrics was determined using psychophysical methods and objectively measured moisture absorption behaviours. Four shirt fabrics were assessed: cotton; regular polyester; high-performance polyester; ahigh-performance polyester/polypropylene blend. After a screening test, six of 10 female subjects participated inthe determination of difference thresholds (DLs) for moisture perception. Low and high amounts of sweat were simulated using 0.5 and 1.5 ml of standard stimuli (St), respectively. The results showed that the different threshold values were affected by the amount of sweat due to the characteristic absorption behaviour of the different fabrics. At St = 0.5 ml, cotton showed the largest difference threshold (DL_1 = 0.257 ml); it also had the highest initial absorption rate. With the high level of simulated sweat (St = 1.5 ml), the high-performance polyester, which had thehighest wicking rate at 30–70% of its maximum absorption capacity, had the largest DL (DL_2 = 0.543 ml). Thesedata indicate that cotton and high-performance polyester provide better moisture comfort in low and heavy sweat situations, respectively. The results suggest the possibility of using the psychophysical method as a tool to predict the end-use-specific performance of functional textiles when traditional subjective ratings fail. **Statement of Relevance:** Since the moisture management behaviour of high-tech and conventional fabrics may differ, the moisture comfort ofhigh-performance fabrics cannot be predicted using existing subjective rating methods. The feasibility ofincorporating psychophysical human factors into the end-use-specific performance evaluation of high-performance textiles was examined to help develop and optimise their comfort level.

- **Keywords:** demand wettability, difference threshold, end-use-specific evaluation, moisture perception, shirt fabric, sweat levels