

Ergonomics– rok 2011, ročník 54

Číslo 1



Peter Buckle. *'The perfect is the enemy of the good'* - ergonomics research and practice : Institute of Ergonomics and Human Factors Annual Lecture 2010. Pages 1 – 11.

The relationship between research and practice in ergonomics and human factors has rarely been addressed in the literature. This presents specific problems for researchers when seeking to relate their work to the research community. Equally, practitioners are often frustrated by the lack of appropriate research to meet their needs. This paper seeks to identify current drivers for ergonomics research along with an analysis of how these are changing. Specifically, the use of bibliometric data to assess research output and its impact on a multi-disciplinary subject such as ergonomics is examined. Areas where action may be required to stimulate better research and improved practice are proposed. These include a greater role for the practitioner in completing the circle of knowledge and improving the evidence base for practice with, in particular, practitioners becoming more active in determining research priorities. It is concluded that combined effort is needed by researcher and practitioner communities to enable and promote a more effective understanding of the true impact of ergonomics across industry and society. **Statement of Relevance:**The relationship between ergonomics research and practice is examined. Research 'drivers' are identified, including the influence of bibliometric data. Implications for researchers and practitioners are discussed. The role of practitioners in completing the circle of knowledge and improving the ergonomics evidence base is stressed, as is the need to promote the impact of ergonomics across society.

- **Keywords:** ergonomics impact; ergonomics practice; ergonomics research

Jan Dul; Canan Ceylan. *Work environments for employee creativity.* Pages 12 – 20.

Innovative organisations need creative employees who generate new ideas for product or process innovation. This paper presents a conceptual framework for the effect of personal, social-organisational and physical factors on employee creativity. Based on this framework, an instrument to analyse the extent to which the work environment enhances creativity is developed. This instrument was applied to a sample of 409 employees and support was found for the hypothesis that a creative work environment enhances creative performance. This paper illustrates how the instrument can be used in companies to select and implement improvements. **Statement of Relevance:**The

ergonomics discipline addresses the work environment mainly for improving health and safety and sometimes productivity and quality. This paper opens a new area for ergonomics: designing work environments for enhancing employee creativity in order to strengthen an organisation's capability for product and process innovation and, consequently, its competitiveness.

- **Keywords:** creativity; innovation; work environment; management

Iain T. Darker; David Gerret; Ruth Filik; Kevin J. Purdy; Alastair G. Gale. *The influence of 'Tall Man' lettering on errors of visual perception in the recognition of written drug names. Pages 21 – 33.*

Visual errors in the perception of written drug names can reflect orthographic similarity amongst certain names. Drug names are typically printed in lowercase text. 'Tall Man' lettering, the capitalisation of the portions that differ amongst orthographically similar drug names, is employed in the field of medication labelling and prescribing to reduce medication errors by highlighting the area most likely to prevent confusion. The influence of textual format on visual drug name perception was tested amongst healthcare professionals ($n = 133$) using the Reicher-Wheeler task. Relative to lowercase text, Tall Man lettering improved accuracy in drug name perception. However, an equivalent improvement in accuracy was obtained using entirely uppercase text. Thus, character size may be a key determinant of perceptual accuracy for Tall Man lettering. Specific considerations for the manner in which Tall Man lettering might be best formatted and implemented in practice to reduce medication errors are discussed. **Statement of Relevance:**Tall Man lettering aims to prevent medication errors by reducing visual confusions amongst orthographically similar drug names. It was found that, compared to lowercase text, Tall Man lettering improved accuracy in drug name perception. Character size appeared to be a key determinant of perceptual accuracy for Tall Man lettering.

- **Keywords:** drug name; medication error; reading; Tall Man lettering; visual perception

Sandra Sülzenbrück; Herbert Heuer. *Type of visual feedback during practice influences the precision of the acquired internal model of a complex visuo-motor transformation. Pages 34 – 46.*

This study investigated the influence of the type of visual feedback during practice with a complex visuo-motor transformation of a sliding two-sided lever on the acquisition of an internal model of the transformation. Three groups of participants, who practised with different types of visual feedback, were compared with regard to movement accuracy, curvature and movement time. One group had continuous visual feedback during practice and two groups were presented terminal visual feedback, either only the end position of the movement or the end position together with the trajectory of the cursor. Results showed that continuous visual feedback led to more precise movement end positions during practice than terminal visual feedback, but to less precise movements during open-loop tests. This finding indicates that terminal visual feedback supports the development of a precise internal model of a new visuo-motor transformation. However, even terminal feedback of the cursor trajectory during practice did not result in an internal model, which includes appropriate curvatures of hand movements. **Statement of Relevance:**This paper presents results on the influence of type of visual feedback on learning the complex motor skill of controlling a sliding lever. These findings contribute to the conceptual basis of optimised training procedures for the acquisition of sensori-motor skills required for the mastery of instruments utilised in minimally invasive surgery.

- **Keywords:** motor learning; tool use; visual feedback; visuo-motor transformation

Suzanne G. Hoffman; Matthew P. Reed; Don B. Chaffin. *A study of the difference between nominal and actual hand forces in two-handed sagittal plane whole-body exertions.* Pages 47 – 59.

Given a task posture, changes in hand force magnitude and direction with regard to joint locations result in variations in joint loads. Previous work has quantified considerable vertical force components during push/pull exertions. The objective of this work was to quantify and statistically model actual hand forces in two-hand, standing exertions relative to the required nominal horizontal and vertical hand forces for a population of widely varying stature and strength. A total of 19 participants exerted force on a fixed handle while receiving visual feedback on the magnitude of force exerted in the required horizontal or vertical direction. A set of regression equations with adjusted R^2 values ranging from 0.20 to 0.66 were developed to define actual hand force vectors by predicting off-axis forces from the required hand force magnitude. Off-axis forces significantly increase the overall magnitude of force exerted in two-hand push/pull and up/down standing force exertions. **Statement of Relevance:** This study quantifies and statistically models actual hand forces in two-hand, standing exertions. Inaccuracies in hand force estimates affect the ability to accurately assess task-oriented strength capability. Knowledge of the relationship between nominal and actual hand forces can be used to improve existing ergonomic analysis tools, including biomechanical simulations of manual tasks.

- **Keywords:** force direction; hand force; lifting; push/pull; standing exertions

Sunwook Kim; Maury A. Nussbaum; Bochen Jia. *Low back injury risks during construction with prefabricated (panelised) walls : effects of task and design factors.* Pages 60 – 71.

New technology designed to increase productivity in residential construction may exacerbate the risk of work-related musculoskeletal disorders (WMSDs) among residential construction workers. Of interest here are panelised (prefabricated) wall systems (or panels) and facilitating an ongoing effort to provide proactive control of ergonomic exposures and risks among workers using panels. This study, which included 24 participants, estimated WMSD risks using five methods during common panel erection tasks and the influences of panel mass (sheathed vs. unsheathed) and size (wall length). WMSD risks were fairly high overall; e.g. 34% and 77% of trials exceeded the 'action limits' for spinal compressive and shear forces, respectively. Heavier (sheathed) panels significantly increased risks, although the magnitude of this effect differed with panel size and between tasks. Higher levels of risk were found in tasks originating from ground vs. knuckle height. Several practical recommendations based on the results are discussed. **Statement of Relevance:** Panelised wall systems have the potential to increase productivity in residential construction, but may result in increased worker injury risks. Results from this study can be used to generate future panel design and construction processes that can proactively address WMSD risks.

- **Keywords:** ergonomics; prevention through design; residential construction; risk assessment

Gert S. Faber; Idsart Kingma; Jaap H. van Dieën. *Effect of initial horizontal object position on peak L5/S1 moments in manual lifting is dependent on task type and familiarity with alternative lifting strategies.* Pages 72 – 81.

This study investigated whether the effects of initial horizontal object position on peak L5/S1 total moment (PTM) are affected by task type or familiarity with alternative lifting strategies during manual lifting. Nine subjects lifted low-lying boxes from far and close

initial horizontal positions in a typical laboratory lifting task (without any transportation of the load) and in a more realistic lifting task in which the box was transported to a location at a few metres distance. Subsequently, subjects were familiarised with alternative lifting strategies (e.g. shifting and tilting) and they then repeated the more realistic lifting task. Compared with the typical laboratory lifting task, the more realistic lifting task resulted in 6% larger PTMs for the close-positioned box. Familiarisation with alternative lifting techniques resulted in a 10% reduction in PTMs for the far-positioned box. As a result, the effect of initial horizontal box position on PTMs was smaller for the more realistic lifting task than for the typical laboratory lifting task and vanished after familiarisation with alternative lifting strategies. **Statement of Relevance:** This study showed that the effect of horizontal box position on peak L5/S1 moments is dependent on the type of lifting task (comparing a typical laboratory simulated lifting task with a more realistic task involving carrying the load for a short distance) and familiarity with alternative lifting strategies. Therefore, it is recommended that back loading should be evaluated in a realistic simulation of the work situation or at the workplace itself.

- **Keywords:** ergonomics; lifting strategy; low back loading; manual materials handling; spine biomechanics

Kieran O'Sullivan; Luciana Galeotti; Wim Dankaerts; Leonard O'Sullivan; Peter O'Sullivan. *The between-day and inter-rater reliability of a novel wireless system to analyse lumbar spine posture. Pages 82 – 90.*

Lumbar posture is commonly assessed in non-specific chronic low back pain (NSCLBP), although quantitative measures have mostly been limited to laboratory environments. The BodyGuard™ is a spinal position monitoring device that can monitor posture in real time, both inside and outside the laboratory. The reliability of this wireless device was examined in 18 healthy participants during usual sitting and forward bending, two tasks that are commonly provocative in NSCLBP. Reliability was determined using intraclass correlation coefficients (ICC), the standard error of measurement (SEM), the mean difference and the minimal detectable change (MDC90). Between-day ICC values ranged from 0.84 to 0.87, with small SEM (5%), mean difference (<9%) and MDC90 (<14%) values. Inter-rater ICC values ranged from 0.91 to 0.94, with small SEM (4%), mean difference (6%) and MDC90 (9%) values. Between-day and inter-rater reliability are essential requirements for clinical utility and were excellent in this study. Further studies into the validity of this device and its application in clinical trials in occupational settings are required. **Statement of Relevance:** A novel device that can analyse spinal posture exposure in occupational settings in a minimally invasive manner has been developed. This study established that the device has excellent between-day and inter-rater reliability in healthy pain-free subjects. Further studies in people with low back pain are planned.

- **Keywords:** back pain; posture; reliability

Sean Gallagher; Jonisha Pollard; William L. Porter. *Electromyography of the thigh muscles during lifting tasks in kneeling and squatting postures. Pages 91 – 102.*

Underground coal miners who work in low-seam mines frequently handle materials in kneeling or squatting postures. To assess quadriceps and hamstring muscle demands in these postures, nine participants performed lateral load transfers in kneeling and squatting postures, during which electromyographic (EMG) data were collected. EMG activity was obtained at five points throughout the transfer for three quadriceps muscles and two hamstring muscles from each thigh. ANOVA results indicated that EMG data for nine of 10 thigh muscles were affected by an interaction between posture and angular

position of the load lifted ($p < 0.001$). Muscles of the right thigh were most active during the lifting portion of the task (lifting a block from the participant's right) and activity decreased as the block was transferred to the left. Left thigh muscles showed the opposite pattern. EMG activity for the majority of thigh muscles was affected by the size of the base of support provided by different postures, with lower EMG activity observed with a larger base of support and increased activity in postures where base of support was reduced ($p < 0.05$). Thigh EMG activity was lowest in postures with fully flexed knees, which may explain worker preference for this posture. However, such postures are also associated with increased risk of meniscal damage. **Statement of Relevance:** Kneeling and squatting postures are sometimes used for manual lifting activities, but are associated with increased knee injury risk. This paper examines the EMG responses of knee extensors/flexors to lifting in these postures, discusses the impact of posture and kneepads on muscle recruitment and explores the implications for work in such postures.

- **Keywords:** electromyography; knee disorders; kneeling; manual material handling; posture; squatting