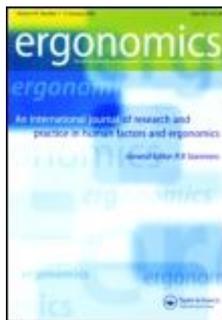


Ergonomics– rok 2008, ročník 51

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Číslo 2 – Special Issue: The Future of Ergonomics?

A. N. Rimell; N. J. Mansfield; D. Hands. *The influence of content, task and sensory interaction on multimedia quality perception*. S. 85 – 97.

Human sensory interaction plays an important (but not yet fully understood) role in determining how individuals interact with the world around them. There are numerous types of sensory interaction and this paper examines the interaction of the auditory and visual senses for viewers of multimedia systems. This paper addresses two questions: first, does perception of quality in one modality affect the perception of quality in the other modality and, second, does focusing attention towards one modality affect the viewer's ability to detect errors in the other modality? The perception of audio quality and video quality are closely linked for certain multimedia content. To investigate this relationship, two experiments were conducted where participants were presented with multimedia content where varying distortion had been introduced into both the auditory and visual streams. Participants were asked to state their opinion of the audio, video or overall quality using a standardized scale. Results and subsequent statistical analysis showed that subjective audio quality varied with the video quality and vice versa. Furthermore, when a participant was attending to just one modality, they were less sensitive to reduced quality in the other modality.

- **Keywords:** Visual perception; Auditory perception; Multimodal perception; Multimedia system design

L. Lindbeck; U. Höglund. *Ergonomics evaluation of picture archiving and communication system implementations in two X-ray departments*. S. 98 – 124.

Two large X-ray departments in the County of Stockholm have changed from traditional analogue technology to digital imaging, including the implementation of Picture Archiving and Communication Systems (PACS). One of the departments was moved to a completely new purpose-built building and equipped with the latest technology, but for the other one the change merely meant rebuilding and adaptation of existing rooms on the premises. The objectives of the present study were to evaluate the ergonomics effects of the new technique in the two X-ray departments and to find out whether the implementation of digital imaging technique came up to expectations of improved ergonomics and work environment. Another purpose was to compare the outcomes for the two departments, in order to learn about the importance of the different implementation approaches. Questionnaires were sent out to the two departments both before the implementation of PACS and after the transition. The questionnaires covered several aspects of work conditions, such as working time, the physical and psychosocial environment, physical work load and musculoskeletal complaints, expectations from the digital technology, etc. The changeover went better than expected and even high expectations were fulfilled and surpassed. However, there were also some unexpected and distressing results; for example, a substantial increase in headaches and musculoskeletal symptoms as well as the use of pain killers among the radiologists of one of the X-ray departments.

- **Keywords:** X-ray; Digital imaging; Workplace changes; Ergonomics

S. Tuomivaara; R. Ketola; P. Huuhtanen; R. Toivonen. *Perceived competence in computer use as a moderator of musculoskeletal strain in VDU work : an ergonomics intervention case*. S. 125 – 139.

Musculoskeletal strain and other symptoms are common in visual display unit (VDU) work. Psychosocial factors are closely related to the outcome and experience of

musculoskeletal strain. The user - computer relationship from the viewpoint of the quality of perceived competence in computer use was assessed as a psychosocial stress indicator. It was assumed that the perceived competence in computer use moderates the experience of musculoskeletal strain and the success of the ergonomics intervention. The participants (n = 124, female 58%, male 42%) worked with VDU for more than 4 h per week. They took part in an ergonomics intervention and were allocated into three groups: intensive; education; and reference group. Musculoskeletal strain, the level of ergonomics of the workstation assessed by the experts in ergonomics and amount of VDU work were estimated at the baseline and at the 10-month follow-up. Age, gender and the perceived competence in computer use were assessed at the baseline. The perceived competence in computer use predicted strain in the upper and the lower part of the body at the follow-up. The interaction effect shows that the intensive ergonomics intervention procedure was the most effective among participants with high perceived competence. The interpretation of the results was that an anxiety-provoking and stressful user - computer relationship prevented the participants from being motivated and from learning in the ergonomics intervention. In the intervention it is important to increase the computer competence along with the improvements of physical workstation and work organization.

- **Keywords:** Psychosocial factors; Musculoskeletal symptoms; VDU work; Ergonomics intervention; Perceived competence; Moderation effect

Heleen De Kraker; Elsbeth M. De Korte; Ferry L. K. Van Mil; Bartjan P. Rijs; Paulien M. Bongers. *The effect of a feedback signal in a computer mouse on hovering behaviour, productivity, comfort and usability in a field study.* S. 140 – 155.

The aim of this study was to determine the effect of a tactile feedback signal on hovering behaviour, productivity, usability and comfort after 1 week of using an experimental mouse. In a randomized controlled trial, a regular computer mouse was compared to a new developed mouse with a tactile, vibrating feedback signal to prevent unnecessary hovering above the computer mouse. According to this study, participants do decrease their hovering behaviour when using a mouse with tactile feedback. Furthermore, the mouse with tactile feedback did not influence productivity. Usability was rated somewhat mixed. The use of a mouse with a tactile vibrating feedback signal seems promising for preventing neck, shoulder and arm complaints. Further research is needed to study long-term effects on (prevention of) neck, shoulder and arm complaints and development of learning effects.

- **Keywords:** Prevention of work related upper limb symptoms; Productivity; Feedback; Behaviour; Computer mouse

C. B. Irwin; R. G. Radwin. *A new method for estimating hand internal loads from external force measurements.* S. 156 – 167

This study examines using force vectors measured using a directional strain gauge grip dynamometer for estimating finger flexor tendon tension. Fifty-three right-handed participants (25 males and 28 females) grasped varying-sized instrumented cylinders (2.54, 3.81, 5.08, 6.35 and 7.62 cm diameter) using a maximal voluntary power grip. The grip force vector magnitude and direction, referenced to the third metacarpal, was resolved by taking two orthogonal grip force measurements. A simple biomechanical model incorporating the flexor tendons was used to estimate long finger tendon tension during power grip. The flexor digitorum superficialis and the flexor digitorum profundus were assumed to create a moment about the metacarpal phalange (MCP) joint that equals and counteracts a moment around the MCP joint measured externally by the dynamometer. The model revealed that tendon tension increased by 130% from the smallest size handle to the largest, even though grip force magnitude decreased 36% for

the same handles. The study demonstrates that grip force vectors may be useful for estimating internal hand forces.

- **Keywords:** Upper extremity biomechanical model; Hand force; Grip force

P. Lemerle; A. Klinger; A. Cristalli; M. Geuder. *Application of pressure mapping techniques to measure push and gripping forces with precision.* S. 168 – 191.

Gripping and push forces, also named coupling forces, have induced effects on the transmission of the vibration in the upper limb. The assessment of the vibration exposure with powered tools thus requires that these man/machine coupling parameters are controlled and monitored. To date, no reliable metrological systems enable their precise measurements. This study first investigated how much precision could be expected from the pressure mapping technique for the determination of coupling forces by means of numerical integration. Then a specific procedure was worked out and validated to instrument hand-held tools and measure the coupling forces with regard to the appropriate current standards. The proposed method was applied as a case study on an ordinary breaker and an anti-vibration breaker.

- **Keywords:** Pressure distribution; Coupling force; Grip; Push; Friction; Handle; Vibration

Olanrewaju O. Okunribido; Christine M. Haslegrave. *Ready steady push : a study of the role of arm posture in manual exertions.* S. 192 – 216.

This study investigated arm posture and hand forces during bi-manual pushing. Nine male and eight female participants performed isometric exertions at two reach distances (0 and elbow-grip) and six different positions of the hand interface (handle), defined by the plane (longitudinal, lateral, horizontal) and orientation (0° and 45°). Electrogoniometer instruments were used to measure the displacements/postures of the wrist and elbow joints and the forearm, and force measuring strain gauges were used to measure the exerted hand forces (x-, y- and z-components). The results showed that ability to vary arm posture, particularly the forearm, is important during build up of force and that people tend to seek for a balance in the forces applied at the hands by exerting more in the vertical direction. Also, lateral plane handle positions permitted exertion of greater forces than longitudinal and horizontal plane positions.

- **Keywords:** Biomechanics; Bi-manual; Pushing; Arm posture; Force; Handle position

H. W. Mackie; S. J. Legg. *Postural and subjective responses to realistic schoolbag carriage.* S. 217 – 231.

The objective of this study was to determine school student's postural and self-reported responses to realistic daily schoolbag carriage and to provide support for an upper schoolbag weight limit. Sixteen boys carried unloaded, 5%, 10%, 12.5% and 15% of body weight (BW) schoolbag loads, each for a simulated school day. The 10% BW condition was repeated with tightened shoulder straps. Participants' posture was quantified and a questionnaire asked them about a number of areas relating to the physical strain caused by each schoolbag. Posture, rating of perceived exertion (RPE) and muscular strain and ability to walk and balance were significantly affected when student's schoolbag load reached 10% BW. It is suggested that 15% BW may be excessive, which supports a schoolbag weight limit of 10% BW for a typical school day. Posture, RPE and

muscular strain and ability to walk and balance were not significantly affected by the duration of carriage or by shoulder strap tightness.

- **Keywords:** Schoolbag; Posture; Subjective; Weight; Simulated

Bertil Jonsson; Hans Stenlund; Mats Y. Svensson; Ulf Björnstig. *Seat adjustment - capacity and repeatability among occupants in a modern car.* S. 232 – 241.

Families in the Western world have a car and several family members share the same car. In this study, 154 participants have adjusted a driver's seat three times. The primary objective was to study intrapersonal repeatability and intraclass correlation (ICC) on seat; length adjustment, backrest angle, seat front edge and seat rear edge adjustment, related to participant age, sex, stature and weight. Length adjustment has the best intrapersonal repeatability within two repetitions, 49 mm and ICC-value 0.87. Females and younger participants (age <40 years) adjust seats generally more accurately. Females adjust the seat 41 mm more forward, 120 mm compared to men 79 mm counted from 0-starting position. Females sit with more upright seat backrests, 46° compared to 43° for males counted from 0-starting position. Females sit higher than males in both the frontal and rear part of the seat cushion.

- **Keywords:** Car; Seat; Adjustment; Sex; Age; Length