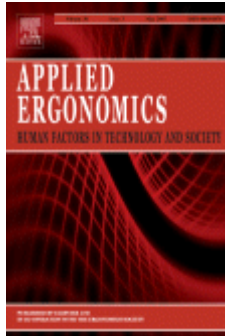


Applied Ergonomics - rok 2007, ročník 38

Číslo 1 (January 2007)



Vincent M. Ciriello. The effects of container size, frequency and extended horizontal reach on maximum acceptable weights of lifting for female industrial workers. Pages 1-5.

In the development of our present manual materials handling (MMH) guidelines (Snook, S.H., Ciriello, V.M., 1991. The design of manual tasks: revised tables of maximum acceptable weights and forces. *Ergonomics* 34, 1197–1213), the assumption was made that the effects of frequency on maximum acceptable weights (MAWs) of lifting with a large box (hand distance, 38 cm from chest) were similar to that of lifting with a small box (hand distance, 17 cm from chest). The first purpose of the present experiment was to investigate this assumption with female industrial workers. The second purpose was to study the effects of extended horizontal reach lifting (hand distance, 44.6 cm from chest) on MAWs as a confirmation of the results of a previous studies on this variable with males (Ciriello, V.M., Snook, S.H., Hughes, G.J., 1993. Further studies of psychophysically determined maximum acceptable weights and forces. *Hum. Factors* 35(1), 175–186; Ciriello, V.M., 2003. The effects of box size, frequency, and extended horizontal reach on maximum acceptable weights of lifting. *Int. J. Ind. Ergon.* 32, 115–120). Lastly, we studied the effects of high frequency (20 lifts/min) on MAWs of lifting. Ten female industrial workers performed 15 variations of lifting using our psychophysical methodology whereby the subjects were asked to select a workload they could sustain for 8 h without “straining themselves or without becoming unusually tired weakened, overheated or out of breath”. The results confirmed that MAWs of lifting with the large box was significantly effected by frequency. The frequency factor pattern in this study was similar to the frequency pattern from a previous study using the small box (Ciriello, V.M., Snook, S.H., 1983. A study of size distance height, and frequency effects on manual handling tasks. *Hum. Factors* 25(5), 473–483) for all fast frequencies down to one lift every 2 min with deviations of 7%, 15%, and 13% for the one lift every 5 and 30 min tasks and the one lift in 8 h task, respectively. The effects of lifting with an extended horizontal reach decreased MAW 22% and 18% for the mid and center lift and the effects of the 20 lifts/min frequency resulted in a MAW that was 47% of a 1 lift/min MAW. Incorporating these results in future guidelines should improve the design of MMH tasks for female workers.

Sue Hignett and Emma Crumpton. Competency-based training for patient handling. Pages 7-17.

A technique-training approach has traditionally been used to address the problem of back pain associated with patient handling. This project aimed to investigate whether different levels of safety culture, based on competency-based training, resulted in different behaviour (physical and cognitive) for patient handling tasks. Sixteen healthcare organisations in the UK participated from the acute and primary healthcare sectors. Archival data for each organisation were benchmarked against the Royal College of Nursing competencies for manual handling. Behavioural data were collected on two patient handling tasks: (1) sitting-to-standing and (2) repositioning-in-sitting using observations (postural analysis) and interviews (verbal protocol analysis). The data were analysed for each organisation and then grouped by task and method into larger data sets. These data sets were triangulated using the key decision-making points (from the interview data) as the framework. The results showed that in organisations with a more positive safety culture the nursing staff demonstrated more complex decision-making about the patient handling tasks and had lower levels of associated postural risk.

Charlene A. Yauch. *Team-based work and work system balance in the context of agile manufacturing*. Pages 19-27.

Manufacturing agility is the ability to prosper in an environment characterized by constant and unpredictable change. The purpose of this paper is to analyze team attributes necessary to facilitate agile manufacturing, and using Balance Theory as a framework, it evaluates the potential positive and negative impacts related to these team attributes that could alter the balance of work system elements and resulting "stress load" experienced by persons working on agile teams. Teams operating within the context of agile manufacturing are characterized as multifunctional, dynamic, cooperative, and virtual. A review of the literature relevant to each of these attributes is provided, as well as suggestions for future research.

City bus driving and low back pain: A study of the exposures to posture demands, manual materials handling and whole-body vibration • ARTICLE
Pages 29-38

Olanrewaju O. Okunribido, Steven J. Shimbles, Marianne Magnusson and Malcolm Pope

A cross-sectional study was conducted to investigate worker exposure to posture demands, manual materials handling (MMH) and whole body vibration as risks for low back pain (LBP). Using validated questionnaire, information about driving experience, driving (sitting) posture MMH, and health history was obtained from 80 city bus drivers. Twelve drivers were observed during their service route driving (at least one complete round trip) and vibration measurements were obtained at the seat and according to the recommendations of ISO 2631 (1997), for three models of bus (a mini-bus, a single-decker bus, a double-decker bus). The results showed that city bus drivers spend about 60% of the daily work time actually driving, often with the torso straight or unsupported, perform occasional and light MMH, and experience discomforting shock/jerking vibration events. Transient and mild LBP (not likely to interfere with work or customary levels of activity) was found to be prevalent among the drivers and a need for ergonomic evaluation of the drivers' seat was suggested.

Henri Juslén, Marius Wouters and Ariadne Tenner. *The influence of controllable task-lighting on productivity : a field study in a factory*. Pages 39-44.

This study examines whether or not a controllable task-lighting system that allows people to select high lighting levels will enhance productivity under real working conditions. For a period of 16 months a study was carried out in a luminaire factory in Finland in which

such a task-lighting system was installed above 10 individual workstations. The illuminances selected by the users were recorded and productivity was monitored. Enhancing productivity can be relevant in industrial processes. The increase of productivity for the test group was +4.5% compared to a reference group, and statistically significant. The mechanism for this increase can be improved visual performance, biological effects of light, or psychological effects. Different dimming speeds were used to see whether the subjects' choices were based on illuminance or on the response of the control system. Decreasing the dimming speed of the system decreased the illuminance chosen by 13%. However, at slower dimming speeds the subjects took 55% longer to reach a given level, which suggests that they were aiming to set the lighting to their preferred level and not just pushing the button for a certain time.

Ingvar Holmér and Désirée Gavhed. *Classification of metabolic and respiratory demands in fire fighting activity with extreme workloads.* Pages 45-52.

Fire fighting work comprises work tasks requiring an energy yield at maximal or close to maximal levels of the individual. Due to the very nature of fire fighting more complex physiological variables are difficult to measure. We measured metabolic and respiratory responses in 15 male, professional fire fighters during simulated work tasks on a test ground. Work time was on the average 22 min with individual components of work tasks lasting 2–4 min. The mean oxygen consumption for the whole exercise (22 min) was 2.75 ± 0.29 l/min. The most demanding work task demanded an oxygen uptake of 3.55 ± 0.27 l/min. Corresponding values for respiratory minute volumes were 82 ± 14 and 102 ± 14 l/min, respectively. Heart rates averaged 168 ± 12 for the whole test and 179 ± 13 beats/min for the heaviest work task. Two new classes for classification of intensive and exhausting, short term physical work are proposed for inclusion in ISO8996 and values for relevant parameters are proposed.

Kyungmee Choi and Changrim Jun. *A systematic approach to the Kansei factors of tactile sense regarding the surface roughness.* Pages 53-63.

Designing products to satisfy customers' emotion requires the information gathered through the human senses, which are visual, auditory, olfactory, gustatory, or tactile senses. By controlling certain design factors, customers' emotion can be evaluated, designed, and satisfied. In this study, a systematic approach is proposed to study the tactile sense regarding the surface roughness. Numerous pairs of antonymous tactile adjectives are collected and clustered. The optimal number of adjective clusters is estimated based on the several criterion functions. The representative average preferences of the final clusters are obtained as the estimates of engineering parameters to control the surface roughness of the commercial polymer-based products.

Hong-In Cheng and Patrick E. Patterson. *Iconic hyperlinks on e-commerce websites.* Pages 65-69.

The proper use of iconic interfaces reduces system complexity and helps users interact with systems more easily. However, due to carelessness, inadequate research, and the web's relatively short history, the icons used on web sites often are ambiguous. Because non-identifiable icons may convey meanings other than those intended, designers must consider whether icons are easily identifiable when creating web sites. In this study, visual icons used on e-business web sites were examined by population stereotypy and categorized into three groups: identifiable, medium, and vague. Representative icons from each group were tested by comparing selection performance in groups of student

volunteers, with identifiable and medium icons improving performance. We found that only easily identifiable icons can reduce complexity and increase system usability.

Steven A. Lavender, Karen M. Conrad, Paul A. Reichelt, Jessica Gacki-Smith and Aniruddha K. Kohok. *Designing ergonomic interventions for EMS workers : part I : transporting patients down the stairs. Pages 71-81.*

The objective of the current work was to test ergonomic interventions aimed at reducing the magnitude of trunk muscle exertions in firefighters/paramedics (FFPs) providing emergency medical services (EMS) when transporting patients down the stairs. The interventions, developed using focus groups, were a footstrap to prevent the patient from sliding down on the backboard, a change in the handle configuration on the stairchair, and 2 devices, the "backboard wheeler" and a tank tread-like device (descent control system, DCS) for a stretcher, that change the backboard and stretcher carrying tasks into rolling and sliding tasks. Eleven two-person teams transported a 75 kg dummy with each intervention and its corresponding control condition down a flight of steps. Surface electromyographic (EMG) data were collected from 8 trunk muscles from each participant. Results showed that the backboard footstrap reduced the erector spinae (ERS) activity for the FFP in the "leader" role by 15 percent, on average. The change in handle configuration on the stairchair had no effect on the variables measured. The backboard wheeler reduced the ERS activity bilaterally in the FFP in the leader role and unilaterally for the FFP in the "follower" role, by 28 and 24 percent, respectively. The DCS reduced the 90th percentile ERS activity for both FFPs from 26 to 16 percent MVC, but increased the latissimus dorsi activity in the follower from 11 to 15 percent MVC. The DCS was the only intervention tested that resulted in a reduced rating of perceived exertion relative to the corresponding control condition. In summary, the hypotheses that the proposed interventions could reduce trunk muscle loading were supported for 3 of the 4 transport interventions tested.

Jacques Marsot, Laurent Claudon and Marc Jacqmin. *Assessment of knife sharpness by means of a cutting force measuring system. Pages 83-89.*

Following a brief description of the problem of musculoskeletal disorders (MSDs) in the meat industry and use of knives, this paper presents a study of the influence of the main intrinsic technical characteristics of a knife on its cutting performance. This study prompted design of a specific system for measuring initial cutting capacity and cutting edge retention. This design process preceded research into test conditions (cutting speed, sample nature and thickness, knife inclination angle, etc.) offering optimum test bench operation. This equipment was then used to study the influence of blade inclination angle, steel grade and sharpening angle on cutting performance. It has been shown that cutting force varies with blade inclination. Use of knives with curved blades and/or a blade inclined with respect to the knife handle is therefore preferred in relation to our cutting force reduction objective. It has also been shown that choices are in fact governed by compromises in relation to other parameters (steel grade and edge angle). These observations confirm the need to set up suitable training of knife users to achieve best possible cutting performance.

Steven J. Russell, Lori Winnemuller, Janice E. Camp and Peter W. Johnson. *Comparing the results of five lifting analysis tools. Pages 91-97.*

The objective of this study was to compare the results of the NIOSH, ACGIH TLV, Snook, 3DSSPP and WA L&I lifting assessment instruments when applied to a uniform task (lifting and lowering milk cases with capacities of 15 and 23 l). To enable comparisons between the various lifting assessment instruments, the outputs of each method were converted to an exposure index similar to the NIOSH Lifting Index. All instruments showed higher exposures associated with lifting the 23 l cases versus the 15 l cases. The NIOSH, ACGIH TLV and Snook methods were similar in their results with respect to the pattern of exposure over various height levels and the differences in exposures associated with lifting 15 and 23 l cases. However, the WA L&I and 3DSSPP predicted substantially lower exposures. The reasons for instrument differences are presented so that practitioners can better select the methods they need and interpret the results appropriately.

Gerard P. van Galen, Hanneke Liesker and Ab de Haan. *Effects of a vertical keyboard design on typing performance, user comfort and muscle tension.* Pages 99-107.

To circumvent the awkward pronated hand position inherent to conventional horizontal keyboards, a vertical, split keyboard was designed with flexible cushions supporting the wrists, allowing relaxed hand and arm postures. During eight twice-weekly 30-min training sessions, the performance and subjective comfort of nine experienced typists were tested. Typing speed and error percentage, and surface electromyographic activity of six forearm muscles and two postural muscles were recorded in separate sessions at the end of each week. Typing speed rapidly recovered to the preset rate of 300 keystrokes/min and error percentages were similar for the two keyboards. The vertical keyboard caused lower muscular activity in especially finger extensor muscles, did not increase postural muscle activity, and self-reported comfort was higher. Thus, the vertical keyboard was easily mastered, was experienced as comfortable, and caused less stress on muscles sensitive to repetitive strain injuries.

Dries Dekker, Sonja N. Buzink, Johan F.M. Molenbroek and Renate de Bruin. *Hand supports to assist toilet use among the elderly.* Pages 109-118.

Improving the toilet environment holds promises for increasing the quality of life for elderly and disabled persons. This is one of the goals of the Friendly Rest Room (FRR) project.

The study described in this article explored the preference and use of supports in the toilet environment during the entire toilet ritual.

An adjustable test frame was built with a toilet and three types of supports. Fourteen subjects were asked which positions they favoured for each support. After using all three supports, they were asked which support they found most comfortable.

In general, the preferred positions depended on personal preferences more than on dimensions of the body. It was concluded that there is a preference for vertical supports for sitting down and standing up. During toilet use the side supports were equally appreciated.