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L. -X. Guo; M. Zhang; E. -C. Teo. Influences of denucleation on contact force of facet joints under whole body vibration. S. 967–978.

To investigate the influence of the injured disc, frequency, load and damping on the facet contact forces of the low lumbar spine on the condition of whole body vibration, a detailed 3-D nonlinear finite element model was created based on the actual geometrical data of embalmed vertebrae of lumbar spine. The denucleation and facetectomy, together with removal of the capsular ligaments was employed to mimic the injury conditions of lumbar spine after surgery. The compression cyclic force was assumed to mimic the dynamic loads of transport vehicles. The results show that the high frequency vibration might increase both of the value and the vibration amplitude of facet contact forces of the lumbar spine under whole body vibration. The nucleus removal may increase significantly the facet contact forces. Although damping can decrease the vibration amplitude of facet contact forces for intact models, it has less effect on the vibration amplitude of facet contact force for the denucleated models. The denucleation of intervertebral discs is more harmful to the facet articulation on the condition of whole body vibration.

- **Keywords:** Lumbar spine; Whole body vibration; Finite element dynamic analysis; Facet contact force; Frequency; Damping

H. Heuer; M. Hegele. Learning new visuo-motor gains at early and late working age. S. 979–1003.

Modern workplaces often require adaptation to novel visuo-motor transformations. Findings on age-related variations of such adaptation are rather inconsistent, suggesting that whether or not age-related impairments do occur depends on boundary conditions. This paper examined the hypotheses that age-related variations affect primarily strategic adjustments to novel transformations and can be found for complex (non-linear) transformations, but not for simple (linear) ones. After a practice period with linear and non-linear visuo-motor transformations, open-loop performance, after-effects and explicit knowledge were examined. Consistent with previous findings, older participants had longer movement times and shorter open-loop amplitudes, more so for long than for short target amplitudes. However, the study did not find any age-related variation of adaptation to a novel visuo-motor gain. Regarding adaptation to a non-linear transformation, the findings suggest slightly superior explicit knowledge of younger adults and the development of slightly more efficient closed-loop processes in the course of practice.

- **Keywords:** Adaptation; Ageing; Motor skill; Visuo-motor transformation

C. R. Dickerson; B. J. Martin; D. B. Chaffin. Predictors of perceived effort in the shoulder during load transfer tasks. S. 1004–1016.

The mechanism of muscular effort perception in the shoulder was examined in this experiment. Two shoulder biomechanical models and experimental muscle activity data were used to assess physical exposure for a series of reaching tasks. Effort perception was quantitatively correlated to these measures of physical loading, both at the resultant torque ($r^2 = 0.50$) and muscle activity model-based muscle force predictions (MFPs): $r^2 = 0.42$, electromyography (EMG): $r^2 = 0.26$) levels. Muscle data did not explain variation in effort perception more fully than torque data. The inclusion of subject and task variables improved the ability of each model to explain variability in effort perception (torque: $r^2 = 0.74$; MFP: $r^2 = 0.67$, EMG: $r^2 = 0.64$). These results suggest that effort perception may not be fully explained by only an image of the motor command, but is rather a complex integrative quantity that is affected by other factors, such as posture and task goals, which may be dependent on sensory feedback.

- **Keywords:** Muscle activation; Effort perception; Biomechanical modelling; Shoulder; Load transfer tasks

K. Kindblom-Rising; R. Wahlström; S. -L. Ekman. Nursing staff's perception of changes in patient transfer habits after a course - a phenomenological-hermeneutic study. S. 1017–1025.

The objective of the study was to illuminate nursing staff's perception of changes after a course in patient transfer. The learning process took the form of self-experience focusing on the manner of supporting the patient to move independently. A total of 20 participants, who had answered a previously administered questionnaire, were chosen for interviews. The themes concerned the meaning of changing transfer habits. A phenomenological-hermeneutic analysis method showed that changes focused on the patient's body, the staff member's own body or cooperation with the patient. Awareness of one's own body and confidence in one's own ability seem to indicate differences in the manner of supporting the patient to move. The changes in transfer habits varied in content and meaning from person to person, depending on the focus during the transfer. These findings can contribute to an understanding of how change takes place after an educational intervention.

- **Keywords:** Movement awareness; Communication; Change; Patient transfer; Intervention

C. Iani; D. Gopher; A. J. Grunwald; P. Lavie. Peripheral arterial tone as an on-line measure of load in a simulated flight task. S. 1026–1035.

Variations in continuous and discrete flight demands were investigated in a simulated flight mission measuring peripheral arterial tone (PAT) from the tip of the finger. A total of 12 participants performed a computer-simulated agricultural flight task. They were required to fly over a specific lane of a simulated corn field (continuous task) and change lanes in response to flags, which appeared at varying intervals (discrete task). The difficulty of the flight task was manipulated by varying the airplane control (single- vs. dual-axis control), while the difficulty of the discrete task was manipulated by varying the amount of lateral change signalled by the flag. PAT amplitude was lower in the difficult level of the continuous task and was further attenuated following the appearance of the flag only when a change in the flight position was required. These results suggest the potential utility of PAT as an on-line measure of the joint continuous and discrete demands of a flight mission.

- **Keywords:** Peripheral arterial tone; Continuous load; Discrete load; Simulated flight

A. Buchner; N. Baumgartner. Text - background polarity affects performance irrespective of ambient illumination and colour kontrast. S. 1036–1063.

In a series of experiments, proofreading performance was consistently better with positive polarity (dark text on light background) than with negative polarity displays (light text on dark background). This positive polarity advantage was independent of ambient lighting (darkness vs. typical office illumination) and of chromaticity (black and white vs. blue and yellow). A final experiment showed that colour contrast (red text on green background) could not compensate for a lack of luminance contrast. Physiological measures of effort and strain (breathing rate, heart rate, heart rate variability and skin conductance level) and self-reported mood, fatigue, arousal, eyestrain, headache, muscle strain and back pain did not vary as a function of any of the independent variables, suggesting that participants worked equally hard in all experimental conditions, so that the interpretation of the primary performance measure was unlikely to be contaminated by a performance-effort trade-off.

- **Keywords:** Display polarity; Ambient illumination; Luminance contrast; Colour contrast; Visual displays; Reading

K. S. O'Brien; D. O'Hare. Situational awareness ability and cognitive skills training in a complex real-world task. S. 1064–1091.

Successful performance in complex dynamic environments depends on domain-dependent factors, such as situational awareness (SA). Underlying SA in a domain are domain-independent cognitive abilities in perception, memory, attention and executive control. Individuals with lower underlying ability perform relatively poorly in complex dynamic real-world tasks. The first experiment examined whether cognitive skills training could overcome limitations in underlying SA ability that impact on complex dynamic task performance. Participants were taught a mix of cognitive management strategies (e.g. divided and focused attention and visual search) in a simulated air traffic control task. A second experiment investigated the link between underlying SA ability, TRACON and SAGAT, a widely used measure of domain-specific SA. In a third experiment, the focus was on encouraging participants to plan ahead and consider the interrelations of elements (aircraft) in the environment. Whilst both training methods ameliorated the negative impact that lower SA ability had on complex dynamic task performance, the results of the third study indicated that this may have been achieved through improved planning behaviour. Finally, participants with higher underlying SA ability performed well irrespective of training condition.

- **Keywords:** *Keywords*; Situational awareness; Cognitive skills; Planning; Training

A. C. Laing; D. C. Cole; N. Theberge; R. P. Wells; M. S. Kerr; M. B. Frazer. Effectiveness of a participatory ergonomics intervention in improving communication and psychosocial exposures. S. 1092–1109.

A participatory ergonomics programme was implemented in an automotive parts manufacturing factory in which an ergonomics change team was formed, composed of members from management, the organized labour union and the research team. It was hypothesized that the participatory nature of this change process would result in enhanced worker perceptions of workplace communication dynamics, decision latitude and influence, which in conjunction with anticipated mechanical exposure reductions would lead to reduced worker pain severity. Utilizing a sister plant in the corporation as a referent group, a quasi-experimental design was employed with a longitudinal, repeat questionnaire approach to document pre-post intervention changes. Nine participatory

activities (psychosocial interventions) were implemented as part of the process. Communication dynamics regarding ergonomics were significantly enhanced at the intervention plant compared to the referent plant. However, there were no significantly different changes in worker perceptions of decision latitude or influence between the two plants, nor did pain severity change. Possible explanations for these results include limited intervention intensity, context and co-intervention differences between the two plants, high plant turnover reducing the statistical power of the study and lack of sensitivity and specificity in the psychosocial measures used. Further research should include the development of psychosocial tools more specific to participatory ergonomic interventions and the assessment of the extent of change in psychosocial factors that might be associated with improvements in pain.

- **Keywords:** Participatory; Intervention; Communication; Psychosocial risk factors; Musculoskeletal disorders

Yassierli; M. A. Nussbaum. Muscle fatigue during intermittent isokinetic shoulder abduction: Age effects and utility of electromyographic measures. S. 1110–1126.

Most existing evidence regarding the effects of age on muscular fatigue has focused on prolonged isometric contractions, repeated maximum dynamic contractions and individuals beyond traditional retirement age (>65 years). In the present study, age-related differences in muscle fatigue during submaximal dynamic efforts were examined. There were 24 younger (18-25 years) and 24 older (55-65 years) participants, all of whom were healthy and active, with equal numbers of each gender within each age group. Participants performed repetitive, intermittent shoulder abductions until exhaustion, at peak moments of 30% and 40% of individual maximum voluntary isokinetic contraction (MVIC) and with cycle durations of 20 and 40 s. Fatigue development was determined based on changes in MVIC, electromyographic (EMG) signals and ratings of perceived discomfort (RPD). Following the exhaustive exercises, strength recovery was monitored using a series of MVICs over a 15-min period. Results indicated the existence of an age-related fatigue resistance, with the older group demonstrating significantly slower rates of MVIC decline and RPD increase and smaller modifications in EMG-based fatigue measures. These age effects were generally more pronounced at the higher effort level. Main effects of effort level and cycle duration were also significant, while gender effects appeared to be marginal. Rates of strength recovery were not significantly influenced by age. In addition, the utility of standard EMG-based fatigue measures was assessed. Findings indicated that time-dependent changes in static and dynamic EMG-based measures were roughly comparable in terms of sensitivity and variability, supporting the use of standard EMG analyses for fatigue monitoring during intermittent dynamic contractions.

- **Keywords:** Ageing; Muscle fatigue; Shoulder; Intermittent exercise; Electromyography; Isokinetic strength

E. A. Bustamante; J. P. Bliss; B. L. Anderson. Effects of varying the threshold of alarm systems and workload on human performance. S. 1127–1147.

The purpose of this research was to investigate the effects of varying the threshold of alarm systems and workload on human response to alarm signals and performance on a complex task. A receiver operating characteristic (ROC) curve was selected to reflect the sensitivity of the alarm system. The threshold of the alarm system was manipulated by changing the value of beta along the ROC curve. A total of 84 students participated in experiment 1 and 48 students participated in experiment 2. Participants performed a compensatory-tracking, a resource management and a monitoring task. As expected, results showed that participants responded significantly faster to true alarm signals when they were using the system with the highest threshold under low-workload conditions.

Results also indicated that changing the threshold of the alarm system had a significant effect on overall performance and this effect was greater under high-workload conditions. However, contrary to expectations, the highest level of performance was achieved by setting the threshold at a low level. Results from both experiments revealed that the advantage of faster alarm reaction time as a result of increasing the system's threshold was lost because of its increased probability of missed events.

- **Keyword:** False-Alarm-Prone and Miss-Prone Automation