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Rodrigo Rico Bini, Daniel Wundersitz & Michael Kingsley. *Physiological and biomechanical comparison between electrically assisted bicycles and motorbikes during simulated mail delivery*. Pages: 123-132.

Electrically assisted bicycles (EABs) and motorbikes were compared in terms of energy expenditure, internal and external forces, and technique when delivering mail with different loads at different distances from the mailbox. Twenty-two postal workers performed two simulated postal tasks (foot placement [close vs. far] and delivery, and simulated mail delivery circuit) while carrying 0 and 32 kg. Independent of mail load, delivering mail with EABs was classified as moderate intensity and resulted in 33% higher energy expenditure when compared to motorbikes. Ground reaction forces were larger (7–25%) for EAB when compared to motorbike. Larger ground reaction forces were observed when both EABs and motorbikes were positioned further from the mailbox (5–23%). Using EABs during mail delivery has potential to result in numerous health benefits that are associated with moderate intensity physical activity, but can lead to larger external forces when compared to motorbikes. **Practitioner summary:** In order to compare electrically assisted bicycles (EAB) and motorbikes, postal workers performed simulated deliveries in the laboratory whilst measurements of energy expenditure, body loads and movement patterns were undertaken. Body loads and energy expenditure were larger using EAB, which result in health benefits associated with moderate intensity exercise.

- **Keywords:** Motion analysis, ground reaction force, joint forces, postal workers

Pinata H. Sessoms, Marcus Gobrecht, Brenda A. Niederberger, Jordan T. Sturdy, John D. Collins, Jose A. Dominguez, Rebecca L. Jaworski & Karen R. Kelly. *Effect of a load distribution system on mobility and performance during simulated and field hiking while under load*. Pages: 133-144.

This study was conducted to test a modular scalable vest-load distribution system (MSV-LDS) against the plate carrier system (PC) currently used by the United States Marine Corps. Ten Marines engaged in 1.6 km load carriage trials in seven experimental conditions in a laboratory study. Kinematic, kinetic, and spatiotemporal gait parameters, muscle activity (electromyography), heart rate, caloric expenditure, shooting reaction

times, and subjective responses were recorded. There was lower mean trapezius recruitment for the PC compared with the MSV-LDS for all conditions, and muscle activity was similar to baseline for the MSV-LDS. Twenty-seven Marines carrying the highest load were evaluated in the field, which measured an increase in energy expenditure with MSV-LDS; however, back discomfort was reduced. The field evaluation showed significantly reduced estimated ground reaction force on flat-ground segments with the MSV-LDS, and the data suggest both systems were comparable with respect to mobility and energy cost. **Practitioner summary:** This study found that a novel load distribution system appears to redistribute load for improved comfort as well as reduce estimated ground reaction force when engaged in hiking activities. Further, hiking with a load distribution system enables more neutral walking posture. Implications of load differences in loads carried are examined.

- **Keywords:** Load carriage, gait, virtual environments, back pain, body armour

Hayden D. Gerhart, Ruby Pressl, Kristi L. Storti, Madeline P. Bayles & Yongsuk Seo. *The effects of a loaded rucksack and weighted vest on metabolic cost and stride frequency in female adults.* Pages: 145-151.

This study evaluated the metabolic cost and stride frequency during exercise while wearing an evenly distributed weight vest in recreationally fit women. Nine healthy women performed a modified Balke treadmill test until volitional fatigue in one of three conditions; (1) unloaded (2) rucksack and (3) weighted vest. Wearing a weighted vest did not show improvement of VO₂peak, HRpeak, peak stride frequency or average stride frequency (all $p \geq 0.05$). However, total time of exercise was significantly longer in the evenly distributed weight vest condition compared to the rucksack condition ($p = 0.024$) despite similar VO₂peak and HRpeak. These results may provide practical information when females in tactical populations are preparing for missions in which heavy loads must be carried. **Practitioner summary:** This study compared the effects of load carriage mode on metabolic cost and stride frequency during graded exercise in females. The weighted vest showed significantly longer exercise time despite similar VO₂peak and HRpeak. Development of standardised weight distribution mode may serve as an advantageous strategy for females in tactical settings.

- **Keywords:** Metabolic cost, stride frequency, load carriage, women

Daniel P. Armstrong, Claragh E. E. Pegg & Steven L. Fischer. *Is deep squat movement strategy related to floor-to-waist height lifting strategy: implications for physical employment testing.* Pages: 152-162.

Generalised predictive tests may be viable screening tools to evaluate job candidate workability if movement strategy used in assessment is consistent with movement strategy used in work. This study investigated if deep squat (DS) kinematics could predict floor-to-waist height lifting kinematics. Participants performed three DS repetitions, and 10 lifts of both a 10 kg and 20 kg box. Whole body kinematics were collected to calculate knee, hip and low back angles, and coordination as measured by relative phase angles. Movement features of lower extremity control, including knee and hip angles and coordination, were significantly correlated ($r = 0.43-0.85$) between the DS and lifting. However, low back movement features, measures linked to injury risk, were not significantly correlated between the DS and lifting. These findings do not support the DS as a suitable movement screen to predict lifting strategy, specifically when considering low back control. **Practitioner summary:** This study investigated whether lifting strategy could be inferred from deep squat performance. Knee and hip movement strategies were associated between the deep squat and lifting. However, inconsistencies in low back control between the deep squat and lifting limit the deep squat's injury risk assessment potential.

- **Keywords:** Movement screening, relative phase angle, inter-segmental coordination, post-offer employment test

Maria-Gabriela Garcia, Paola Tapia, Thomas Läubli & Bernard J. Martin. *Physiological and neuromotor changes induced by two different stand-walk-sit work rotations. Pages: 163-174.*

The potential of rotating postures to alleviate the effects of prolonged standing and sitting postures has been advocated to attenuate the accumulation of muscle fatigue, considered a precursor to musculoskeletal disorders. We aimed to evaluate the effects of two posture rotations, both including standing, walking, sitting, on physiological and neuromotor measures. Twenty-two participants followed two posture rotations, with different rest-break distributions, for 5.25 h. Lower-leg muscle twitch force, volume, force control and discomfort perception were evaluated during and after work exposure on two non-consecutive days. Significant changes in all measures indicate a detrimental effect in lower-leg long-lasting muscle fatigue, oedema, performance and discomfort after 5 h for both exposures. However, for both exposures recovery was significant 1 h and 15 h post-workday. Differences between the two rotation schedules were not significant. Hence, stand-walk-sit posture rotation promotes recovery of the tested measures and is likely to better prevent muscle fatigue accumulation. **Practitioner summary:** Lower-leg muscle twitch force, volume, force control, and discomfort were quantified during and after 5 h of stand-walk-sit work rotations with two different rest-break distributions. Measures revealed similar significant effects of work exposures regardless of rotation; which did not persist post-work. This beneficial recovery contrasts with the standing only situations.

- **Keywords:** Muscle twitch force, fatigue, performance, oedema, discomfort

Min-Chih Hsieh, Li-Ying Hong, Eric Min-Yang Wang, Wei-Cheng Chao, Chi-Chin Yang & Li-Chi Su. *Effect of correlated colour temperature and illuminance levels on user's visual perception under LED lighting in Taiwan. Pages: 175-190.*

This study aimed to utilise the characteristics of light-emitting diode (LED) lighting, including the adjustable correlated colour temperature (CCT) and illuminance levels, to evaluate the effects of various CCT and illuminance level combinations on visual perception and their patterns under different lighting conditions. Five white light balances with different CCTs were created together with four levels of illuminance. Based on the patterns of visual perception, when the CCT increased with the illuminance levels, the participants' visual perception changed from dim, boring, and sleepy to intense, vivid, energetic, and bright. As the CCT decreased, the participants gradually perceived the lighting as warm and relaxing. As illuminance levels increased, dim and unpleasant feelings progressively changed to bright and pleasant ones. The study attempted to identify lighting combinations that can respond to different psychological needs and can be used as a guide in the future design of lighting equipment. **Practitioner summary:** Appropriate lighting conditions could aid individuals in increasing the quality of life. This study conducted an experiment to evaluate the effects of various correlated colour temperature and illuminance level combinations on visual perception by using LED lighting. The results showed the effect of the different lighting combinations on the visual perception of the participants.

- **Keywords:** Led lighting, correlated colour temperature, illuminance levels, visual perception

Christen E. L. Sushereba, Kevin B. Bennett & Adam Bryant. *Visual displays for cyber network defense. Pages: 191-209.*

Five computer network Defence displays (one Alphanumeric and four graphical displays: Radial Traffic Analyser, Bar Graph, Cube, and Treemap) were evaluated. Two experiments were conducted using different methodological procedures. Participants responded to questions that were structured to approximate various ways in which analysts might need to consider network traffic. Numerous significant effects were obtained and a fairly clear rank ordering of performance for the four graphical displays was obtained across experiments (from best to worst): Bar Graph, Cube, Radial Traffic Analyser, and Treemap. The results are interpreted from the perspective of ecological interface design: the quality of performance is directly related to the quality of semantic mapping between work domain, display, and human constraints. Factors that may have contributed to the poor performance for the Radial Traffic Analyser and Treemap displays are discussed. General implications for display and interface design are provided.

Practitioner summary: Proposed displays for computer network Defence are evaluated; the results are interpreted from the perspective of ecological interface design. The associated design principles are applicable to all analogical graphical displays.

- **Keywords:** Ecological interface design, computer network defense, semantic mapping, direct perception, configural displays

Brian Thoroman, Paul Salmon & Natassia Goode. *Evaluation of construct and criterion-referenced validity of a systems-thinking based near miss reporting form.* Pages: 210-224.

The validity of methods is an ongoing issue in ergonomics. Inconsistent definitions and approaches to evaluation exacerbate this challenge. In this study, the construct and criterion-referenced validity of a new near miss reporting form was evaluated to determine the extent to which it comprehensively captures near miss incidents and is aligned with the systems thinking approach to accident causation. Interview data were used as the reference standard in the evaluation. Using signal detection theory (SDT), a high average hit rate (HR), predictive value (PV) and sensitivity index (SI) were found, with an almost perfect ranking for the index of concordance. The findings show that the reporting form has strong construct and criterion-referenced validity. It is proposed that the approach used in this study could be used by researchers and practitioners when testing the validity of incident data collection tools. **Practitioner summary:** The validity of methods is a key issue in ergonomics. In this study, we test the validity of a near miss reporting form using interview data as a standard. This approach could be used by practitioners when testing the validity of other ergonomics methods.

- **Keywords:** Near miss, systems thinking, construct validity, criterion-referenced validity, Incident reporting

Natasa Vujica Herzog & Gregor Harih. *Decision support system for designing and assigning ergonomic workplaces to workers with disabilities.* Pages: 225-236.

Workers with disabilities are still lagging in employment rates compared to the healthy workforce. Those workers are also more sensitive for stress at work and possible injuries that are usually connected with non-adequate workplace design. Generally, absenteeism presents high costs for companies and costs can be even higher if injuries at work occur. Therefore, companies face the problem of identifying a suitable workplace for workers with disabilities and supplying the needed requirements. The purpose of our research was to develop a decision support system that would aid in the process of identifying and categorising disabilities of workers, and assigning the most suitable workplace with needed requirements in an integrated work environment to ensure high safety, productivity and satisfaction. The developed decision support system is also a step toward prevention of injuries at work. The usefulness of the system has been shown in a case study of a large-sized production company. **Practitioner summary:** The purpose of

our research was to develop a decision support system that would aid companies to identify a suitable workplace for workers with disabilities with needed requirements in an integrated work environment to ensure high safety, productivity and satisfaction with lower costs.

- **Keywords:** Decision support system, occupational ergonomics, workers with disabilities, integrated work environment