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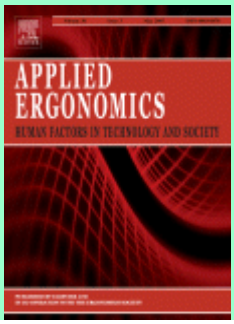

Marie-Ève Chiasson, Daniel Imbeau, Judy Major, Karine Aubry, Alain Delisle. *Influence of musculoskeletal pain on workers' ergonomic risk-factor assessments*. Pages 1-7.

This study compares the ergonomic risk-factor assessments of workers with and without musculoskeletal pain. A questionnaire on the musculoskeletal pain experienced in various body regions during the 12 months and seven days preceding the data collection was administered to 473 workers from three industrial sectors. The Ergonomic Workplace Analysis method, developed by the Finnish Institute of Occupational Health (FIOH), was then used by the workers and an ergonomics expert to assess the workstations. The ergonomic quality of the workstations and the need for change were also assessed by the expert and the workers at the workstation, using visual analog scales (VAS). Results show that the workers in this study were exposed to significant musculoskeletal disorder (MSD) risk factors, according to the FIOH assessment and the high percentages of reported pain. The results also show that those who reported pain in the seven days prior to the assessment evaluated their workstations more negatively than subjects who reported no pain, while the expert found no difference between the two groups' exposure to MSD risk factors.

- **Keywords:** Self-assessment; Musculoskeletal pain; MSD risk factors

Peter G. Renden, Arne Nieuwenhuys, Geert J.P. Savelsbergh, Raôul R.D. Oudejans. *Dutch police officers' preparation and performance of their arrest and self-defence skills: A questionnaire study*. Pages 8-17.

We investigated how Dutch police officers perceive their preparation for arrest and self-defence skills (ASDS) and their ability to manage violence on duty. Furthermore, we assessed whether additional experience (i.e., by having encountered violence on duty or by practicing martial arts) and self-perceived anxiety have an influence on these perceptions. Results of an online questionnaire (n = 922) showed that having additional experience was associated with self-perceived better performance. Officers who experience anxiety more often, on the other hand, reported more problems. Although most officers report sufficiently effective performance on duty, they, especially those with additional experience, feel that training frequency is too low and that the currently taught ASDS are only moderately usable (at least with the current amount of training). Based on the results, we suggest that increasing officers' ASDS experience, teaching officers to perform with high anxiety, or reconsidering the taught skills, may be necessary to further improve performance of police officers on duty.

- **Keywords:** Anxiety; Deliberate practice; Perceptual-motor performance

Jonathan Power, António Simões Ré, Martin Barwood, Peter Tikuisis, Michael Tipton. *Reduction in predicted survival times in cold water due to wind and waves*. Pages 18-24.

Recent marine accidents have called into question the level of protection provided by immersion suits in real (harsh) life situations. Two immersion suit studies, one dry and the other with 500 mL of water underneath the suit, were conducted in cold water with 10–12 males in each to test body heat loss under three environmental conditions: calm, as mandated for immersion suit certification, and two combinations of wind plus waves to simulate conditions typically found offshore. In both studies mean skin heat loss was higher in wind and waves vs. calm; deep body temperature and oxygen consumption were not different. Mean survival time predictions exceeded 36 h for all conditions in the first study but were markedly less in the second in both calm and wind and waves. Immersion suit protection and consequential predicted survival times under realistic environmental conditions and with leakage are reduced relative to calm conditions.

- **Keywords:** Immersion suits; Heat loss; Survival time prediction

Jordan Smith, Neil Mansfield, Diane Gyi, Mark Pagett, Bob Bateman. *Driving performance and driver discomfort in an elevated and standard driving position during a driving simulation*. Pages 25-33.

The primary purposes of a vehicle driver's seat, is to allow them to complete the driving task comfortably and safely. Within each class of vehicle (e.g. passenger, commercial, industrial, agricultural), there is an expected driving position to which a vehicle cabin is designed. This paper reports a study that compares two driving positions, in relation to Light Commercial Vehicles (LCVs), in terms of driver performance and driver discomfort. In the ‘elevated’ driving position, the seat is higher than usually used in road vehicles; this is compared to a standard driving position replicating the layout for a commercially available vehicle. It is shown that for a sample of 12 drivers, the elevated position did not, in general, show more discomfort than the standard position over a 60 min driving simulation, although discomfort increased with duration. There were no adverse effects shown for emergency stop reaction time or for driver headway for the elevated posture compared to the standard posture. The only body part that showed greater discomfort for the elevated posture compared to the standard posture was the right ankle. A second experiment confirmed that for 12 subjects, a higher pedal stiffness eliminated the ankle discomfort problem.

- **Keywords:** Driver comfort; Driver posture; Driving performance

Jessica A. Dobson, Diane L. Riddiford-Harland, Julie R. Steele. *Effects of wearing gumboots and leather lace-up boots on lower limb muscle activity when walking on simulated underground coal mine surfaces*. Pages 34-40.

This study aimed to investigate the effects of wearing two standard underground coal mining work boots (a gumboot and a leather lace-up boot) on lower limb muscle activity when participants walked across simulated underground coal mining surfaces. Quadriceps (rectus femoris, vastus medialis, vastus lateralis) and hamstring (biceps femoris, semitendinosus) muscle activity were recorded as twenty male participants walked at a self-selected pace around a circuit while wearing each boot type. The circuit consisted of level, inclined and declined surfaces composed of rocky gravel and hard dirt. Walking in a leather lace-up boot, compared to a gumboot, resulted in increased vastus lateralis and increased biceps femoris muscle activity when walking on sloped surfaces. Increased

muscle activity appears to be acting as a slip and/or trip prevention strategy in response to challenging surfaces and changing boot features.

- **Keywords:** Boots; Mining; Surfaces

Marcelo P. Castro, Maria Cristina Figueiredo, Sofia Abreu, Helena Sousa, Leandro Machado, Rubim Santos, João Paulo Vilas-Boas. *The influence of gait cadence on the ground reaction forces and plantar pressures during load carriage of young adults*. Pages 41-46.

Biomechanical gait parameters—ground reaction forces (GRFs) and plantar pressures—during load carriage of young adults were compared at a low gait cadence and a high gait cadence. Differences between load carriage and normal walking during both gait cadences were also assessed. A force plate and an in-shoe plantar pressure system were used to assess 60 adults while they were walking either normally (unloaded condition) or wearing a backpack (loaded condition) at low (70 steps per minute) and high gait cadences (120 steps per minute). GRF and plantar pressure peaks were scaled to body weight (or body weight plus backpack weight). With medium to high effect sizes we found greater anterior-posterior and vertical GRFs and greater plantar pressure peaks in the rearfoot, forefoot and hallux when the participants walked carrying a backpack at high gait cadences compared to walking at low gait cadences. Differences between loaded and unloaded conditions in both gait cadences were also observed.

- **Keywords:** Backpack; Walking; Gait speed

Yasuhiro Shimazaki, Masaaki Murata. *Effect of gait on formation of thermal environment inside footwear*. Pages 55-62.

In this study, the relationship between the gait condition and foot temperature distributions inside footwear was investigated using subject experiments. Mechanical, physical, and physiological variables such as the foot contact force, landing speed, and metabolic heat generation were also measured. Gait motion measurements showed that a large contact force was concentrated in the small area of the heel at the initial contact and later at the forefoot. A faster gait produced a larger contact force, higher landing velocity, higher skin temperature, and larger metabolism during gait. The temperature at the bottom of the foot increased, and the temperature on the upper side decreased. The metabolic heat generation had a basic impact on the temperature profile, and skin temperatures tended to increase gradually. In addition, high-temperature-elevation regions such as the big toe and heel coincided with regions with high-contact loads, which suggested a relationship between the temperature elevation and contact load.

- **Keywords:** Skin temperature; Foot contact; Heat transfer

Catherine Trask, Svend Erik Mathiassen, Mehdi Rostami. *Partly visible periods in posture observation from video: Prevalence and effect on summary estimates of postures in the job*. Pages 63-69.

This paper investigated the extent to which observers rated clearly visible postures on video differently from partly visible postures, and whether visibility affected full-shift posture summaries. Trunk and upper arm postures were observed from 10,413 video frames representing 80 shifts of baggage handling; observers reported postures as fully or only partly visible. Postures were summarized for each shift into several standard metrics using all available data, only fully visible frames, or only partly visible frames. 78% of trunk and 70% of upper arm postural observations were inferred. When based on all data, mean and 90th percentile trunk postures were 1.8° and 5.6° lower, respectively, than when based only on fully visible situations. For the arm; differences in mean and

90th percentile were 0.7° and 8.2°. Daily posture summaries were significantly influenced by whether partly visible postures are included or not.

- **Keywords:** Observation; Posture; Exposure assessment

Xu Xu, Raymond W. McGorry. *The validity of the first and second generation Microsoft Kinect™ for identifying joint center locations during static postures*. Pages 47-54.

The Kinect™ sensor released by Microsoft is a low-cost, portable, and marker-less motion tracking system for the video game industry. Since the first generation Kinect sensor was released in 2010, many studies have been conducted to examine the validity of this sensor when used to measure body movement in different research areas. In 2014, Microsoft released the computer-used second generation Kinect sensor with a better resolution for the depth sensor. However, very few studies have performed a direct comparison between all the Kinect sensor-identified joint center locations and their corresponding motion tracking system-identified counterparts, the result of which may provide some insight into the error of the Kinect-identified segment length, joint angles, as well as the feasibility of adapting inverse dynamics to Kinect-identified joint centers. The purpose of the current study is to first propose a method to align the coordinate system of the Kinect sensor with respect to the global coordinate system of a motion tracking system, and then to examine the accuracy of the Kinect sensor-identified coordinates of joint locations during 8 standing and 8 sitting postures of daily activities. The results indicate the proposed alignment method can effectively align the Kinect sensor with respect to the motion tracking system. The accuracy level of the Kinect-identified joint center location is posture-dependent and joint-dependent. For upright standing posture, the average error across all the participants and all Kinect-identified joint centers is 76 mm and 87 mm for the first and second generation Kinect sensor, respectively. In general, standing postures can be identified with better accuracy than sitting postures, and the identification accuracy of the joints of the upper extremities is better than for the lower extremities. This result may provide some information regarding the feasibility of using the Kinect sensor in future studies.

- **Keywords:** Reference frame alignment; Daily activities; Kinect v2