

# **Ergonomics– rok 2019, ročník 62**

## **Číslo 1**



**Maral Babapour Chafi & Linda Rolfö. [Policies in Activity-based Flexible Offices -'I am sloppy with clean-desking. We don't really know the rules.'](#) Pages: 1-20.**

Activity-based Flexible Offices (A-FOs) are offices with unassigned desks that provide a variety of workspaces. This paper presents desk-sharing and speech rules identified in A-FOs in four Swedish organisations, the emergence of and compliance with these rules, and their consequences for work conditions. Data collection involved 105 semi-structured interviews, document analyses, and observations. The identified rules were: (1) to remove belongings, (2) temporal restrictions on using the same workstations, (3) temporal restrictions on using scarce zones, (4) restrictions on verbal interactions, and (5) restrictions on phone conversations. The cases with extensive user involvement in their planning process had explicit unambiguous rules. A better compliance with rules occurred when (i) the employees were well-prepared and had a unified understanding regarding how and why to follow the rules, (ii) the rules were explicitly communicated and were regarded as easy to follow, and (iii) following the rules facilitated work and improved work conditions. **ractitioner summary:** Five rules were identified for applying desk-sharing and speech policies in A-FOs. Extensive user involvement resulted in having well-defined and explicitly communicated rules, and prepared employees for how to use the A-FO. Implicit and ambiguous rules led to conflicting interpretations, disregarding rules, and were associated with more negative work conditions.

- **Keywords:** Activity-based working (ABW), codes of conduct, desk-sharing and speech policies, implementation, planning process, work conditions, work environment design

**Aadil Kazi, Cheryl Haslam, Myanna Duncan, Stacy Clemes & Ricardo Twumasi. [Sedentary behaviour and health at work: an investigation of industrial sector, job role, gender and geographical differences.](#) Pages: 21-30.**

This article presents baseline data from 1120 employees across 10 worksites enrolled in a workplace physical activity intervention. The study provides new data on physical activity, sedentary behaviour, and health and highlights gender, geographical, job type

and industrial sector differences. Sitting at work accounted for more than 60% of participants' total daily sitting time on work days. Weekly and monthly hours worked, body mass index (BMI) and waist circumference were significantly higher for workers in the private sector compared to the public sector. Employees in sales and customer services had significantly higher BMI scores and significantly lower scores for workability index (WAI), job satisfaction, organisational commitment and job motivation, compared to other groups. This study provides further evidence that work is a major contributor to sedentary behaviour and supports the pressing need for interventions particularly targeting private sector industries and sales and customer service sectors. **Practitioner Summary:** Work accounts for more than 60% of the daily sitting time. Private sector employees had higher BMIs than those in the public sector and employees in sales and customer services had higher BMIs and poorer health compared to other occupations, suggesting that these groups should be targeted in workplace interventions.

- **Keywords:** Workplace intervention, health risks, physical activity, sedentary behaviour

**Cheryl Haslam, Aadil Kazi, Myanna Duncan, Stacy Clemes & Ricardo Twumasi.** *Walking Works Wonders: a tailored workplace intervention evaluated over 24 months.* **Pages: 31-41.**

This article presents longitudinal data from 1120 participants across 10 worksites enrolled in Walking Works Wonders, a tailored intervention designed to increase physical activity and reduce sedentary behaviour. The intervention was evaluated over 2 years, using a quasi-experimental design comprising 3 conditions: tailored information; standard information and control. This study explored the impact of the intervention on objective measures (BMI, %Fat, waist circumference, blood pressure and heart rate) and self-reported measures of physical activity, sedentary behaviour, physical and psychological health. Interventions tailored to employees' stage of change significantly reduced BMI and waist circumference compared to standard and control conditions. Employees who received either a standard or tailored intervention demonstrated significantly higher work ability, organizational commitment, job motivation, job satisfaction and a reduction in intention to quit the organization. The results suggest that adopting a tailored approach to interventions is particularly effective in terms of improving health in the workplace. **Practitioner Summary:** This study describes Walking Works Wonders, a tailored intervention, which aims to encourage physical activity in the workplace. The study evaluated Walking Works Wonders over a 2 year period and demonstrated that interventions are more effective in improving health outcomes where the information is tailored to employees' stage of change.

- **Keywords:** Stage of change, tailored workplace intervention, physical activity, sedentary behaviour

**Steven Visser, Henk F. van der Molen, Judith K. Sluiter & Monique H. W. Frings-Dresen.** *Evaluation of the effects of two alternative participatory ergonomics intervention strategies for construction companies.* **Pages: 42-51.**

To improve the use of ergonomics tools by construction workers, the effect of two guidance strategies – a face-to-face strategy (F2F) and an e-guidance strategy (EG) – of a participatory ergonomics intervention was studied. Twelve construction companies were randomly assigned to the F2F group or the EG group. The primary outcome measure, the percentage of workers using ergonomics tools, and secondary outcome measures – work ability, physical functioning and limitations due to physical problems – were assessed using surveys at baseline and after 6 months. Additionally, a cost-benefit analysis was performed on company level. No differences in primary and secondary

outcomes were found with the exception of the use of ergonomics tools to adjust working height (F2F +1%; EG +10%;  $p = .001$ ). Newly-implemented tools were used by 23% (F2F) and 42% (EG) of the workers ( $p = .271$ ). Costs were mainly determined by guidance costs (F2F group) or purchase costs (EG group). **Practitioner Summary:** Participatory strategies aim to stimulate behavioural change of stakeholders to increase the use of ergonomics tools. Two guidance strategies – face-to-face or e-mail interventions – among construction companies were studied. Both guidance strategies led to an increase in the use of new ergonomics tools.

- **Keywords:** Construction industry, E-strategy, ergonomics tools, participative ergonomics

**Stephanie P. Borgs, Nicholas J. La Delfa & Clark R. Dickerson. *An evaluation of off-axis manual forces and upper extremity joint moments during unilateral pushing and pulling exertions*. Pages: 52-64.**

This study quantified changes in off-axis manual force production and upper extremity joint moments during sub-maximal one-handed push and pull tasks. Off-axis forces in the up/down and left/right directions were quantified in the presence or absence of constraints placed upon the direction of manual force application and/or arm posture. Resultant off-axis forces of 13.1% and 9.4% were produced for pulls and pushes, respectively. Off-axis forces during pulling were oriented downwards and to the right and were associated with a decreased shoulder flexion moment when posture was constrained. Off-axis forces in the up/down direction were minimized with increased on-axis force level. Off-axis forces during pushing tended to be oriented to the left and were associated with increased elbow flexion moment when off-axis forces were allowed. By not accounting for these off-axis forces, we may not be accurately reflecting actionable muscle- and joint-level loading characteristics derived from biomechanically-based proactive ergonomics assessment approaches. **Practitioner Summary:** Constrained arm postures and directions of manual force application influence the production of off-axis forces. As inaccurate estimation of true manual forces can markedly influence actionable outcomes of proactive ergonomic assessments, this study suggests that simplification of these estimates is insufficient and potentially misleading.

- **Keywords:** Off-axis forces, pushing and pulling, proactive ergonomics, constrained posture

**Joost Heutink, Minou Broekman, Karel A. Brookhuis, Bart J. M. Melis-Dankers & Christina Cordes. *The effects of habituation and adding a rest-frame on experienced simulator sickness in an advanced mobility scooter driving simulator*. Pages: 65-75.**

The aim of this article is to investigate the effect of a physical rest-frame, habituation and age on simulator sickness in an advanced mobility scooter driving simulator. Twenty-six young and 34 older adults completed a total of 12 drives in an advanced mobility scooter driving simulator over two visits. A 2x2 crossover design was used to measure the effect of a rest frame that was added to the driving simulator on either the first or second visit. The Simulator Sickness Questionnaire was used to measure simulator sickness symptoms. A significant decrease in simulator sickness was observed between the first and the second visit. Older adults reported more severe simulator sickness symptoms compared to younger participants. No effect of rest-frame could be found. Habituation appears to be the most effective method to reduce simulator sickness in an advanced mobility scooter driving simulator. More research is needed to investigate simulator sickness in patient groups. **Practitioner summary:** Experiencing simulator sickness is a major problem across all types of simulators. The present experiment investigated the effect of a rest-frame, habituation and age on developing simulator

sickness symptoms in an advanced mobility scooter driving simulator. Habituation appeared to be the most effective method to reduce simulator sickness.

- **Keywords:** Driving simulator, simulator sickness, rest-frame, mobility scooter, habituation effect

**Bereket Haile Woldegiorgis, Chiuhsiang Joe Lin & Wei-Zhe Liang. *Impact of parallax and interpupillary distance on size judgment performances of virtual objects in stereoscopic displays.* Pages: 76-87.**

Effective interactions in both real and stereoscopic environments require accurate perceptions of size and position. This study investigated the effects of parallax and interpupillary distance (IPD) on size perception of virtual objects in widescreen stereoscopic environments. Twelve participants viewed virtual spherical targets displayed at seven different depth positions, based on seven parallax levels. A perceptual matching task using five circular plates of different sizes was used to report the size judgment. The results indicated that the virtual objects were perceived as larger and smaller than the corresponding theoretical sizes, respectively, in negative and positive parallaxes. Similarly, the estimates from participants with small IPDs were greater than the predicted estimates. The findings of this study are used to explain human factor issues such as the phenomenon of inaccurate depth judgments in virtual environments, where compression is widely reported, especially at farther egocentric distances. Furthermore, a multiple regression model was developed to describe how the size was affected by parallax and IPD. **Practitioner Summary:** The study investigates the effects of parallax and interpupillary distance on size perception of virtual targets in a stereoscopic environment. Virtual objects were perceived as larger in negative and smaller in positive parallax. Also, size estimates were greater than the theoretical sizes for participants with smaller IPD. A multiple-regression model explains the impact of parallax and measured IPD.

- **Keywords:** Stereoscopic displays, size perception, parallax, interpupillary distance, virtual reality

**Ashish Kumar Singh. *Comparative assessment of shift in hearing threshold among handicraft operatives in India.* Pages: 88-102.**

This case-control exploratory study is first of its kind to assess the noise exposure and loss in hearing threshold (HT) due to the occupational use of hand tools used for handicraft work. Sixty male participants involved in different crafts trade and a reference group of 50 office workers were selected. The sound pressure levels under actual work conditions were measured as per the method outlined in IS 7194:1994. The mean equivalent sound pressure level was quite high (96.37 dB(A)), exceeding the exposure limit of 90 dB(A). Audiometric tests were conducted to compare the HT between both the groups. In agreement with dose consumed, the exposed workers exhibit moderate hearing impairment in the frequency range of 1500–6000 Hz. The association of HT at different frequencies among occupation were detected using *post-hoc* multiple comparisons. 95% of the workers showed hearing handicap at some level and noise-induced hearing loss increases with higher age and experience. Interventions in the hand tools, implementation of hearing conservation programmes and practice of personal protective equipments have been suggested. **Practitioner Summary:** As the primary outcomes, comparative assessment of the shift in hearing threshold was analyzed in anticipation to develop a better work system. Results from the study report that the sound pressure level was fairly high and 95% of the handicraft operatives showed hearing handicap at some level.

- **Keywords:** Handicrafts, noise exposure, ergonomics, shift in hearing threshold, noise-induced hearing loss (NIHL)

**Harish Chander, Adam C. Knight, John C. Garner, Chip Wade, Daniel Carruth, Samuel J. Wilson, Jacob R. Gdovin & Caleb C. Williams. *Impact of military type footwear and load carrying workload on postural stability*. Pages: 103-114.**

Postural stability has been shown to be impacted by footwear and task performed. This study analysed the impact of two military footwear, standard boot (STB) and minimalist boot (MTB) on postural stability, before (PRE) and after (POST) a load carriage task. Sixteen participants were tested for postural stability using sensory organisation and motor control tests on Neurocom Equitest™. Postural sway, equilibrium scores and postural latencies were analysed using a two-factor repeated measures ANOVA: boot type (STB-MTB) × time (PRE-POST) load carriage task. Significantly greater postural sway variables, lower balance scores and slower postural latencies were seen in STB and POST load carriage conditions ( $p < .05$ ). The results suggest that MTB exhibited greater balance compared to STB in balance conditions that rely on somatosensory feedback and that balance is lowered after a load carriage task. Decrements in postural stability could be attributed to boot design characteristics and muscular exertion due to the load carriage task. **Practitioner Summary:** Maintaining optimal postural stability is crucial in military. Impact of military footwear types and load carriage task on postural stability are addressed. Findings provide footwear design and physical exertion implications on postural stability leading to potential interventions that reduce postural stability decrements; thereby, reducing potential falls and fall related injuries.

- **Keywords:** Postural stability, balance, military footwear, military workload, centre of pressure

**Janette Rose, Chris Bearman, Anjum Naweed & Jillian Dorrian. *Proceed with caution: using verbal protocol analysis to measure situation awareness*. Pages: 115-127.**

Verbal protocol analysis (VPA) is often used to elicit information about the cognitive processes of operators as it provides rich data and can be used in naturalistic settings. Recently VPA has been used to investigate the acquisition and maintenance of situation awareness (SA), and to make comparisons between groups despite a lack of research regarding the efficacy of using VPA for this purpose. This train simulator experiment investigated whether VPA can effectively measure SA. Novice and expert participants were recorded on an audio device while talking aloud throughout the trials and their verbalisations were transcribed verbatim. A coding scheme developed from the transcripts was used to code the verbalisations. Results did not support the use of VPA as a measure of SA but did show that VPA detected differences in SA errors. Potential reasons for the conflicting findings between this experiment and those conducted by other researchers are discussed. **Practitioner summary:** This paper examined the validity of verbal protocol analysis (VPA) as a situation awareness (SA) measure. A repeated measures experiment was conducted using a train simulator. Normal VPA did not detect changes in SA but a measure of errors did. Caution should be used when using VPA to measure SA.

- **Keywords:** Situation awareness, verbal protocol analysis, situation awareness measurement, train simulator study