

Ergonomics– rok 2018, ročník 61

Číslo 2



Andrew Thatcher, Patrick Waterson, Andrew Todd & Neville Moray. [State of Science: ergonomics and global issues](#). Pages: 197-213.

In his 1993 IEA keynote address, Neville Moray urged the ergonomics discipline to face up to the global problems facing humanity and consider how ergonomics might help find some of the solutions. In this State of Science article we critically evaluate what the ergonomics discipline has achieved in the last two and a half decades to help create a secure future for humanity. Moray's challenges for ergonomics included deriving a value structure that moves us beyond a Westernised view of worker-organisation-technology fit, taking a multidisciplinary approach which engages with other social and biological sciences, considering the gross cross-cultural factors that determine how different societies function, paying more attention to mindful consumption, and embracing the complexity of our interconnected world. This article takes a socio-historical approach by considering the factors that influence what has been achieved since Moray's keynote address. We conclude with our own set of predictions for the future and priorities for addressing the challenges that we are likely to face. **Practitioner Summary:** We critically reflect on what has been achieved by the ergonomics profession in addressing the global challenges raised by Moray's 1993 keynote address to the International Ergonomics Association. Apart from healthcare, the response has largely been weak and disorganised. We make suggestions for priority research and practice that is required to facilitate a sustainable future for humanity.

- **Keywords:** Global challenges, macroergonomics, green ergonomics, sustainable development, values

Andrew May & Tracy Ross. [The design of civic technology: factors that influence public participation and impact](#). Pages: 214-225.

Civic technology needs to be better understood in terms of the factors that promote representative public participation and impact. This paper reports on a mixed-methods study of a civic tech platform that enabled the public to provide feedback on public transport to the service providers. The overall aim of this research was to investigate the public's use of a leading civic tech platform, FixMyTransport. The key findings were that: an effective and easy-to-use civic technology platform enables broad participation; data

and process complexity need to be removed; factual information can be captured *in situ* with impacts, consequences and opinions added later; emotions (if important) need to be *explicitly* elicited; feedback to, and a 'conversation' with, the users is important for engagement, as is a feeling of being part of a community. These findings can contribute to the future design of civic technology platforms. **Practitioner Summary:** There is a lack of understanding of how 'civic tech' platforms are used and how they may be designed for maximum effectiveness. Multiple data collection methods were used to investigate a well-developed example of civic tech. Effective civic tech can enable broad democratic participation to improve public services.

- **Keywords:** Civic technology, crowdsourcing, citizen-sourcing, public participation, user impact, user-centred design, transport

Özgür Göçer, Kenan Göçer, Ebru Ergöz Karahan & Işıl İlhan Oygür. *Exploring mobility & workplace choice in a flexible office through post-occupancy evaluation.* Pages: 226-242.

Developments in information and communication systems, organisational structure and the nature of work have contributed to the restructuring of work environments. In these new types of work environments, employees do not have assigned workplaces. This arrangement helps organisations to minimise rent costs and increase employee interaction and knowledge exchange through mobility. This post-occupancy evaluation (POE) study focuses on a flexible office in a Gold Leadership in Energy and Environmental Design-certified building in Istanbul. An integrated qualitative and quantitative POE technique with occupancy tracking via barcode scanning and instant surveying has been introduced. Using this unique approach, we examined the directives/drivers in workplace choice and mobility from different perspectives. The aggregated data was used to discern work-related consequences such as flexibility, workplace choice, work and indoor environment satisfaction, place attachment and identity. The results show that employees who have a conventional working culture develop a new working style: 'fixed-flexible working'. **Practitioner Summary:** This paper introduces a new POE approach for flexible offices based on occupancy tracking through barcode scanning to explore workplace choice and mobility. More than half (52.1%) of the participants have tended to choose the same desk every day. However, the satisfaction level of the 'mobile' employees was higher than that of the 'fixed flexible' employees.

- **Keywords:** Post-occupancy evaluation, flexible offices, spatio-temporal mapping, mobility, GIS

Stephen Bao & Jia-Hua Lin. *An investigation into four different sit-stand workstation use schedules.* Pages: 243-254.

Twelve office workers participated in a study investigating effects of four sit/stand schedules (90-min sit/30-min stand, 80/40, 105/15, and 60/60) via several objective and subjective measures (muscle fatigue, foot swelling, spinal shrinkage, and self-reported discomfort). Results showed that there were no significant differences in shoulder and low back static muscle activities between sitting and standing. Muscle fatigue was developed during workday under all schedules. The longest standing schedule seemed to have a tendency of reducing muscle fatigue. None of the schedules helped or worsened foot swelling and spinal shrinkage. More active break-time activities seemed reducing muscle fatigue and foot swelling. While the self-reported bodily discomfort levels were generally low, the preferred schedules among the participants were varied, although the least standing schedule was the least preferred. We may conclude that effects of using sit-stand workstation to improve musculoskeletal health may be limited but promoting more active break-time activities can help. **Practitioner Summary:** Sit-stand workstations are used to reduce work-related musculoskeletal disorders. This study shows that office workers prefer sit/stand durations in the range

between 1:1 and 3:1. Longer standing may have the potential to reduce muscle fatigue. However, active break-time activities may be more effective in reducing muscle fatigue and foot swelling.

- **Keywords:** Office ergonomics, work-related musculoskeletal disorders, muscle fatigue, electromyography, foot swelling

André Scholz, Argang Ghadiri, Usha Singh, Johannes Wendsche, Theo Peters & Stefan Schneider. *Functional work breaks in a high-demanding work environment: an experimental field study.* Pages: 255-264.

Work breaks are known to have positive effects on employees' health, performance and safety. Using a sample of twelve employees working in a stressful and cognitively demanding working environment, this experimental field study examined how different types of work breaks (boxing, deep relaxation and usual breaks) affect participants' mood, cognitive performance and neurophysiological state compared to a control condition without any break. In a repeated measures experimental design, cognitive performance was assessed using an auditory oddball test and a Movement Detection Test. Brain cortical activity was recorded using electroencephalography. Individual's mood was analysed using a profile of mood state. Although neurophysiological data showed improved relaxation of cortical state after boxing (vs. 'no break' and 'deep relaxation'), neither performance nor mood assessment showed similar results. It remains questionable whether there is a universal work break type that has beneficial effects for all individuals. **Practitioner Summary:** Research on work breaks and their positive effects on employees' health and performance often disregards break activities. This experimental field study in a stressful working environment investigated the effect of different work break activities. A universal work break type that is beneficial for this workplace could not be identified.

- **Keywords:** Cognitive performance, exercise, recovery, relaxation, work breaks

Aaron Silk, Gavin Lenton, Robbie Savage & Brad Aisbett. *Job task characteristics of Australian emergency services volunteers during search and rescue operations.* Pages: 265-272.

Search and rescue operations are necessary in locating, assisting and recovering individuals lost or in distress. In Australia, land-based search and rescue roles require a range of physically demanding tasks undertaken in dynamic and challenging environments. The aim of the current research was to identify and characterise the physically demanding tasks inherent to search and rescue operation personnel within Australia. These aims were met through a subjective job task analysis approach. In total, 11 criterion tasks were identified by personnel. These tasks were the most physically demanding, frequently occurring and operationally important tasks to these specialist roles. Muscular strength was the dominant fitness component for 7 of the 11 tasks. In addition to the discrete criterion tasks, an operational scenario was established. With the tasks and operational scenario identified, objective task analysis procedures can be undertaken so that practitioners can implement evidence-based strategies, such as physical selection procedures and task-based physical training programs, commensurate with the physical demands of search and rescue job roles. **Practitioner Summary:** The identification of physically demanding tasks amongst specialist emergency service roles predicates health and safety strategies which can be incorporated into organisations. Knowledge of physical task parameters allows employers to mitigate injury risk through the implementation of strategies modelled on the precise physical demands of the role.

- **Keywords:** Job task analysis, search and rescue, emergency services, physical demands

Lin-dong Yang, Rui-feng Yu, Xue-lian Lin, Ya-qing Xie & Liang Ma. *Visual search tasks: measurement of dynamic visual lobe and relationship with display movement velocity*. Pages: 273-283.

Visual lobe is a useful tool for predicting visual search performance. Up till now, no study has focused on dynamic visual lobe. This study developed a dynamic visual lobe measurement system (DVLMS) that could effectively map dynamic visual lobe and calculate visual lobe shape indices. The effects of display movement velocity on lobe shape indices were examined under four velocity conditions: 0, 4, 8 and 16 deg/s. In general, with the increase of display movement velocity, visual lobe area and perimeter became smaller, whereas lobe shape roundness, boundary smoothness, symmetry and regularity deteriorated. The elongation index was not affected by velocity. Regression analyses indicated that display movement velocity was important in determining dynamic visual lobe shape indices. Dynamic visual lobe provides another option for better understanding dynamic vision, in addition to dynamic visual acuity. Findings of this study can provide guidelines for analysing and designing dynamic visual tasks. **Practitioner Summary:** Dynamic visual lobe is important in reflecting the visual ability of searching for a moving target. We developed a dynamic visual lobe measurement system (DVLMS) and examined display movement velocity's effects on lobe shape. Findings revealed that velocity was a key factor affecting dynamic visual lobe shape indices.

- **Keywords:** Visual lobe, dynamic, velocity, visual search

Da Tao, Tieyan Wang, Tieshan Wang & Xingda Qu. *Influence of drug colour on perceived drug effects and efficacy*. Pages: 284-294.

A drug's physical characteristics, such as colour, could be factors influencing its therapeutic effects. It is not well understood whether people's expectations on drug effects and efficacy are affected by colour, especially among Chinese population. This study was conducted to examine people's expectations on drug effects and efficacy on the basis of drug colour, and to reveal possible gender differences in colour-related drug expectations. Participants ($n = 224$) were asked to classify seven single-coloured and six two-coloured capsules into one of four categories of drug effects, and to indicate the strength of drug efficacy. It is found that all the coloured capsules yielded non-chance distributions in classifications of drug effects, with six single-coloured and four two-coloured capsules associated with specific drug effects. Colour also conveyed differential strengths of drug efficacy in general and in relation to specific drug effects. There were gender differences in drug expectations for some colours and colour combinations. **Practitioner Summary:** Drug colour was found to have impacts on perceived drug effects and efficacy. The findings from the present study can be used by ergonomics practitioners to design appropriate drug colours in support of drug differentiation, therapeutic effects and medication adherence.

- **Keywords:** Colour perception, colour combination, drug expectation, gender difference

Margaret J. Trotter, Paul M. Salmon, Natassia Goode & Michael G. Lenné. *Distributed improvisation: a systems perspective of improvisation 'epics' by led outdoor activity leaders*. Pages: 295-312.

Improvisation represents the spontaneous and real-time conception and execution of a novel response to an unanticipated situation. In order to benefit from the positive safety potential of this phenomenon, it is necessary to understand what influences its appropriateness and effectiveness. This study has applied the system-based methodology Impromaps to analysing accounts of improvisation aimed at mitigating adverse safety outcomes. These accounts were obtained from led outdoor activity (LOA) leaders through

critical decision method interviews. Influencing factors and interactions have been identified across all system levels. The factors most influential to leaders' ability to improvise are 'Policy, procedures and rules', 'Organisation culture', 'Training', 'Role responsibilities', 'Communication/instruction/demonstration', 'Situation awareness', 'Leader experience', 'Mental simulation', 'Equipment, clothing & PPE' and 'Terrain/physical environment'. To enhance the likelihood of effective, appropriate improvisation, LOA providers are recommended to focus on higher level factors over which they are able to exert greater control. **Practitioner Summary:** To enhance resilience in safety-critical situations, organisations need to understand what influences appropriate, effective improvisation. To elucidate this, the Impromaps methodology is applied to in-depth interview data. The Impromap affords a graphical depiction of the influencing factors and interactions across the system, providing a basis for the development of interventions.

- **Keywords:** Improvisation, led outdoor activities, resilience, Accimap, sociotechnical systems

Timothy J. Neville, Paul M. Salmon & Gemma J.M. Read. *Radio Gaga? Intra-team communication of Australian Rules Football umpires – effect of radio communication on content, structure and frequency.* Pages: 313-328.

Intra-team communication plays an important role in team effectiveness in various domains including sport. As such, it is a key consideration when introducing new tools within systems that utilise teams. The difference in intra-team communication of Australian Rules Football (AFL) umpiring teams was studied when umpiring with or without radio communications technology. A cross-sectional observational study was conducted to analyse the verbal communication of seven umpiring teams (20 participants) grouped according to their experience with radio communication. The results identified that radio communication technology increased the frequency and altered the structure of intra-team communication. Examination of the content of the intra-team communication identified impacts on the 'Big Five' teamwork behaviours and associated coordinating mechanisms. Analysis revealed that the communications utilised did not align with the closed-loop form of communication described in the Big Five model. Implications for teamwork models, coaching and training of AFL umpires are discussed. **Practitioner Summary:** Assessing the impact of technology on performance is of interest to ergonomics practitioners. The impact of radio communications on teamwork is explored in the highly dynamic domain of AFL umpiring. When given radio technology, intra-team communication increased which supported teamwork behaviours, such as backup behaviour and mutual performance monitoring.

- **Keywords:** Teamwork, team communication, Big Five, technology insertion, officials in sport

Joe Langley, Silvia Pancani, Karen Kilner, Heath Reed, Andy Stanton, Nicola Heron, Simon Judge, Avril McCarthy, Susan Baxter, Claudia Mazzà & Christopher J. McDermott. *A comfort assessment of existing cervical orthoses.* Pages: 329-338.

Purpose: Identify location and intensity of discomfort experienced by healthy participants wearing cervical orthoses. **Method:** Convenience sample of 34 healthy participants wore *Stro II*, *Philadelphia*, *Headmaster*, and *AspenVista*® cervical orthoses for four-hour periods. Participants reported discomfort level (scale 0–6) and location. **Results:** Participants reported mean discomfort for all orthoses over the four-hour test between 'a little discomfort' and 'very uncomfortable' (mean discomfort score = 1.64, SD = 1.50). Seven participants prematurely stopped tests due to pain and six reported maximum discomfort scores. Significant linear increase in discomfort with duration of

wear was found for all orthoses. Significantly less discomfort was reported with Stro II than Headmaster and Philadelphia. Age correlated with greater perceived discomfort. Orthoses differed in the location discomfort was experienced. **Conclusion:** Existing cervical orthoses cause discomfort influenced by design and duration of wear with orthoses' design the more significant factor. This work informed the design of a new orthosis and future orthoses developments. **Practitioner Summary:** The purpose of this study was to gain greater knowledge about the discomfort caused by wearing of existing neck orthoses in order to inform the design and development of a new neck orthosis. This study gathers empirical data from a surrogate population and concludes that orthosis design is more influential than the duration of wear.

- **Keywords:** Comfort assessment, neck collar, neck support, Motor Neurone Disease, amyotrophic lateral sclerosis, neck weakness, assistive technology, Head-up