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Franziska Hartwich, Matthias Beggiato & Josef F. Krems. *Driving comfort, enjoyment and acceptance of automated driving – effects of drivers’ age and driving style familiarity*. Pages: 1017-1032

Automated driving has the potential to improve the safety and efficiency of future traffic and to extend elderly peoples’ driving life, provided it is perceived as comfortable and joyful and is accepted by drivers. Driving comfort could be enhanced by familiar automated driving styles based on drivers’ manual driving styles. In a two-stage driving simulator study, effects of driving automation and driving style familiarity on driving comfort, enjoyment and system acceptance were examined. Twenty younger and 20 older drivers performed a manual and four automated drives of different driving style familiarity. Acceptance, comfort and enjoyment were assessed after driving with standardised questionnaires, discomfort during driving via handset control. Automation increased both age groups’ comfort, but decreased younger drivers’ enjoyment. Younger drivers showed higher comfort, enjoyment and acceptance with familiar automated driving styles, whereas older drivers preferred unfamiliar, automated driving styles tending to be faster than their age-affected manual driving styles. **Practitioner Summary:** Automated driving needs to be comfortable and enjoyable to be accepted by drivers, which could be enhanced by driving style individualisation. This approach was evaluated in a two-stage driving simulator study for different age groups. Younger drivers preferred familiar driving styles, whereas older drivers preferred driving styles unaffected by age.

- **Keywords:** Older drivers, automated driving style, discomfort, driving enjoyment, acceptance

Julia L. Wright, Jessie Y. C. Chen & Michael J. Barnes. *Human–automation interaction for multiple robot control: the effect of varying automation assistance and individual differences on operator performance*. Pages: 1033-1045.

In a human–automation interaction study, automation assistance level (AL) was investigated for its effects on operator performance in a dynamic, multi-tasking environment. Participants supervised a convoy of manned and unmanned vehicles

traversing a simulated environment in three AL conditions, while maintaining situation awareness and identifying targets. Operators' situation awareness, target detection performance, workload and individual differences were evaluated. Results show increasing AL generally improved task performance and decreased perceived workload, however, differential effects due to operator spatial ability and perceived attentional control were found. Eye-tracking measures were useful in parsing out individual differences that subjective measures did not detect. At the highest AL, participants demonstrated potentially complacent behaviour, indicating task disengagement. **Practitioner Summary:** The effect of varying automation assistance level (AL) on operator performance on multiple tasks were examined in a within-subjects experiment. Findings indicated a moderate AL improved performance, while higher levels encouraged complacent behaviour. Effects due to individual differences suggest that effective AL depends on the underlying characteristics of the operator.

- **Keywords:** Human-automation interaction, situation awareness, workload, multi-tasking, supervisory control, individual differences, eye-tracking

M. C. Emre Simsekler, James R. Ward & P. John Clarkson. *Design for patient safety: a systems-based risk identification Framework*. Pages: 1046-1064.

Current risk identification practices applied to patient safety in healthcare are insufficient. The situation can be improved, however, by studying systems approaches broadly and successfully utilised in other safety-critical industries, such as aviation and chemical industries. To illustrate this, this paper first investigates current risk identification practices in the healthcare field, and then examines the potential of systems approaches. A systems-based approach, called the Risk Identification Framework (RID Framework), is then developed to enhance improvement in risk identification. Demonstrating the strengths of using multiple inputs and methods, the RID Framework helps to facilitate the proactive identification of new risks. In this study, the potential value of the RID Framework is discussed by examining its application and evaluation, as conducted in a real-world healthcare setting. Both the application and evaluation of the RID Framework indicate positive results, as well as the need for further research. **Practitioner Summary:** The findings in this study provide insights into how to make a better amalgamation of risk identification inputs to the safer design and more proactive risk management of healthcare delivery systems, which have been an increasing research interest amongst human factor professionals and ergonomists.

- **Keywords:** Healthcare ergonomics, patient safety, risk identification, systems approach

Nicole E. Werner, Anna F. Jolliff, Gail Casper, Thomas Martell & Kevin Ponto. *Home is where the head is: a distributed cognition account of personal health information management in the home among those with chronic illness*. Pages: 1065-1078.

Managing chronic illness requires personal health information management (PHIM) to be performed by lay individuals. Paramount to understanding the PHIM process is understanding the sociotechnical system in which it frequently occurs: the home environment. We combined distributed cognition theory and the patient work system model to investigate how characteristics of the home interact with the cognitive work of PHIM. We used a 3D virtual reality CAVE that enabled participants who had been diagnosed with diabetes ($N = 20$) to describe how they would perform PHIM in the home context. We found that PHIM is distinctly cognitive work, and rarely performed 'in the head'. Rather, features of the physical environment, tasks, people, and tools and technologies present, continuously shape and are shaped by the PHIM process. We

suggest that approaches in which the individual (sans context) is considered the relevant unit of analysis overlook the pivotal role of the environment in shaping PHIM. **Practitioner Summary:** We examined how Personal Health Information Management (PHIM) is performed in the homes of diabetic patients. We found that approaches to studying cognition that focus on the individual, to the exclusion of their context, overlook the pivotal role of environmental, social, and technological features in shaping PHIM.

- **Keywords:** Distributed cognition, patient work system, personal health information management, chronic illness

Fiona Wixted, Mark Shevlin & Leonard W. O'Sullivan. *Distress and worry as mediators in the relationship between psychosocial risks and upper body musculoskeletal complaints in highly automated manufacturing.* Pages: 1079-1093.

As a result of changes in manufacturing including an upward trend in automation and the advent of the fourth industrial revolution, the requirement for supervisory monitoring and consequently, cognitive demand has increased in automated manufacturing. The incidence of musculoskeletal disorders has also increased in the manufacturing sector. A model was developed based on survey data to test if distress and worry mediate the relationship between psychosocial factors (job control, cognitive demand, social isolation and skill discretion), stress states and symptoms of upper body musculoskeletal disorders in highly automated manufacturing companies ($n = 235$). These constructs facilitated the development of a statistically significant model (RMSEA 0.057, TLI 0.924, CFI 0.935). Cognitive demand was shown to be related to higher distress in employees, and distress to a higher incidence of self-reported shoulder and lower back symptoms. The mediation model incorporating stress states (distress, worry) as mediators is a novel approach in linking psychosocial risks to musculoskeletal disorders. **Practitioners' Summary:** With little requirement for physical work in many modern automated manufacturing workplaces, there is often minimal management focus on Work-Related Musculoskeletal Disorders (WRMSDs) as important occupational health problems. Our model provides evidence that psychosocial factors are important risk factors in symptoms of WRMSD and should be managed.

- **Keywords:** Psychosocial risks, musculoskeletal disorders, cognitive demand, distress, worry

Clark R. Dickerson, Talia Alenabi, Bernard J. Martin & Don B. Chaffin. *Shoulder muscular activity in individuals with low back pain and spinal cord injury during seated manual load transfer tasks.* Pages: 1094-1101.

This study aimed to compare the activity of four shoulder muscles in individuals with low back pain (LBP), spinal cord injuries (SCI) and a control group, during one-handed load transfer trials. Nine individuals with minimum one-year of LBP, eleven with thoracic/lumbar SCI and nine healthy controls participated in this study. The activations of anterior deltoid, upper trapezius, infraspinatus and pectoralis major were recorded by surface EMG during one-handed transferring of a cylinder from a home shelf to six spatially distributed target shelves. The integrated EMG values were compared using repeated measure ANOVA. Both LBPs and SCIs had higher anterior deltoid activation and LBPs required more upper trapezius activation than controls ($p < 0.05$). The spatial position of the targets also significantly influenced demands for these two muscles. The anterior deltoid and upper trapezius in LBP and SCI individuals are under higher demand during occupational load transfer tasks. **Practitioner Summary:** This study aimed to compare the activation of four shoulder muscles in individuals with low back pain, spinal cord injuries and healthy condition. EMG analysis showed that the injured groups

required more upper trapezius and anterior deltoid activation during load transfer tasks, which may predispose them to muscle overexertion.

- **Keywords:** Shoulder, load transferring tasks, spinal cord injuries, low back pain, workplace design

Giulia Patelli, Miyuki Morioka & Michael J. Griffin. *Frequency-dependence of discomfort caused by vibration and mechanical shocks*. Pages: 1102-1115.

The frequency content of a mechanical shock is not confined to its fundamental frequency, so it was hypothesised that the frequency-dependence of discomfort caused by shocks with defined fundamental frequencies will differ from the frequency-dependence of sinusoidal vibration. Subjects experienced vertical vibration and vertical shocks with fundamental frequencies from 0.5 to 16 Hz and magnitudes from ± 0.7 to $\pm 9.5 \text{ ms}^{-2}$. The rate of growth of discomfort with increasing magnitude of motion decreased with increasing frequency of both motions, so the frequency-dependence of discomfort varied with the magnitudes of both motions and no single frequency weighting will be ideal for all magnitudes. At the frequencies of sinusoidal vibration producing greatest discomfort (4–16 Hz), shocks produced less discomfort than vibration with same peak acceleration or unweighted vibration dose value. Frequency-weighted vibration dose values provided the best predictions of the discomfort caused by different frequencies and magnitudes of vibration and shock. **Practitioner Summary:** Human responses to vibration and shock vary according to the frequency content of the motion. The ideal frequency weighting depends on the magnitude of the motion. Standardised frequency-weighted vibration dose values estimate discomfort caused by vibration and shock but for motions containing very low frequencies the filtering is not optimum.

- **Keywords:** Vibration comfort, whole-body vibration, mechanical shocks, frequency weightings, vibration standards

Amir Baghdadi, Fadel M. Megahed, Ehsan T. Esfahani & Lora A. Cavuoto. *A machine learning approach to detect changes in gait parameters following a fatiguing occupational task*. Pages: 1116-1129.

The purpose of this study is to provide a method for classifying *non-fatigued* vs. *fatigued* states following manual material handling. A method of template matching pattern recognition for feature extraction (\$1 Recognizer) along with the support vector machine model for classification were applied on the kinematics of gait cycles segmented by our stepwise search-based segmentation algorithm. A single inertial measurement unit on the ankle was used, providing a minimally intrusive and inexpensive tool for monitoring. The classifier distinguished between states using distance-based scores from the recogniser and the step duration. The results of fatigue detection showed an accuracy of 90% across data from 20 recruited subjects. This method utilises the minimum amount of data and features from only one low-cost sensor to reliably classify the state of fatigue induced by a realistic manufacturing task using a simple machine learning algorithm that can be extended to real-time fatigue monitoring as a future technology to be employed in the manufacturing facilities. **Practitioner Summary:** We examined the use of a wearable sensor for the detection of fatigue-related changes in gait based on a simulated manual material handling task. Classification based on foot acceleration and position trajectories resulted in 90% accuracy. This method provides a practical framework for predicting realistic levels of fatigue.

- **Keywords:** Inertial measurement unit (IMU), classification, physical fatigue, wearable sensors

Jeannette Østergaard Penny, Merete Brink Speedtsberg, Thomas Kallemose & Jesper Bencke. *Can an off-the-rack orthotic stiletto alter pressure and comfort scores in the forefoot, arch and heel?* Pages: 1130-1138.

The study sought to investigate whether an orthotic stiletto could modulate the pressure and comfort under the forefoot, arch and heel that stiletto wearers experience. Twenty-two women participated. We measured the peak pressure and pressure-time integral for orthotic stilettos with built-in metatarsal pad, heel cup and arch support; standard stilettos without inlays; and trainers. Comfort was recorded during 3 × 3 working days. The orthotic stiletto exhibited lower metatarsal head1 (MTH) and MTH2+3 and heel pressures than the standard stiletto ($p < .01$), and a long second metatarsal increased MTH2+3 pressure ($p < .01$). The comfort in the forefoot and heel was higher in the orthotic stiletto than in the standard one ($p < .01$), and comfort in the forefoot was correlated to the pressure-time integral of MTH2+3 ($p = .03$) and not peak pressure. Off-the-rack orthotic stilettos can notably reduce plantar pressures and improve forefoot and heel comfort during everyday use. **Practitioner Summary:** Off-the-rack orthotic stilettos with built-in metatarsal pad, arch support and heel caps can lower the pressure under the heel and forefoot in comparison with a standard stiletto and can improve comfort during everyday use. Having a long second metatarsal is a risk factor for increased forefoot pressure.

- **Keywords:** Stiletto, heels, metatarsal pad, arch support, peak pressure, pressure-time integral, comfort

Mareike Heinzen, Eugenia Cacciatori, Frank A. Zoller & Roman Boutellier. *Who talks to whom about what? How interdisciplinary communication and knowledge of expertise distribution improve in integrated R&D labs.* Pages: 1139-1153.

Although several studies have examined the impact of open workspaces, there is still an on-going debate about its advantages and disadvantages. Our paper contributes to this debate by shedding light on three issues: the effect of open workspaces on (1) the flow of communication along and across hierarchical lines; (2) the content of communication; and (3) the specificities of open integrated laboratories. Our findings derive from a longitudinal case in a large pharmaceutical company that has relocated some R&D teams from enclosed to multi-space offices and labs. The relocation has resulted in (a) increased interdisciplinary communication, particularly at lower hierarchical levels, (b) a shift of the location of discussions and the content of conversations and (c) an improved knowledge about expertise distribution. **Practitioner Summary:** Communication is essential in knowledge-driven organisations. This article examines the impact of a relocation of R&D employees from enclosed to multi-space offices and labs on communication patterns. We explain how the new environment fosters interdisciplinary communication, shifts the location of discussions and increases the knowledge of expertise distribution.

- **Keywords:** Knowledge work, workspace, integrated laboratory, face-to-face communication, distribution of expertise