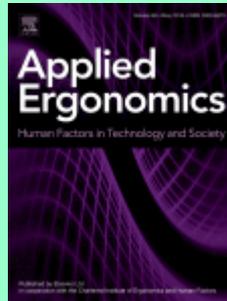


Applied Ergonomics - rok 2022, Volume 105

November



Irene Caballero-Bruno, Thomas Wohllebe, Daniel Töpfer, Pedro M. Hernández-Castellano. *The effect of seating recline on sleep quality, comfort and pressure distribution in moving autonomous vehicles.* 103844.

The revolution of technologically advanced vehicles with a high level of automation involves a profound transformation. The focus of most research in this area has been on the use of travel time for different use cases. Sleeping is one of the most time-consuming activities in everyone's life; therefore, this has been described as one of the most desired use cases for fully automated vehicles. In order to identify the best conditions to allow sleep and improve sleep quality while travelling in such vehicles, two studies were performed: a sleep study and a pressure distribution study, the results of which are included in this document. The focus of both studies was on two seat positions: reclined (60° backrest recline) and flat (87° backrest recline). In the sleep study, forty participants had the opportunity to sleep during a 90-min drive in order to evaluate long-term comfort and subjective sleep quantity and quality. Although both positions resulted in generally similar results in terms of sleep and comfort, some significant differences were identified. Karolinska Sleepiness Scale results showed that sleepiness increased in the reclined position, whereas it decreased in the flat position. Moreover, the self-reported parameter Wake After Sleep Onset was higher in the reclined position. In the pressure distribution study, it was possible to identify specific seat prototype limitations indicating inadequate support, which was related to discomfort detected during the sleep study. As a conclusion, the comparison between the reclined and flat positions showed indications that, in moving fully automated vehicles, the flat seat position is the most comfortable and effective for sleeping.

- **Keywords:** Comfort; Sleep; Ergonomics

Wonil Lee, Nanette L. Yragui, Naomi J. Anderson, Ninica Howard, Jia-Hua Lin, Stephen Bao. *The job demand-control-support model and work-related musculoskeletal complaints in daytime and nighttime janitors: The mediating effect of burnout.* 103836.

Janitors' jobs require repetitive work with low control (skill discretion, decision authority) and social support. Previous studies have found this constellation of work conditions leads to high stress levels. This study investigated the relationships among job demand-control-support, burnout, and musculoskeletal symptoms for commercial janitors in Washington State. Structural equation modeling was performed using data from 208

participants with analyses comparing models of daytime and nighttime janitors. Burnout fully mediated the relationship between job demands and musculoskeletal complaints among daytime janitors. Among nighttime janitors, burnout mediated between job demands, job control, and social support, and musculoskeletal complaints. The nighttime janitors' model was more fully supported compared to the daytime model. This study is one of a small number that examine and bring attention to the importance of janitors' burnout. Recommendations to improve the psychosocial work environment toward mitigating burnout and reducing musculoskeletal complaints are provided.

- **Keywords:** Commercial janitors; Job-demand-control-support model; Burnout; Musculoskeletal complaints; Daytime and nighttime janitors

Lu Lu, Ziyang Xie, Hanwen Wang, Li Li, Xu Xu. *Mental stress and safety awareness during human-robot collaboration* – Review. 103832.

Human-robot collaboration (HRC) is an emerging research area that has gained tremendous attention in both academia and industry. Yet, the feature that humans and robots sharing the workplace has led to safety concerns. In particular, the mental stress or safety awareness of human teammates during HRC remains unclear but is also of great importance to workplace safety. In this manuscript, we reviewed twenty-five studies for understanding the relationships between HRC and workers' mental stress or safety awareness. Specifically, we aimed to understand: (1) robot-related factors that may affect human workers' mental stress or safety awareness, (2) a number of measurements that could be used to evaluate workers' mental stress in HRC, and (3) various methods for measuring safety awareness that had been adopted or could be applied in HRC. According to our literature review, robot-related factors including robot characteristics, social touching and trajectory have relationships with workers' mental stress or safety awareness. For the measurement of mental stress and safety awareness, each method mentioned has its validity and rationality. Additionally, a discussion related to the potential co-robot actions to lower mental stress or improve safety awareness as well as future implications were provided.

- **Keywords:** Human-robot collaboration; Mental stress; Safety awareness; Workplace safety

Evy van Weelden, Maryam Alimardani, Travis J. Wiltshire, Max M. Louwerse. *Aviation and neurophysiology: A systematic review*. 103838.

This paper systematically reviews 20 years of publications (N = 54) on aviation and neurophysiology. The main goal is to provide an account of neurophysiological changes associated with flight training with the aim of identifying neurometrics indicative of pilot's flight training level and task relevant mental states, as well as to capture the current state-of-art of (neuro)ergonomic design and practice in flight training. We identified multiple candidate neurometrics of training progress and workload, such as frontal theta power, the EEG Engagement Index and the Cognitive Stability Index. Furthermore, we discovered that several types of classifiers could be used to accurately detect mental states, such as the detection of drowsiness and mental fatigue. The paper advances practical guidelines on terminology usage, simulator fidelity, and multimodality, as well as future research ideas including the potential of Virtual Reality flight simulations for training, and a brain-computer interface for flight training.

- **Keywords:** Aviation; Flight training; Neurophysiology; Electroencephalography (EEG); Functional near-infrared spectroscopy (fNIRS); Workload; Simulation fidelity; Engagement; Mental fatigue; Multimodality; Social dynamics

Carla L. MacLean. *Cognitive bias in workplace investigation: Problems, perspectives and proposed solutions.* 103860.

Psychological research demonstrates how our perceptions and cognitions are affected by context, motivation, expectation, and experience. A mounting body of research has revealed the many sources of bias that affect the judgments of experts as they execute their work. Professionals in such fields as forensic science, intelligence analysis, criminal investigation, medical and judicial decision-making find themselves at an inflection point where past professional practices are being questioned and new approaches developed. Workplace investigation is a professional domain that is in many ways analogous to the aforementioned decision-making environments. Yet, workplace investigation is also unique, as the sources, magnitude, and direction of bias are specific to workplace environments. The workplace investigation literature does not comprehensively address the many ways that the workings of honest investigators' minds may be biased when collecting evidence and/or rendering judgments; nor does the literature offer a set of strategies to address such happenings. The current paper is the first to offer a comprehensive overview of the important issue of cognitive bias in workplace investigation. In it I discuss the abilities and limitations of human cognition, provide a framework of sources of bias, as well as, offer suggestions for bias mitigation in the investigation process.

- **Keywords:** Cognitive bias; Blinding; Judgment and decision-making; Confirmation bias; Human factors; Expertise; Workplace investigation

Chun Sang Mok, Pavlo Bazilinsky, Joost de Winter. *Stopping by looking: A driver-pedestrian interaction study in a coupled simulator using head-mounted displays with eye-tracking.* 103825.

Automated vehicles (AVs) can perform low-level control tasks but are not always capable of proper decision-making. This paper presents a concept of eye-based maneuver control for AV-pedestrian interaction. Previously, it was unknown whether the AV should conduct a stopping maneuver when the driver looks at the pedestrian or looks away from the pedestrian. A two-agent experiment was conducted using two head-mounted displays with integrated eye-tracking. Seventeen pairs of participants (pedestrian and driver) each interacted in a road crossing scenario. The pedestrians' task was to hold a button when they felt safe to cross the road, and the drivers' task was to direct their gaze according to instructions. Participants completed three 16-trial blocks: (1) Baseline, in which the AV was pre-programmed to yield or not yield, (2) Look to Yield (LTY), in which the AV yielded when the driver looked at the pedestrian, and (3) Look Away to Yield (LATY), in which the AV yielded when the driver did not look at the pedestrian. The driver's eye movements in the LTY and LATY conditions were visualized using a virtual light beam. Crossing performance was assessed based on whether the pedestrian held the button when the AV yielded and released the button when the AV did not yield. Furthermore, the pedestrians' and drivers' acceptance of the mappings was measured through a questionnaire. The results showed that the LTY and LATY mappings yielded better crossing performance than Baseline. Furthermore, the LTY condition was best accepted by drivers and pedestrians. Eye-tracking analyses indicated that the LTY and LATY mappings attracted the pedestrian's attention, while pedestrians still distributed their attention between the AV and a second vehicle approaching from the other direction. In conclusion, LTY control may be a promising means of AV control at intersections before full automation is technologically feasible.

- **Keywords:** Intent communication; Virtual reality; Eye-tracking; AV-Pedestrian interaction; Multi-agent interaction

Anjum Naweed, Janine Chapman, Corneel Vandelanotte, Stephanie E. Chappel, Andreas Holtermann, Leon Straker. *'Just Right' job design: A conceptual framework for sustainable work in rail driving using the Goldilocks Work Paradigm.* 103806.

Excessive physical demand at work has traditionally been connected with adverse health outcomes, but excessive sitting is now also being recognised as an occupational hazard and emerging work-related risk. Traditional preventive occupational health and ergonomics programs are useful but limited through reliance on individual behaviour change and time-diversion from productive work. A new 'Goldilocks Work Paradigm' aims to optimise health and productivity by using movements of productive tasks. Using rail driving as a specific case of a highly sedentary and inflexible working environment, we construct a conceptual framework for designing better jobs, arguing that a theoretical amalgamation of the new Goldilocks Work Paradigm with System Thinking, Participatory Ergonomics, and a Risk Management Framework, is needed, for establishing a unified, strategic approach - a 'just right' job design model. We extend this by outlining a practical process of designing better jobs with tools that can be used to achieve it.

- **Keywords:** Systems thinking; Participatory ergonomics; Occupational health; Sedentary work; Train driving

Maximilian G. Parker, Alex Muhl-Richardson, Greg Davis. *Enhanced threat detection in three dimensions: An image-matched comparison of computed tomography and dual-view X-ray baggage screening.* 103834.

Computed Tomography (CT) is increasingly used in screening of cabin baggage in airports. The current study aimed to establish whether screening with CT confers a detection advantage over dual-view (DV) X-ray when resolution is controlled. We also evaluated whether a 'targetless' search strategy - in which screeners identify and reject safe items - improved detection relative to target-based methods. In an online study, 104 novice screeners were trained with either CT or DV, and either a targetless or a target-based search strategy. Screeners were then tested in a simulated cabin baggage screening task. CT screeners performed with greater sensitivity than DV screeners. Search strategy did not affect sensitivity, although the target-based strategy resulted in a more liberal criterion. We conclude that CT imaging confers a benefit to screening performance over DV when image resolution is controlled. This is likely due to the ability to rotate the image to resolve occlusions.

Alec Gonzales, Jia-Hua Lin, Jackie S. Cha. *Physical activity changes among office workers during the COVID-19 pandemic lockdown and the agreement between objective and subjective physical activity metrics.* 103845.

After the onset of the COVID-19 pandemic, many office workers transitioned to working-from-home (WFH) which altered routine physical activity (PA). To understand how these workers' PA were affected throughout the pandemic, PA data collected in January, April, June, and December 2020 with an activity tracker and a validated survey were analyzed. Between January and December, it was found that step counts during the weekday decreased ($p < 0.01$), weekday heart rate was higher than weekends ($p < 0.01$), activity-tracker and self-reported PA decreased ($p < 0.01$), and sitting time increased ($p < 0.01$). To understand the agreement between the objective and subjective METs, Bland-Altman analyses were completed and demonstrated an acceptable level of agreement. Findings show decreased level of PA amongst WFH office workers and that the activity tracker and survey are reliable methods of recording WFH PA.

- **Keywords:** Sedentary behavior; Wearable sensors; International physical activity questionnaire (IPAQ)

Stewart Birrell, William Payre, Katie Zdanowicz, Paul Herriotts. *Urban air mobility infrastructure design: Using virtual reality to capture user experience within the world's first urban airport.* 103843.

Human factors research can play an important role in the successful design of infrastructure to support future mobility. Through engaging users and stakeholders early in the design process we can gain insights before the physical environments are built. This paper presents data from a truly novel application of Virtual Reality (VR), where user experience and wayfinding were evaluated within an emerging future transport infrastructure to support urban air mobility (UAM) – the urban airport (aka vertiports). Urban airports are located in city centres where drones or 'flying cars' would land and take off from. Previous quantitative studies have investigated passenger experience in traditional airports using field observation and surveys, but this paper is the first to present qualitative research on user experience in this emerging mobility infrastructure using an immersive VR environment. Twenty participants completed a series of six scenarios aimed at understanding customer 'exciters' and 'pain points' within an urban airport. Results and recommendations from this empirical research will help inform the design of all future mobility infrastructure solutions, through improving user experience before the infrastructure is physically deployed. Finally, this paper highlights the benefits of engaging users at an early stage of the design process to ensure that future transport infrastructure will be accessible, easy to navigate and a pleasure to use.

- **Keywords:** Urban air mobility; User experience; Virtual reality; User-centred design; Human factors

AnnaKlara Stenberg Gleisner, Linda Rose, Catherine Trask. *Towards safety and autonomy in the home bathroom: Identifying challenges, needs and gaps.* 103865.

This qualitative study aims to identify challenges, needs and gaps for home care bathroom tasks and gather information that will allow for user-centered, sustainable solutions for home care in the bathroom. Twenty-one interviews were carried out with participants with the perspective of client, health care worker or care organization. The data were analyzed using qualitative content analysis and interpretive description. The findings identify important factors for enabling both independent living for clients and a sustainable work environment for the health care workers. They include adequate space, access to assistive devices and regular risk assessments to recognize changing needs. Enabling independent living is one strategy that can be used to manage the ongoing demographic change as well as the expected future labor shortage in the care sector. Changes can be made in the physical environment (the residential bathroom) in order to facilitate safer task performance for both the clients and the health care workers.

- **Keywords:** Home care; Assistive devices; Injury prevention; Ageing in place; Independent living

Sebastian Mach, Pamela Storozyński, Josephine Halama, Josef F. Krems. *Assessing mental workload with wearable devices – Reliability and applicability of heart rate and motion measurements.* 103855.

Wearable devices are increasingly used for assessing physiological data. Industry 4.0 aims to achieve the real-time assessment of the workers' condition to adapt processes including the current mental workload. Mental workload can be assessed via physiological data. This paper researches the potential of wearable devices for mental workload

assessment by utilizing heart rate and motion data collected with a smartwatch. A laboratory study was conducted with four levels of mental workload, ranging from none to high and during sitting and stepping activities. When sitting, a difference in the heart rate and motion data from the smartwatch was only found between no mental workload and any mental workload task. For the stepping condition, differences were found for the movement data. Based on these results, wearable devices could be useful in the future for detecting whether a mental demanding task is currently performed during low levels of physical activity.

- **Keywords:** Workload assessment; Wearable devices; Validation

Rebecca Wendland, Linda Bossi, Michele Oliver. *Biomechanical and physiological effects of female soldier load carriage: A scoping review.* 103837.

Loads carried by military populations can affect those of smaller stature, such as the average female, due to the higher percentage of body weight the loads represent. Despite this, most load carriage research is performed on males. Peer reviewed articles were collected from four databases to summarize available research on biomechanical and physiological effects of load carriage on females in the military. Extraction and thematic analysis were performed on 18 articles. 39% looked at biomechanical differences between loads in females, 61% looked at how the same load affected males and females, 44% looked at sex-by-load interaction effects, and 72% discussed impacts of load on females. The research revealed that military load carriage affects the biomechanics and physiology differently in females and to a greater extent than in males. Several gaps in available literature were found. Very few studies used military participants, military equipment, and/or employed occupationally relevant data collection methodologies.

- **Keywords:** Load carriage; Biomechanics; Physiology; Female; Military

Francesco Cigarini, Peer Schminkel, Michael Sonnekalb, Pascal Best, Dietmar Göhlich. *Determination of improved climatic conditions for thermal comfort and energy efficiency in electric buses.* 103856.

In electric buses, the heating, ventilation and air conditioning (HVAC) system is responsible for up to 50% of the energy consumption, thereby significantly affecting the efficiency. It is therefore necessary to identify improved thermal settings for the bus cabin to minimize the energy consumption, while guaranteeing good thermal comfort. To achieve this goal, this paper presents the results of climatic measurements in an electric bus in Berlin, Germany. These measurements were performed for outer temperatures between 5.3 °C and 7.8 °C and four cabin temperature settings. During the measurements, several climatic parameters and the energy consumption were measured, whereas the thermal comfort (TC) was evaluated via 71 passengers' surveys. The results show that the climatic conditions in the bus vary greatly depending on the position (up to 3 K difference in mean air temperature) and height (up to 8 K/m temperature-to-height ratio). Additionally, the surveys show that the mean value of the thermal comfort parameter TC is minimized to a value of 0.15 (corresponding to "comfortable" thermal perception) for a set temperature of 21 °C, whereas the thermal conditions are perceived as acceptable even with heating off.

- **Keywords:** Electric buses; HVAC system; Thermal comfort; Energy efficiency

Shannon P. Devlin, Noelle L. Brown, Sabrina Drollinger, Ciara Sibley, Jawad Alami, Sara L. Riggs. *Scan-based eye tracking measures are predictive of workload transition performance.* 103829.

Given there is no unifying theory or design guidance for workload transitions, this work investigated how visual attention allocation patterns could inform both topics, by understanding if scan-based eye tracking metrics could predict workload transition performance trends in a context-relevant domain. The eye movements of sixty Naval flight students were tracked as workload transitioned at a slow, medium, and fast pace in an unmanned aerial vehicle testbed. Four scan-based metrics were significant predictors across the different growth curve models of response time and accuracy. Stationary gaze entropy (a measure of how dispersed visual attention transitions are across tasks) was predictive across all three transition rates. The other three predictive scan-based metrics captured different aspects of visual attention, including its spread, directness, and duration. The findings specify several missing details in both theory and design guidance, which is unprecedented, and serves as a basis of future workload transition research.

- **Keywords:** Workload transitions; Eye tracking; Growth curve modeling; Supervisory control

Mikael Forsman, Xuelong Fan, Ida-Märta Rhen, Carl Mikael Lind. *Mind the gap - development of conversion models between accelerometer- and IMU-based measurements of arm and trunk postures and movements in warehouse work.* 103841.

Sensor type (accelerometers only versus inertial measurement units, IMUs) and angular velocity computational method (inclination versus generalized velocity) have been shown to affect the measurements of arm and trunk movements. This study developed models for conversions between accelerometer and IMU measurements of arm and trunk inclination and between accelerometer and IMU measurements of inclination and generalized (arm) velocities. Full-workday recordings from accelerometers and IMUs of arm and trunk postures and movements from 38 warehouse workers were used to develop 4 angular (posture) and 24 angular velocity (movement) conversion models for the distributions of the data. A power function with one coefficient and one exponent was used, and it correlated well ($r^2 > 0.999$) in all cases to the average curves comparing one measurement with another. These conversion models facilitate the comparison and merging of measurements of arm and trunk movements collected using the two sensor types and the two computational methods.

- **Keywords:** Inertial measurement unit; Field measurement; Sensor conversion

Aroa González Fuentes, Nélica M. Busto Serrano, Fernando Sánchez Lasheras, Gregorio Fidalgo Valverde, Ana Suárez Sánchez. *Work-related overexertion injuries in cleaning occupations: An exploration of the factors to predict the days of absence by means of machine learning methodologies.* 103847.

The special characteristics of the cleaning industry have an important impact on the health and safety of its workforce. Making use of data from more than 79,000 occupational accidents, the aim of the present research is to use machine learning techniques to develop a model to predict incapacity for work (expressed in days of absence) due to work-related overexertion injuries among service sector cleaners in Spain. The severity of accidents caused by overexertion depends on several factors that can be classified into the following categories: injury typology, individual factors, employment conditions, accident circumstances and health and safety management and standards in the company.

- **Keywords:** Work-related overexertion injuries; Absenteeism; Musculoskeletal disorders (MSD); Cleaning sector; Machine learning

May Jorella Lazaro, Jaeyong Lee, Jaemin Chun, Myung Hwan Yun, Sungho Kim. *Multimodal interaction: Input-output modality combinations for identification tasks in augmented reality.* 103842.

Multimodal interaction (MMI) is being widely implemented, especially in new technologies such as augmented reality (AR) systems since it is presumed to support a more natural, efficient, and flexible form of interaction. However, limited research has been done to investigate the proper application of MMI in AR. More specifically, the effects of combining different input and output modalities during MMI in AR are still not fully understood. Therefore, this study aims to examine the independent and combined effects of different input and output modalities during a typical AR task. 20 young adults participated in a controlled experiment in which they were asked to perform a simple identification task using an AR device in different input (speech, gesture, multimodal) and output (VV-VA, VV-NA, NV-VA, NV-NA) conditions. Results showed that there were differences in the influence of input and output modalities on task performance, workload, perceived appropriateness, and user preference. Interaction effects between the input and output conditions on the performance metrics were also evident in this study, suggesting that although multimodal input is generally preferred by the users, it should be implemented with caution since its effectiveness is highly influenced by the processing code of the system output. This study, which is the first of its kind, has revealed several new implications regarding the application of MMI in AR systems.

- **Keywords:** Multimodal interaction; Sensory modalities; Processing codes; Modality combination; Augmented reality

Katherina A. Jurewicz, David M. Neyens. *Redefining the human factors approach to 3D gestural HCI by exploring the usability-accuracy tradeoff in gestural computer systems.* 103833.

3D gestural technology for HCI could transform the way people interact with computing systems. There are traditionally two approaches to developing gestural technology systems: a human-based approach where usability is maximized and a technology-based approach where system accuracy is maximized. The tradeoff between usability and accuracy may negatively affect the overall trust and reliability in the system. Therefore, this study seeks to redefine the human-based approach to gestural system development by introducing a bottom-up approach to identifying the lower-level features that produce a gesture, thus allowing the technology to accurately recognize features. A user elicitation study was performed, and gestures were classified according to a novel feature extraction gesture taxonomy and a traditional taxonomy of classifying gestures as a unit. The feature-extraction approach revealed several advantages because it fosters a bottom-up approach to identifying gesture features. Using this approach may mitigate the effects of the usability-accuracy tradeoff in gestural system development.

- **Keywords:** 3D gestural systems; Human-computer interaction; Computer system development

Jia-Hua Lin, Wonil Lee, Caroline K. Smith, Nanette L. Yragui, Michael Foley, Gwanseob Shin. *Cleaning in the 21st Century: The musculoskeletal disorders associated with the centuries-old occupation – A literature review.* 103839.

Workers performing cleaning duties experience higher injury rates, especially in the form of musculoskeletal disorders (MSDs), than other industries. It is essential to understand

the inherent risks associated with the nature of this occupation. Based on the Balance Theory (Smith & Carayon-Sainfort, 1989), this review surveys the current literature, especially those published since the previous review paper (Kumar & Kumar, 2008), and identifies which elements contributing to MSD risks were examined: task, technology, organization, environment, individual, and their interactions. Thirty-nine research papers published between 2005 and 2021 are identified and summarized. Among these papers, task and individual elements received the most attention, at 42 and 34 occurrences, respectively. The interaction elements of technology-organization, technology-environment, and organization-environment received less than three mentions. The goal of this literature review is to update the knowledge base and identify current trends for the cleaning occupation. Possible interventions for risk reduction and future research directions are suggested.

- **Keywords:** Musculoskeletal disorders; Macroergonomics; Systems approach; Psychosocial factors; Globalization

Emma C. Falkland, Mark W. Wiggins, Heather Douglas, Daniel Sturman, Jaime C. Auton, Lisa Shieh, Johanna I. Westbrook. *Explaining emergency physicians' capacity to recover from interruptions.* 103857.

Objective: To assess whether the capacity to utilize cues amongst emergency physicians is associated with differences in the capacity to recover performance following an interruption. **Background:** Interruptions are implicated in errors in emergency medicine due to the cognitive load that they impose on working memory, resulting in a loss of performance on the primary task. The utilization of cues is associated with a reduction in cognitive load during the performance of a task, thereby enabling the allocation of residual resources that mitigates the loss of performance following interruptions. **Method:** Thirty-nine emergency physicians, recruited at a medical conference, completed an assessment of cue utilization (EXPERTise 2.0) and an online simulation (Septris) that involved the management of patients presenting with sepsis. During the simulation, physicians were interrupted and asked to check a medication order. Task performance was assessed using scores on Septris, with points awarded for the accurate management of patients. **Results:** Emergency physicians with higher cue utilization recorded significantly higher scores on the simulation task following the interruption, compared to physicians with lower cue utilization ($p = .028$). **Conclusion:** The results confirm a relationship between cue utilization and the recovery of performance following an interruption. This is likely due to the advantages afforded by associated reductions in cognitive load. **Application:** Assessments of cue utilization may assist in the development of interventions to support clinicians in interruptive environments.

Ketan Thakur, Pranav Madhav Kuber, Masoud Abdollahi, Ehsan Rashedi. *Why multi-tier surgical instrument table matters? An ergonomic analysis from mento-physical demand perspectives.* 103828.

Using traditional back tables (BT) in operating rooms (OR) can lead to high physical/cognitive demand on nurses due to repetitive manual material handling activities. A multi-tier table (MTT) has been developed to relieve such stressors by providing extra working surfaces to avoid stacking the instrument trays and facilitate access to surgical tools. In this study, sixteen participants performed lifting/lowering and instrument findings tasks on each table, where kinematics, kinetics, subjective, and performance-related measures were recorded. Results indicated that MTT required lesser shoulder flexion (p -value <0.001), ~14% lower shoulder loads (0.012), task completion time (<0.001), and cognitive/physical workloads (<0.004). Although peak low-back demands were ~15% higher using MTT, the number of lifts to complete the same task was 60% lower, leading to lower cumulative demand on the low-back musculature. Utilizing MTT in OR could reduce demand and increase nurses' efficiency, leading to reduced risk of WMSDs and the total time of surgery.

- **Keywords:** Operating room; Perioperative nurses; Biomechanics; Manual material handling; Low-back pain; Musculoskeletal disorders; Wearable sensors

Jack Hutchinson, Luke Strickland, Simon Farrell, Shayne Loft. *Human behavioral response to fluctuating automation reliability*. 103835.

Human perception of automation reliability and automation acceptance behaviours are key to effective human-automation teaming. This study examined factors that impact perceptions of automation reliability over time and the acceptance of automated advice. Participants completed a maritime vessel classification task in which they classified vessels (contacts) with the assistance of automation. In Experiment 1 automation reliability successively switched from high to low (or vice versa). In Experiment 2 automation reliability decreased by varying magnitudes before returning to high. Participants did not initially calibrate to true reliability and experiencing low automation reliability reduced future reliability estimates when experiencing subsequent high reliability. Automation acceptance was predicted by positive differences between participant perception of automation reliability and confidence in their own manual classification reliability. Experiencing low automation reliability caused perceptions of reliability and automation acceptance rates to diverge. These findings have important implications for training and adaptive human-automation teaming in complex work environments.

- **Keywords:** Automation reliability; Human-automation teaming; Automation reliance