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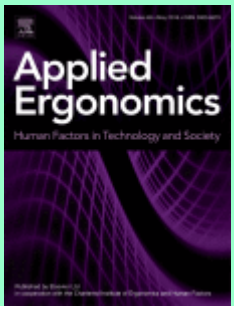


Michael A. Cvirn, Jillian Dorrian, Bradley P. Smith, Grace E. Vincent, Sally A. Ferguson. *The effects of hydration on cognitive performance during a simulated wildfire suppression shift in temperate and hot conditions*. Pages 9-15.

The effects on dehydration and cognitive performance from heat and/or physical activity are well established in the laboratory, although have not yet been studied for personnel working in occupations such as wildland firefighting regularly exposed to these types of conditions. This study aimed to investigate the effects of temperature and dehydration on seventy-three volunteer firefighters (35.7 ± 13.7 years, mean ± standard deviation) during a simulation of wildfire suppression under either *control* or *hot* (18–20; or 33–35 °C) temperature conditions. Results showed cognitive performance on the psychomotor vigilance task declined when participants were dehydrated in the heat and Stroop task performance was impaired when dehydrated late in the afternoon. Firefighters may be at risk of deteriorations in simple cognitive functions in the heat whilst dehydrated, although may also experience impairments in complex cognitive functions if dehydrated late in the day, irrespective of the environmental temperature.

Esdras Paravizo, Daniel Braatz. *Using a game engine for simulation in ergonomics analysis, design and education: An exploratory study*. Pages 22-28.

Among the possible approaches for building virtual environments (VE), researchers have recently started employing game engines (GE). Although there are already studies reporting the usage of GE-based VEs, their potential for supporting a more comprehensive workspace analysis (considering the physical, organizational and cognitive aspects of work) has yet to be better understood. The main goal of this paper is to investigate how a GE-based simulation of a real workplace (a local control room in an oil refinery) can be used as a tool by practitioners and researchers in evaluating work conditions. Participants (n = 38) were recruited to explore the simulation and evaluate the workplace dimensions represented. A comparison between the scores participants attributed to the work dimensions and the scores assigned by the ergonomics consultant was performed through a statistical test to verify whether they significantly differed or not. Out of the 10 aspects evaluated, only 3 presented significant differences, thus showing that GE suitability for ergonomics analysis is conditioned to the aspects represented. Qualitative data analysis highlighted participants' perception of GEs potential as an analysis and educational tool, as well as a medium for fostering communication and stakeholder involvement in the design process.

Marie Birk Jørgensen, Nidhi Gupta, Mette Korshøj, Julie Lagersted-Olsen, ... Andreas Holtermann. *The DPhacto cohort: An overview of technically measured physical activity at work and leisure in blue-collar sectors for practitioners and researchers*. Pages 29-39.

For improved prevention of health issues among blue-collar workers, there is a need for an overview of the physical activity at work and leisure using technical long-term measurements in blue-collar sectors investigation of differences between the sectors. Thus, the objective of this paper was to provide an overview and investigate differences in physical activities and body postures at work and leisure among blue-collar sectors.

The Dphacto cohort consists of 1087 workers from manufacturing, transportation and cleaning sectors (901 blue-collar and 186 white-collar workers) in Denmark. Eligible workers provided physical activity and heart rate measurements over several days with follow-up on health-related outcomes by self-report and registers.

Considerable differences in sitting, standing, time on feet (walking, shuffling and standing combined) and forward bending of the back were found between work and leisure, and between the sectors. This overview of physical activity at work and leisure can be useful for better prevention of work-related health issues among blue-collar workers.

Franka Wehr, Jürgen Held. *Stereoscopic versus monoscopic displays: Learning fine manual dexterity skills using a microsurgical task simulator*. Pages 40-49.

We investigated the learning of fine manual dexterity with a microsurgical instrument and a new simulator in a context of microsurgery. 30 subjects were divided into two groups. One (3D group) interacted with a stereoscopic and the other (2D group) with a monoscopic display. Visual information for the displays was captured from a surgical stereomicroscope. In 20 trials, both groups performed the repetitive tasks of picking up small rods from a funnel-shaped cavity and placing them outside. In analysing learning curves, we found that the initial learning process for hand-eye coordination is easier with a 3D display, and that performance persists at a higher level of proficiency than with the 2D display option. Thus stereoscopic displays can be especially beneficial for novices, for those learning new procedures, or for providing orientation to operators facing a new or altered spatial situation. Simulators with few reliefs or spatial textures should not be used for comparison between 3D and 2D viewing conditions.

Tad T. Brunyé, Shaina B. Martis, John A. Kirejczyk, Kathryn Rock. *Camouflage pattern features interact with movement speed to determine human target detectability*. Pages 50-57.

Applied ergonomics research examines not only the fit, form and function of military uniforms, but also their ability to effectively camouflage personnel as they perform job-related tasks. Many of these job-related tasks involve moving through environments, but existing literature examining camouflage effectiveness often assumes that movement effectively "breaks" even the best camouflage patterns, rendering them of limited utility for reducing the visual signature of a moving target. However, recent research demonstrates that animals equipped with adaptive camouflage change their patterning in predictable ways during movement and this adaptation decreases detectability, suggesting that uniform patterning may still hold value for reducing conspicuity during movement. The present experiment examined whether three visual pattern characteristics, local contrast, orientation, and spatial frequency, would influence the detectability of a moving human target. Participants attempted to detect and localize a simulated human target moving across a background scene, and a factorial design varied

target movement speed, and the local contrast, spatial frequency, and orientation of its camouflage patterning. Results showed that target detectability was strongly influenced by target movement rate, pattern local contrast, and pattern spatial frequency, and these effects persisted even under conditions of very fast movement. Importantly, we found that the effect of local contrast was *most* robust under conditions of movement, suggesting its importance for reducing detectability of moving personnel. We conclude that movement is not always sufficient to break the concealment offered by a pattern with low contrast and a spatial frequency match with its background. Results are discussed in the context of visual processing theories and the application of these findings to the design and development of static and adaptive camouflage patterns for military personnel.

Chao-Hung Wang, Ni-Hsin Tsai, Jun-Ming Lu, Mao-Jiun J. Wang. *Usability evaluation of an instructional application based on Google Glass for mobile phone disassembly tasks*. Pages 58-69.

This study aims at comparing a Google Glass-based instructional application with a printed manual in mobile phone disassembly tasks. Thirty participants (15 males and 15 females) were recruited to perform tasks via three types of instructional methods (Google Glass-based augmented reality, Google Glass-based video, and a printed manual). The objective measures of performance (task completion time, error counts), and the subjective measures (NASA-Task Load Index, system usability scale) were considered. Additionally, visual fatigue was assessed by critical flicker fusion frequency and near point accommodation. According to the findings, although the printed manual method produced better results regarding mental workload and system usability, the augmented reality method improved error reduction and efficiency. Furthermore, the participants indicated that the displayed animations were helpful in locating the exact work-pieces. The augmented reality method is believed to be a potential alternative to printed manuals in mobile disassembly tasks.

R. Schnittker, S.D. Marshall, T. Horberry, K. Young. *Decision-centred design in healthcare: The process of identifying a decision support tool for airway management*. Pages 70-82.

Current decision support interventions for airway management in anaesthesia lack the application of Human Factors Engineering; leading to interventions that can be disruptive, inefficient and error-inducing. This study followed a decision-centred design process to identify decision support that can assist anaesthesia teams with challenging airway management situations. Field observations, Critical Decision Method interviews and focus groups were conducted to identify the most difficult decisions and their requirements. Data triangulation narrowed the focus to key decisions related to preparation and planning, and the transitioning between airway techniques during difficulties. Five decision-support interventions were identified and positively rated by anaesthesia team members in relation to their perceived effectiveness. An organized airway equipment trolley was chosen as the most beneficial decision support intervention. This study reiterated the key importance of both Human Factors Engineering and data triangulation when designing for healthcare.

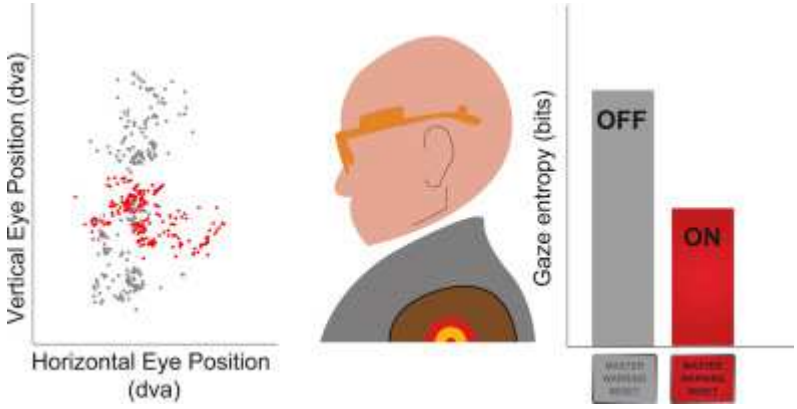
Kyle A. Bernhardt, Dmitri Poltavski, Thomas Petros, F. Richard Ferraro, ... Colt Iseminger. *The effects of dynamic workload and experience on commercially available EEG cognitive state metrics in a high-fidelity air traffic control environment*. Pages 83-91.

The current study evaluated the validity of commercially available electroencephalography (EEG) cognitive state metrics of workload and engagement in differentially experienced air traffic control (ATC) students. EEG and pupil diameter

recordings were collected from 47 ATC students (27 more experienced and 20 less experienced) during a high-fidelity, variable workload approach-control scenario. Scenario workload was manipulated by increasing the number of aircraft released and the presence of a divided attention task. Results showed that scenario performance significantly degraded with increased aircraft and the presence of the divided attention task. No scenario performance differences were found between experience groups. The EEG engagement metric significantly differed between experience groups, with less experienced controllers exhibiting higher engagement than more experienced controllers. The EEG workload metric and pupil diameter were sensitive to workload manipulations but did not differentiate experience groups. Commercially available EEG cognitive state metrics may be a viable tool for enhancing ATC training.

Carolina Diaz-Piedra, Hector Rieiro, Alberto Cherino, Luis J. Fuentes, ... Leandro L. Di Stasi. *The effects of flight complexity on gaze entropy: An experimental study with fighter pilots*. Pages 92-99.

We studied the effects of task load variations as a function of flight complexity on combat pilots' gaze behavior (i.e., entropy) while solving in-flight emergencies. The second company of the Spanish Army Attack Helicopter Battalion ($n = 15$) performed three sets of standardized flight exercises with different levels of complexity (low [recognition flights], medium and high [emergency flights]). Throughout the flight exercises we recorded pilots' gaze entropy, as well as pilots' performance (assessed by an expert flight instructor) and subjective ratings of task load (assessed by the NASA-Task Load Index). Furthermore, we used pilots' electroencephalographic (EEG) activity as a reference physiological index for task load variations. We found that pilots' gaze entropy decreased ~2% (i.e., visual scanning became less erratic) while solving the emergency flight exercises, showing a significant decreasing trend with increasing complexity ($p < .05$). This is in consonance with the ~12% increase in the frontal theta band of their EEG spectra during said exercises. Pilots' errors and subjective ratings of task load increased as flight complexity increased (p-values $< .05$). Gaze data suggest that pilots used nondeterministic visual patterns when the aircraft was in an error-free state (low complexity), and changed their scanning behavior, becoming more deterministic, once emergencies occurred (medium/high complexity). Overall, our findings indicate that gaze entropy can serve as a sensitive index of task load in aviation settings.



Diana Underwood, Ruth Sims. *Do office workers adjust their chairs? End-user knowledge, use and barriers to chair adjustment*. Pages 100-106.

A quantitative field study measured end-user availability, knowledge and use levels of adjustable office chair functions in Korea-based office workers, together with their perceived barriers towards making adjustments. Fifty-one English-speaking workers were interviewed and surveyed in a related design. Results showed that of the number of adjustable functions available on their office chair ($M = 5.39$, $SD = 2.3$), participants knew

fewer than half of them ($M = 2.51$, $SD = 1.52$) and used even less ($M = 1.86$, $SD = 1.21$). Fifty-three percent of participants knew two or less and 73% had used only two or less. Ten percent had used none. Results suggested physical needs (such as increased comfort or postural change) were a strong driver for previous chair adjustment behaviour. Perceived cognitive barriers played a more significant role in limiting chair adjustment knowledge and use than physical or organizational barriers. Highly adjustable office chairs have the possibility of satisfying the adjustment needs of most end-users. However, adjustable chair functions need to be both available and known in order to be used.

Special Section on Comfort; Edited by Peter Vink, Susanne Frohriep, Neil J Mansfield & Alessandro Naddeo

Lizandra da Silva Menegon, Silvana Ligia Vincenzi, Dalton Francisco de Andrade, Pedro Alberto Barbetta, ... Eugenio Andrés Díaz Merino. An aircraft seat discomfort scale using item response theory. Pages 1-8.

The purpose of this study is to construct an aircraft seat discomfort scale and verify the evidence of its validity and reliability. We developed a questionnaire and presented it to 1500 Brazilian passengers at an airport. The data analysis included: 1) factor analysis; 2) the analysis of the items to be used in the scale created using Item Response Theory. The scale covered all levels, from "without discomfort" to "maximum discomfort". At the level of minimal, a passenger feels that the aircraft seat is cramped and has little space. Discomfort tends to increase when passengers are unable to perform desired activities (eg: reading, sleeping), which causes irritation and disappointment. The maximum discomfort level occurs when noise disrupts activities and an aircraft seat is considered hard. The scale developed presented indications that it is reliable and valid, proving to be a useful tool for identifying levels of discomfort in aircraft seats.

Suzanne Hiemstra-Van Mastrigt, Richard Ottens, Peter Vink. *Identifying bottlenecks and designing ideas and solutions for improving aircraft passengers' experience during boarding and disembarking*. Pages 16-21.

Interferences during the boarding procedure are one of the main reasons of delay and increased turnaround time, becoming a relevant problem for airlines. Observations of the boarding process and questionnaires inside the aircraft revealed three main bottlenecks during the boarding process: (1) Hand luggage: Storage space is not sufficient and/or not used efficiently; (2) Preparation: Passengers are not well prepared for the boarding process; and (3) Communication: Audio announcements are unclear and unfocused. By translating these bottlenecks as possibilities for improvement, solutions were designed for the airport and aircraft interiors to reduce boarding time and improve the passenger boarding experience. Concepts ranged from an app to scan your hand luggage at home and make a reservation for overhead bin space; to a redesigned waiting area to help passengers prepare for boarding; to new boarding methods and redesigned aircraft seats. In this paper, several design concepts are presented in more detail.