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**Sandra Keller, Franziska Tschan, Guido Beldi, Anita Kurmann, Daniel Candinas & Norbert K. Semmer. *Noise peaks influence communication in the operating room. An observational study.* Pages 1541-1552.**

Noise peaks are powerful distractors. This study focuses on the impact of noise peaks on surgical teams' communication during 109 long abdominal surgeries. We related measured noise peaks during 5-min intervals to the amount of observed communication during the same interval. Results show that noise peaks are associated with less case-relevant communication; this effect is moderated by the level of surgical experience; case-relevant communications decrease under high noise peak conditions among junior, but not among senior surgeons. However, case-irrelevant communication did not decrease under high noise level conditions, rather there was a trend to more case-irrelevant communication under high noise peaks. The results support the hypothesis that noise peaks impair communication because they draw on attentional resources rather than impairing understanding of communication. As case-relevant communication is important for surgical performance, exposure to high noise peaks in the OR should be minimised especially for less experienced surgeons. **Practitioner Summary:** This study investigated whether noise during surgeries influenced the communication within surgical teams. During abdominal surgeries, noise levels were measured and communication was observed. Results showed that high noise peaks reduced the frequency of patient-related communication, but did not reduce patient-irrelevant communication. Noise may negatively affect team coordination in surgeries.

- **Keywords:** Operating room, noise, communication, distractors

**Jordan Navarro, Elsa Yousfi, Jonathan Deniel, Christophe Jallais, Mercedes Bueno & Alexandra Fort. *The impact of false warnings on partial and full lane departure warnings effectiveness and acceptance in car driving.* Pages 1553-1564.**

In the past, lane departure warnings (LDWs) were demonstrated to improve driving behaviours during lane departures but little is known about the effects of unreliable warnings. This experiment focused on the influence of false warnings alone or in combination with missed warnings and warning onset on assistance effectiveness and

acceptance. Two assistance unreliability levels (33 and 17%) and two warning onsets (partial and full lane departure) were manipulated in order to investigate interaction. Results showed that assistance, regardless unreliability levels and warning onsets, improved driving behaviours during lane departure episodes and outside of these episodes by favouring better lane-keeping performances. Full lane departure and highly unreliable warnings, however, reduced assistance efficiency. Drivers' assistance acceptance was better for the most reliable warnings and for the subsequent warnings. The data indicate that imperfect LDWs (false warnings or false and missed warnings) further improve driving behaviours compared to no assistance. **Practitioner Summary:** This study revealed that imperfect lane departure warnings are able to significantly improve driving performances and that warning onset is a key element for assistance effectiveness and acceptance. The conclusion may be of particular interest for lane departure warning designers.

- **Keywords:** Lane departure warning, warning onset, false alert, alert miss, steering behavior

**Bryan Reimer, Bruce Mehler, Ian Reagan, David Kidd & Jonathan Dobres. [Multi-modal demands of a smartphone used to place calls and enter addresses during highway driving relative to two embedded systems.](#) Pages 1565-1585.**

There is limited research on trade-offs in demand between manual and voice interfaces of embedded and portable technologies. Mehler et al. identified differences in driving performance, visual engagement and workload between two contrasting embedded vehicle system designs (Chevrolet MyLink and Volvo Sensus). The current study extends this work by comparing these embedded systems with a smartphone (Samsung Galaxy S4). None of the voice interfaces eliminated visual demand. Relative to placing calls manually, both embedded voice interfaces resulted in less eyes-off-road time than the smartphone. Errors were most frequent when calling contacts using the smartphone. The smartphone and MyLink allowed addresses to be entered using compound voice commands resulting in shorter eyes-off-road time compared with the menu-based Sensus but with many more errors. Driving performance and physiological measures indicated increased demand when performing secondary tasks relative to 'just driving', but were not significantly different between the smartphone and embedded systems. **Practitioner Summary:** The findings show that embedded system and portable device voice interfaces place fewer visual demands on the driver than manual interfaces, but they also underscore how differences in system designs can significantly affect not only the demands placed on drivers, but also the successful completion of tasks.

- **Keywords:** Voice interface, visual demand, distraction, workload, human machine interface

**Ian J. Reagan, Tim Frischmann & Matthew L. Brumbelow. *Test track evaluation of headlight glare associated with adaptive curve HID, fixed HID, and fixed halogen low beam headlights.* Pages 1586-1595.**

adaptive curve headlights swivel with steering input and are linked to reduced insurance claims and improved visual performance. This study assessed glare experienced from adaptive curve high-intensity discharge (HID), fixed (non-swiveling) HID and fixed halogen headlights – all tested in low beam mode. Twenty participants rated glare from vehicles' headlights using the DeBoer visual discomfort scale as a test driver drove towards them from five approaches on a test track. Participants rated the fixed halogen condition as less glaring than the adaptive curve and fixed HID conditions. There was no significant difference in ratings between the HID low-beam conditions. Collapsing across roadway approaches, the mean subjective ratings for the fixed halogen, adaptive curve

HID and fixed HID low-beam conditions indicated 'satisfactory' levels of glare. Differences between subjective ratings were supported by illuminance data. Differences among the three low-beam systems appear minor, relative to their differences from a benchmark high-beam condition. **Practitioner Summary:** Insurance data indicates reduced claims associated with adaptive curve lighting. The current effort was to study how such lighting affects discomfort glare of oncoming drivers relative to conventional headlights. Participants rated halogen headlights as less glaring than fixed and adaptive curve HID low beams. Differences among systems were small and associated with acceptable levels of discomfort glare.

- **Keywords:** Adaptive curve headlights, discomfort glare, night time driving

**Antonio Peña-García, Rocío de Oña, Pedro Antonio García & Juan de Oña. *Personal factors influencing the visual reaction time of pedestrians to detect turn indicators in the presence of Daytime Running Lamps. Pages 1596-1605.***

Daytime running lamps (DRL) on vehicles have proven to be an effective measure to prevent accidents during the daytime, particularly when pedestrians and cyclists are involved. However, there are negative interactions of DRL with other functions in automotive lighting, such as delays in pedestrians' visual reaction time (VRT) when turn indicators are activated in the presence of DRL. These negative interactions need to be reduced. This work analyses the influence of variables inherent to pedestrians, such as height, gender and visual defects, on the VRT using a classification and regression tree as an exploratory analysis and a generalized linear model to validate the results. Some pedestrian characteristics, such as gender, alone or combined with the DRL colour, and visual defects, were found to have a statistically significant influence on VRT and, hence, on traffic safety. These results and conclusions concerning the interaction between pedestrians and vehicles are presented and discussed. **Practitioner Summary:** Visual interactions of vehicle daytime running lamps (DRL) with other functions in automotive lighting, such as turn indicators, have an important impact on a vehicle's conspicuity for pedestrians. Depending on several factors inherent to pedestrians, the visual reaction time (VRT) can be remarkably delayed, which has implications in traffic safety.

- **Keywords:** Perception, vision and lighting, product safety, injury risks

**Michelle Jessica Pereira, Leon Melville Straker, Tracy Anne Comans & Venerina Johnston. *Inter-rater reliability of an observation-based ergonomics assessment checklist for office workers. Pages 1606-1612.***

**Objectives:** To establish the inter-rater reliability of an observation-based ergonomics assessment checklist for computer workers. **Methods:** A 37-item (38-item if a laptop was part of the workstation) comprehensive observational ergonomics assessment checklist comparable to government guidelines and up to date with empirical evidence was developed. Two trained practitioners assessed full-time office workers performing their usual computer-based work and evaluated the suitability of workstations used. Practitioners assessed each participant consecutively. The order of assessors was randomised, and the second assessor was blinded to the findings of the first. Unadjusted kappa coefficients between the raters were obtained for the overall checklist and subsections that were formed from question-items relevant to specific workstation equipment. **Results:** Twenty-seven office workers were recruited. The inter-rater reliability between two trained practitioners achieved moderate to good reliability for all except one checklist component. **Conclusions:** This checklist has mostly moderate to good reliability between two trained practitioners. **Practitioner Summary:** This reliable ergonomics assessment checklist for computer workers was designed using accessible government guidelines and supplemented with up-to-date evidence. Employers in

Queensland (Australia) can fulfil legislative requirements by using this reliable checklist to identify and subsequently address potential risk factors for work-related injury to provide a safe working environment.

- **Keywords:** Computer terminals, risk assessment, musculoskeletal diseases, reproducibility of results

**Sylvia Guendelman, Alison Gemmill & Leslie A. MacDonald. *Biomechanical and organisational stressors and associations with employment withdrawal among pregnant workers: evidence and implications. Pages 1613-1624.***

The distribution of exposure to biomechanical and organisational job stressors (BOJS) and associations with employment withdrawal (antenatal leave, unemployment) was examined in a case-control study of 1114 pregnant workers in California. We performed descriptive and multivariate logistic and multinomial regression analyses. At pregnancy onset, 57% were exposed to one or more biomechanical stressors, including frequent bending, heavy lifting and prolonged standing. One-third were simultaneously exposed to BOJS. Exposure to biomechanical stressors declined as pregnancy progressed and cessation often (41%) coincided with employment withdrawal (antenatal leave and unemployment). In multivariate modelling, whether we adjusted for or considered organisational stressors as coincident exposures, results showed that pregnant workers exposed to biomechanical stressors had increased employment withdrawal compared to the unexposed. Work schedule accommodations moderate this association. Paid antenatal leave, available to few US women, was an important strategy for mitigating exposure to BOJS. Implications for science and policy are discussed. **Practitioner Summary:** This case-control study showed that exposure to biomechanical stressors decline throughout pregnancy. Antenatal leave was an important strategy used for mitigating exposure among sampled California women with access to paid benefits. Employment withdrawal among workers exposed to BJOS may be reduced by proactive administrative and engineering efforts applied early in pregnancy.

- **Keywords:** Health risks, health and safety, physical fatigue, physical ergonomics, psychological stress, physical work capacity, biomechanical job stressors, employment withdrawal during pregnancy, strenuous work during pregnancy

**Nicholas J. La Delfa & Jim R. Potvin. *Multidirectional manual arm strength and its relationship with resultant shoulder moment and arm posture. Pages 1625-1636.***

Previous work has quantified manual force capabilities for ergonomics design, but the number of studies and range of conditions tested are limited in scope. Therefore, the aims of this study were to collect seated manual arm strength (MAS) data from 24 females in several unique exertion directions ( $n = 26$ ) and hand locations relative to the shoulder ( $n = 8$ ), and to investigate the associations between MAS and shoulder/elbow moments. MAS was generally highest when the direction of force application was oriented parallel to the vector from the shoulder to knuckle, and weakest when oriented orthogonal to that vector. Moderate correlations were found between MAS and: (1) resultant shoulder moment ( $r = 0.34$ ), (2) resultant moment arms ( $r = -0.545$ ) and (3) elbow flexion/extension moment ( $r = 0.481$ ). Our strength data will be used in the development of a comprehensive MAS predictive method, so that strength capabilities can be predicted to help design acceptable tasks in the workplace. **Practitioner Summary:** This study sought to enhance our understanding of one-handed manual arm strength capabilities for ergonomics task evaluations. Our findings provide researchers and practitioners with manual strength data for off-axis force directions, as well as hand

locations not previously measured. These data will contribute to future methods for predicting strength capabilities.

- **Keywords:** Manual arm strength, strength capabilities, upper extremity strength, maximum shoulder moment

**Robert D. Catena & Xu Xu. *Hip and knee net joint moments that correlate with success in lateral load transfers over a low friction surface.* Pages 1637-1645.**

We previously described two different preferred strategies used to perform a lateral load transfer. The wide stance strategy was not used successfully on a low-friction surface, while the narrow stance strategy was successful. Here, we retrospectively examined lower extremity net joint moments between successful and unsuccessful strategies to determine if there is a kinetic benefit consideration that may go into choosing the preferred strategy. Success vs. failure over a novel slippery surface was used to dichotomise 35 healthy working-age individuals into the two groups (successful and unsuccessful). Participants performed lateral load transfers over three sequential surface conditions: high friction, novel low friction and practised low friction. The unsuccessful strategy required larger start torques, but lower dynamic moments during transfer compared to the successful strategy. These results indicate that the periodically unsuccessful strategy may be preferred because it requires less muscle recruitment and lower stresses on lower extremity soft tissues. **Practitioner Summary:** The reason for this paper is to retrospectively examine the joint moment in two different load transfer strategies that are used in a lateral load transfer. We found that periodically unsuccessful strategies that we previously reported may be a beneficial toward reduced lower extremity joint stresses.

- **Keywords:** Net moment, low friction, lower extremity, manual material handling, load transfer

**Jean Mangharam, Rachael Moorin & Leon Straker. *A comparison of the burden and resultant risk associated with occupational falls from a height and on the same level in Australia.* Pages 1646-1660.**

Occupational falls are one of the leading causes of occupational injury and death internationally. This study described the nature of occupational falls following an analysis of workers compensation data in Western Australia. Frequencies, proportions and incidence rates were calculated following mechanism, gender, age and industry stratification. The natures of injury and bodily locations affected were compared between mechanisms of fall. Industry incidence rates were ranked and their corresponding proportions reported. Cost and lost time were described and risk scores for each burden type (incapacity, cost and lost time) were calculated and compared between fall mechanisms. Of all occupational falls, the proportion, incidence rates and risk scores of falls on same level were consistently greater compared to falls from a height. Gender, age and industry groups that appear to be at highest risk vary with the measure used and mechanism of incident. This study translates epidemiological information into a risk score that can aid in prioritisation. **Practitioner Summary:** This paper presents an in-depth analysis of Worker's Compensation claims for falls in Western Australia. Calculated proportion, incidence rates and formulated risk scores for falls on the level were consistently greater compared to falls from a height. Limitations associated with the analysis of large-scale data-sets are described.

- **Keywords:** Falls, fall on same level, occupational injuries, characteristic of injured worker, consequences of occupational fall

**François Fraysse, Steven Milanese & Dominic Thewlis. *Practices and risks associated with operation of tie-down lashings in the vehicle transport industry.* Pages 1661-1672.**

Load restraint systems in automobile transport utilise tie-down lashings placed over the car's tyres, which are tensioned manually by the operator using a ratchet assembly. This process has been identified as a significant manual handling injury risk. The aim of this study was to gain insight on the current practices associated with tie-down lashings operation, and identify the gaps between current and optimal practice. We approached this with qualitative and quantitative assessments and one numerical simulation to establish: (i) insight into the factors involved in ratcheting; (ii) the required tension to hold the car on the trailer; and (iii) the tension achieved by drivers in practice and associated joint loads. We identified that the method recommended to the drivers was not used in practice. Drivers instead tensioned the straps to the maximum of their capability, leading to over-tensioning and mechanical overload at the shoulder and elbow. We identified the postures and strategies that resulted in the lowest loads on the upper body during ratcheting (using both hands and performing the task with their full body). This research marks the first step towards the development of a training programme aiming at changing practice to reduce injury risks associated with the operation of tie-down lashings in the automobile transport industry. **Practitioner Summary:** The study investigated current practice associated with the operation of tie-down lashings through qualitative (interviews) and quantitative (biomechanical analysis) methods. Operators tended to systematically over-tension the lashings and consequently overexert, increasing injury risks.

- **Keywords:** Industrial ergonomics, biomechanics, task analysis, injury risks, manual handling

**Chuang-Yuan Chiu, David L. Pease & Ross H. Sanders. *The effect of pose variability and repeated reliability of segmental centres of mass acquisition when using 3D photonic scanning.* Pages 1673-1678.**

Three-dimensional (3D) photonic scanning is an emerging technique to acquire accurate body segment parameter data. This study established the repeated reliability of segmental centres of mass when using 3D photonic scanning (3DPS). Seventeen male participants were scanned twice by a 3D whole-body laser scanner. The same operators conducted the reconstruction and segmentation processes to obtain segmental meshes for calculating the segmental centres of mass. The segmental centres of mass obtained from repeated 3DPS were compared by relative technical error of measurement (TEM). Hypothesis tests were conducted to determine the size of change required for each segment to be determined a true variation. The relative TEMs for all segments were less than 5%. The relative changes in centres of mass at  $\pm 1.5\%$  for most segments can be detected ( $p < 0.05$ ). The arm segments which are difficult to keep in the same scanning pose generated more error than other segments. **Practitioner Summary:** Three-dimensional photonic scanning is an emerging technique to acquire body segment parameter data. This study established the repeated reliability of segmental centres of mass when using 3D photonic scanning and emphasised that the error for arm segments need to be considered while using this technique to acquire centres of mass.

- **Keywords:** Body segment parameters, 3D photonic scanning, reliability, anthropometry, biomechanics