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Phuoc Tran & Kaveri Subrahmanyam. *Evidence-based guidelines for the informal use of computers by children to promote the development of academic, cognitive and social skills.* Pages 1349-1362.

The use of computers in the home has become very common among young children. This paper reviews research on the effects of informal computer use and identifies potential pathways through which computers may impact children's development. Based on the evidence reviewed, we present the following guidelines to arrange informal computer experiences that will promote the development of children's academic, cognitive and social skills: (1) children should be encouraged to use computers for moderate amounts of time (2–3 days a week for an hour or two per day) and (2) children's use of computers should (a) include non-violent action-based computer games as well as educational games, (b) not displace social activities but should instead be arranged to provide opportunities for social engagement with peers and family members and (c) involve content with pro-social and non-violent themes. We conclude the paper with questions that must be addressed in future research.

Practitioner Summary: This paper reviews research on the effects of informal computer use on children's academic, cognitive and social skills. Based on the evidence presented, we have presented guidelines to enable parents, teachers and other adults to arrange informal computer experiences so as to maximise their potential benefit for children's development.

- **Keywords:** computers, games, Internet, cognitive, academic and social skills, informal computer use

Anna Pereira, Tevis Miller, Yi-Min Huang, Dan Odell & David Rempel. *Holding a tablet computer with one hand: effect of tablet design features on biomechanics and subjective usability among users with small hands.* Pages 1363-1375.

The purpose of this study was to evaluate tablet size (weight), orientation, grip shape, texture and stylus shape on productivity, biomechanics and subjective usability and fatigue when the tablet was held with just the left hand. A total of 15 male and 15 female subjects, ages 16–64 years, tested eight tablets and three styluses. Overall, the usability, fatigue and biomechanical evaluation of tablet design features supported the

use of smaller to medium-sized tablets, with a ledge or handle shape on the back and surfaced with a rubberised texture. Larger, heavier tablets had significantly worse usability and biomechanics and their use with one hand should be limited. The stylus with a tapered grip (7.5–9.5 mm) or larger grip (7.6 mm) had better usability and biomechanics than one with a smaller grip (5 mm). There were no significant differences in productivity between design features. These design parameters may be important when designing tablets.

Practitioner Summary: Different tablet and stylus design features were evaluated for usability and biomechanical properties. On the basis of short-term tasks, emulating functional tablets, usability was improved with the smaller and medium-sized tablets, portrait (vs. landscape) orientation, a back ledge grip and rubberised texture. There were no differences in productivity between design features.

- **Keywords:** mobile computing, hand-held, fatigue, productivity, design

B. Rolander, D. Jonker, J. Winkel, L. Sandsjö, I. Balogh, E. Svensson & K. Ekberg. *Working conditions, health and productivity among dentists in Swedish public dental care – a prospective study during a 5-year period of rationalisation.* Pages 1376-1386.

In recent decades, comprehensive rationalisations have been implemented in public dentistry in Sweden. How rationalisations affect working conditions, health and production from a long-term perspective has been poorly investigated. This study aims to analyse changes and associations in dentists' working conditions, health and productivity during a 5-year period. In 2003 and 2008, 65 dentists responded to questionnaires measuring work conditions and health. Treatment times for patients and productivity were tracked in electronic registers. Paired *t*-tests showed that the number of treated adult patients per dentist increased, and perceived physical working conditions improved while perceived work control and leadership deteriorated. Structural equation modelling showed that physical factors were important for health and productivity. When assessing risks in the work environment, there is a need to understand the interaction of effects on working conditions and health due to rationalisations so as to increase the sustainability of production systems.

Practioner Summary: Dentistry in Sweden has undergone considerable change. Questionnaire surveys with dentists, undertaken in 2003 and 2008, found that the present rationalisations resulted in improved perceived physical working conditions. Aspects of the psychosocial working environment had deteriorated, however. This is a concern as health and workability are important for workplace efficiency.

- **Keywords:** physical working conditions, production, organisational sustainability, leadership, work control

P.A. Hancock. *Task partitioning effects in semi-automated human–machine system performance.* Pages 1387-1399.

Twelve professional pilots performed a flight simulation consisting of three component sub-tasks: (i) tracking, (ii) monitoring and (iii) targeting, respectively. The targeting sub-task required (i) target identification, (ii) weapon selection and then (iii) weapon release. Pilots performed in a fully manual condition, a partial automation condition or a fully automated condition. Automated assistance was provided for the targeting sub-task only, while tracking and monitoring sub-tasks were always performed manually. During full automation, the computer located the target, identified it and released the appropriate weapon without any pilot input. During partial automation, the computer located and identified the target while the pilot retained final control over weapon release.

Significantly higher levels of tracking error distinguished manual from both automated conditions and also between the two levels of automation. Monitoring response times were also sensitive to the degree of automation engaged, with the partial-automation condition exhibiting faster responses than full automation. Findings support a design principle in which pilots retain control over final weapons release directly on the basis of objective performance outcome. These collective results support the contention that effective and principled task-partitioning should represent a central strategy for the evolution of complex human–machine systems.

Practitioner Summary: Advantages of partitioning tasks between human and automated control are contingent upon the overall context of performance and the actual way the partitioning is accomplished. Simple algorithms, for example, automate on every feasible occasion, are poor design heuristics and may even prove actively harmful to overall response capacity. Transitioning humans from active controllers to passive monitors can be a problematic design choice, especially when that individual is socially deemed to retain overall responsibility for ultimate system effects in the real world.

- **Keywords:** degree of automation, pilot control, task partitioning

Judy Edworthy, Christina Meredith, Elizabeth Hellier & David Rose. *Learning medical alarms whilst performing other tasks.* Pages 1400-1417.

Two studies are reported which first observe, and then attempt to replicate, the cognitive demands of intensive care unit (ICU) activity whilst concurrently learning audible alarms. The first study, an observational study in an ICU ward, showed that the alarms are very frequent and co-occur with some activities more than others. The three most frequently observed activities observed in the ICU were drugs (calculation, preparation and administration), patient observation and talking. The cognitive demands of these activities were simulated in a second, laboratory-based experiment in which alarms were learned. The results showed that performance in the alarm task generally improved as participants were exposed to more repetitions of those alarms, but that performance decrements were observed in the secondary tasks, particularly when there were two or three of them. Some confusions between the alarms persisted to the end of the study despite prolonged exposure to the alarms, confusions which were likely caused by both acoustic and verbal labelling similarities.

Practitioner Summary: The cognitive demands of working in an ICU were observed and simulated whilst alarms were learned. Alarms should generally avoid sharing similar rhythmic (and other) characteristics. The simulation task described here could be used for testing alarm learning without requiring a clinical environment.

- **Keywords:** alarms, task sharing, learning

Susanne Mayr, Maja Köpper & Axel Buchner. *Comparing colour discrimination and proofreading performance under compact fluorescent and halogen lamp lighting.* Pages 1418-1429.

Legislation in many countries has banned inefficient household lighting. Consequently, classic incandescent lamps have to be replaced by more efficient alternatives such as halogen and compact fluorescent lamps (CFL). Alternatives differ in their spectral power distributions, implying colour-rendering differences. Participants performed a colour discrimination task – the Farnsworth–Munsell 100 Hue Test – and a proofreading task under CFL or halogen lighting of comparable correlated colour temperatures at low (70 lx) or high (800 lx) illuminance. Illuminance positively affected colour discrimination and proofreading performance, whereas the light source was only relevant for colour

discrimination. Discrimination was impaired with CFL lighting. There were no differences between light sources in terms of self-reported physical discomfort and mood state, but the majority of the participants correctly judged halogen lighting to be more appropriate for discriminating colours. The findings hint at the colour-rendering deficiencies associated with energy-efficient CFLs.

Practitioner Summary: In order to compare performance under energy-efficient alternatives of classic incandescent lighting, colour discrimination and proofreading performance was compared under CFL and halogen lighting. Colour discrimination was impaired under CFLs, which hints at the practical drawbacks associated with the reduced colour-rendering properties of energy-efficient CFLs.

- **Keywords:** compact fluorescent lamp, halogen lamp, colour discrimination, proofreading, colour-rendering index

Jelte E. Bos, Wietse D. Ledegang, Astrid J.A. Lubeck & John F. Stins. *Cinerama sickness and postural instability.* Pages 1430-1436.

Motion sickness symptoms and increased postural instability induced by motion pictures have been reported in a laboratory, but not in a real cinema. We, therefore, carried out an observational study recording sickness severity and postural instability in 19 subjects before, immediately and 45 min after watching a 1 h 3D aviation documentary in a cinema. Sickness was significantly larger right after the movie than before, and in a lesser extent still so after 45 min. The average standard deviation of the lateral centre of pressure excursions was significantly larger only right afterwards. When low-pass filtered at 0.1 Hz, lateral and for-aft excursions were both significantly larger right after the movie, while for-aft excursions then remained larger even after 45 min. Speculating on previous findings, we predict more sickness and postural instability in 3D than in 2D movies, also suggesting a possible, but yet unknown risk for work-related activities and vehicle operation.

Practitioner Summary: Watching motion pictures may be sickening and posturally destabilising, but effects in a cinema are unknown. We, therefore, carried out an observational study showing that sickness then is mainly an issue during the exposure while postural instability is an issue afterwards.

- **Keyword:** visually induced motion sickness, cybersickness, cinerama sickness, postural instability, balance

Russell Marshall, Stephen Summerskill & Sharon Cook. *Development of a volumetric projection technique for the digital evaluation of field of view.* Pages 1437-1450.

Current regulations for field of view requirements in road vehicles are defined by 2D areas projected on the ground plane. This paper discusses the development of a new software-based volumetric field of view projection tool and its implementation within an existing digital human modelling system. In addition, the exploitation of this new tool is highlighted through its use in a UK Department for Transport funded research project exploring the current concerns with driver vision. Focusing specifically on rearwards visibility in small and medium passenger vehicles, the volumetric approach is shown to provide a number of distinct advantages. The ability to explore multiple projections of both direct vision (through windows) and indirect vision (through mirrors) provides a greater understanding of the field of view environment afforded to the driver whilst still maintaining compatibility with the 2D projections of the regulatory standards.

Practitioner Summary: Field of view requirements for drivers of road vehicles are defined by simplified 2D areas projected onto the ground plane. However, driver vision is

a complex 3D problem. This paper presents the development of a new software-based 3D volumetric projection technique and its implementation in the evaluation of driver vision in small- and medium-sized passenger vehicles.

- **Keyword:** vision, field of view, digital human modelling, road vehicles

Wonsup Lee, Jeongrim Jeong, Jangwoon Park, Eunjin Jeon, Heeeun Kim, Daehan Jung, Seikwon Park & Heecheon You. *Analysis of the facial measurements of Korean Air Force pilots for oxygen mask design.* Pages 1451-1464.

This study measured the facial dimensions of Korean Air Force (KAF) pilots, to design a pilot oxygen mask, and compared them with those of Korean civilians and US Air Force (USAF) personnel. Twenty-two facial dimensions were measured for 278 KAF male pilots (KMP) and 58 KAF female pilots and cadets (KFP) using an anthropometer and a three-dimensional scanner. The KMP face measurements were found to be significantly larger (mean difference, $\bar{d}$ = 0.7–26.5 mm) and less varied (ratio of SDs = 0.29–0.82) than those of Korean male civilians. The average face length, lip width and nasal root breadth of the KMP were significantly longer ($\bar{d}$ = 4.7 mm), narrower ($\bar{d}$ = – 2.4 mm), and wider ($\bar{d}$ = 5.2 mm), respectively, than those of USAF male personnel. Lastly, the KMP face measurements were significantly larger ($\bar{d}$ = 1.8–26.1 mm) than those of the KFP.

Practitioner Summary: The face measurements of KAF pilots were collected and compared with those of Korean civilians and USAF personnel. The distinct facial features of the populations identified in this study are applicable to custom design of an oxygen mask for prevention of excessive pressure and oxygen leakage.

- **Keyword:** oxygen mask design, face measurement, anthropometer, 3D scanner, Korean pilots

Gavin P. Horn, Sue Blevins, Bo Fernhall & Denise L. Smith. *Core temperature and heart rate response to repeated bouts of firefighting activities.* Pages 1465-1473.

During live-fire firefighting operations and training evolutions, firefighters often consume multiple cylinders of air and continue to wear their personal protective equipment even after fire suppression activities have ceased. However, most studies have only reported core temperature changes during short-term firefighting activities and have shown a very modest increase in core temperature. Therefore, the purpose of this study is to evaluate core temperature and heart rate (HR) during repeated bouts of firefighting activity over ~ 3 h. The results of this study show that core temperatures increase by an average of 1.9°C – to a larger magnitude than previously reported – and continue to increase during subsequent work cycles (38.4 vs. 38.7) even after long breaks of more than 30 min. The rate of core temperature increase during work continues to increase later in the training exercise (from 0.036 to 0.048°C/min), increasing the risk for exertional heat stress particularly if long-duration firefighting activity is required at these later times.

Practitioner Summary: To date, core temperature and HR changes during firefighting have been reported for short-term studies, which may significantly underestimate the physiological burden of typical firefighting activities. Firefighter core temperatures are shown to increase to a larger magnitude than previously observed and the rate of rise in core temperature increases during subsequent firefighting activities.

- **Keyword:** firefighting, core temperature, heart rate, heat stress

Jennifer B. Hodkinson, Susan J. Gordon, Robert G. Crowther & Petra G. Buettner. *Time to stabilisation of the cervical spine when supported by a pillow in side lying.* Pages 1474-1485.

Currently, there is little information to guide consumers, retailers and health professionals about the length of time it takes for the cervical spine to stabilise when resting on a pillow. The aim of this study was to determine the time required to achieve stabilisation of the cervical spine when supported by a polyester pillow and innerspring mattress in side lying. Twenty-four asymptomatic females rested in a standardised side lying position during the capture of 3D data from markers placed over cervical landmarks. Time to stabilisation was assessed for each axis, each landmark and globally for each participant. A large variation in global stabilisation times was identified between participants; however, 70.8% of participants had stabilised by 15 min or earlier. Fifteen minutes is the best estimate of the time to stabilisation of the cervical spine for young females in a side lying position when resting on a polyester pillow.

Practitioner Summary: This study aimed to determine the time required to achieve stabilisation of the cervical spine when supported by a polyester pillow and innerspring mattress in side lying. Through a laboratory study using 3D VICON® motion analysis technology, we identified that 70.8% of participants had stabilised by 15 min.

- **Keyword:** motion analysis, cervical spine, stabilisation, VICON® Nexus, pillow