

Human Factors – rok 2008, roč. 50

Číslo 6



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AUTOMATION, EXPERT SYSTEMS

Ezer, Neta; Fisk, Arthur D.; Rogers, Wendy A. Age-Related Differences in Reliance Behavior Attributable to Costs Within a Human-Decision Aid System. S. 853-863(11).

Abstract: Objective: An empirical investigation was done to determine if there are age-related differences attributable to costs in reliance on a decision aid. **Background:** Costs of reliance on a decision aid may affect reliance on the aid. Older and younger adults may not perceive and respond to a dynamic cost structure equally or objectively. **Method:** Sixteen older adults (65-74 years) and 16 younger adults (18-28 years) performed a counting task with an imperfect decision aid. Two types of costs were manipulated: (a) cost of error (CoE) and (b) cost of verification (CoV). The percentage of trials in which participants agreed with the decision aid and did not perform the task manually was recorded as reliance. **Results:** Participants decreased their reliance as the CoE increased and increased their reliance with a lower CoV; however, they tended to under-rely on the decision aid. Younger adults tended to change their reliance behavior more than older adults did with the changing cost structure. **Conclusions:** Older and younger adults appear to interpret costs differently, with older adults being less responsive to changes in costs. Older adults may have been less able to monitor the changing costs and hence not adapt to them as well as younger adults. **Application:** Designers of decision aids should consider explicitly stating costs associated with reliance on the aid, as individuals may differ in how they interpret and respond to changing costs.

- **Keywords:** AGING; AUTOMATION; COST OF VERIFICATION; COST OF ERROR; DECISION AIDS; NATURALISTIC DECISION MAKING; RELIANCE ON AUTOMATION

COGNITIVE PROCESSES

Schriver, Angela T.; Morrow, Daniel G.; Wickens, Christopher D.; Talleur, Donald A. *Expertise Differences in Attentional Strategies Related to Pilot Decision Making*. S. 864-878(15).

Abstract: Objective: We investigated expertise differences in pilot decision making by examining a hypothesized attention-action link. During simulated flight we measured the accuracy and latency of more and less expert pilots' decision outcomes and used eye tracking to measure their attention. We also examined whether decision outcomes and attentional strategies were influenced by properties of the cues indicating problems. **Background:** Errors in decision making contribute to many accidents and incidents, especially among inexperienced pilots. Although much is known about decision errors in terms of their outcomes, less is known about the cognitive processes that underlie expert differences in aviation decision making. **Method:** Fourteen more expert and 14 less expert pilots flew 16 flights in a simulator. Half of the flights contained a failure requiring diagnosis and action in response to the failure. Cues signaling the failures varied in how diagnostic and/or correlated they were. **Results:** The more expert pilots generally made better decisions in terms of speed and accuracy. Both groups made faster correct decisions when cues were high versus low in diagnosticity. Only the more expert pilots made faster correct decisions when cues were correlated. More attention was allocated to relevant cues (measured by percentage dwell time on areas of interest) when a failure was present, primarily among expert pilots. Moreover, the amount of attention to cues was associated with decision accuracy. **Conclusion:** The findings support the link between greater attention and more effective decision making. **Application:** The expert advantage in attention underlying decision outcomes may provide targets for improving pilot training.

- **Keywords:** COGNITIVE PROCESSES; AVIATION; DECISION MAKING; EXPERTISE; ATTENTIONAL PROCESSES; PILOT DECISION MAKING; AEROSPACE SYSTEMS; NATURALISTIC DECISION MAKING

SENSORY AND PERCEPTUAL PROCESSES

Fowler, Barry; Meehan, Sean; Singhal, Anthony. *Perceptual-Motor Performance and Associated Kinematics in Space*. S. 879-892(14).

Abstract: Objective: To determine whether the impairment of perceptual-motor performance often observed during the initial stages of space flight is attributable to the direct effects of microgravity on sensory-motor input-output relationships or to cognitive overload arising from the variety of stressors encountered in this environment. **Background:** Experimental evidence is contradictory, and the present experiment investigated the role of two variables: use of a joystick with tracking or aiming tasks and degree of arm restraint. **Methods:** Five well-trained astronauts performed Fitts' reciprocal aiming task on three occasions (preflight, on the International Space Station, and postflight) under the following conditions: (a) with a stylus or a joystick, (b) with the arm restrained or unrestrained, and (c) as a single task or together with auditory reaction time (RT) as a dual task. In addition to the speed and accuracy of responses, kinematic measures were derived from the joystick. **Results:** In space, the slope of Fitts' function increased only in the dual task condition with the joystick. RT was also slowed in the dual condition, and there was an increase in aiming and RT errors. Percentage time to peak acceleration, velocity, and deceleration were increased when the aiming task was performed alone. **Conclusion:** These results support the cognitive overload rather than the microgravity hypothesis and indicate that an impairment in sensory-motor performance is not a necessary concomitant of space flight. **Application:** Impairments in perceptual-motor performance in space can be eliminated or mitigated by appropriate training and task design.

- **Keywords:** MICROGRAVITY; FITTS' LAW; SENSORIMOTOR PERFORMANCE; DUAL-TASK PERFORMANCE; SPACEFLIGHT; STRESSORS; KINEMATICS; MULTIPLE RESOURCES

SURFACE TRANSPORTATION SYSTEMS

Cooper, Joel M.; Strayer, David L. Effects of Simulator Practice and Real-World Experience on Cell-Phone-Related Driver Distraction. S. 893-902(10).

Abstract: Objective: Our research examined the effects of practice on cell-phone-related driver distraction. **Background:** The driving literature is ambiguous as to whether practice can reduce driver distraction from concurrent cell phone conversation. **Methods:** Drivers reporting either high or low real-world cell phone usage were selected to participate in four 90-min simulated driving sessions on successive days. The research consisted of two phases: a practice phase and a novel transfer phase. **Results:** Dual-task performance deficits persisted through practice and transfer driving conditions. Moreover, groups reporting high and low real-world experience exhibited similar driving impairments when conversing on a hands-free cell phone. **Conclusions:** These data indicate that practice is unlikely to eliminate the disruptive effects of concurrent cell phone use on driving. **Application:** Multiple regulatory agencies have considered, or are currently considering, legislation to restrict in-vehicle cell phone use. Findings reported herein may be useful to inform these public policy decisions.

- **Keywords:** PRACTICE; DUAL-TASK PERFORMANCE; DRIVER BEHAVIOR; MULTIPLE RESOURCES; DRIVING SIMULATION; CELL PHONE; DRIVER DISTRACTION; TRANSFER OF TRAINING; CAR-FOLLOWING; DRIVER REACTION TIME; CITY DRIVING; HIGHWAY DRIVING; DRIVER EXPERIENCE; SURFACE TRANSPORTATION SYSTEMS; AUTOMATIC AND CONTROLLED PROCESSING

TRAINING, EDUCATION, INSTRUCTIONAL SYSTEMS

Salas, Eduardo; DiazGranados, Deborah; Klein, Cameron; Burke, C. Shawn; Stagl, Kevin C.; Goodwin, Gerald F.; Halpin, Stanley M. Does Team Training Improve Team Performance? : a Meta-Analysis. S. 903-933(31).

Abstract: Objective: This research effort leveraged the science of training to guide a taxonomic integration and a series of meta-analyses to gauge the effectiveness and boundary conditions of team training interventions for enhancing team outcomes. **Background:** Disparate effect sizes across primary studies have made it difficult to determine the true strength of the relationships between team training techniques and team outcomes. **Method:** Several meta-analytic integrations were conducted to examine the relationships between team training interventions and team functioning. Specifically, we assessed the relative effectiveness of these interventions on team cognitive, affective, process, and performance outcomes. Training content, team membership stability, and team size were investigated as potential moderators of the relationship between team training and outcomes. In total, the database consisted of 93 effect sizes representing 2,650 teams. **Results:** The results suggested that moderate, positive relationships exist between team training interventions and each of the outcome types. The findings of moderator analyses indicated that training content, team membership stability, and team size moderate the effectiveness of these interventions. **Conclusion:** Our findings suggest that team training interventions are a viable approach organizations can take in order to enhance team outcomes. They are useful for improving cognitive outcomes, affective outcomes, teamwork processes, and performance outcomes. Moreover, results suggest that training content, team membership stability, and team size moderate the effectiveness of team training interventions. **Application:** Applications of the results from this research are numerous. Those who design and administer training can benefit

from these findings in order to improve the effectiveness of their team training interventions.

- **Keywords:** TEAM DEVELOPMENT; TEAMWORK; TEAM PROCESSES; TEAM EFFECTIVENESS; INSTRUCTION; EMBEDDED TRAINING; CROSS-TRAINING AND TEAM TRAINING; TRAINING TECHNOLOGIES; EDUCATION; INSTRUCTIONAL SYSTEMS; TRAINING METHODS; TEAM INTERVENTION; TRAINING EVALUATION; TEAM PERFORMANCE IMPROVEMENT; TRAINING OUTCOMES