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AGING AND INDIVIDUAL DIFFERENCES

Brault, Lynn M.; Gilbert, Jaimie L.; Lansing, Charissa R.; McCarley, Jason S.; Kramer, Arthur F. *Bimodal Stimulus Presentation and Expanded Auditory Bandwidth Improve Older Adults' Speech Perception. s. 479-491(13).*

Objective: A pair of experiments investigated the hypothesis that bimodal (auditory-visual) speech presentation and expanded auditory bandwidth would improve speech intelligibility and increase working memory performance for older adults by reducing the cognitive effort needed for speech perception. **Background:** Although telephone communication is important for helping older adults maintain social engagement, age-related sensory and working memory limits may make telephone conversations difficult. **Method:** Older adults with either age-normal hearing or mild-to-moderate sensorineural hearing loss performed a running memory task. Participants heard word strings of unpredictable length and at the end of each string were required to repeat back the final three words. Words were presented monaurally in telephone bandwidth (300 Hz to 3300 Hz) or expanded bandwidth (50 Hz to 7500 Hz), in quiet (65 dBZ SPL), or in white noise (65 dBZ SPL with noise at 60 dBZ SPL), with or without a visual display of the talker. **Results:** In quiet listening conditions, bimodal presentation increased the number of words correctly reported per trial but only for listeners with hearing loss and with high lipreading proficiency. Stimulus bandwidth did not affect performance. In noise, bimodal presentation and expanded bandwidth improved performance for all participant groups but did so by improving speech intelligibility, not by improving working memory. **Conclusion:** Expanded bandwidth and bimodal presentation can improve speech perceptibility in difficult listening conditions but may not always improve working memory performance. **Application:** Results can inform the design of telephone features to improve ease of communication for older adults

- **Keywords:** AGING; BIMODAL DISPLAYS; SPEECH PERCEPTION; AGING AND INDIVIDUAL DIFFERENCES; HEARING LOSS; TELEPHONE COMMUNICATION

BIOMECHANICS, ANTHROPOMETRY, AND WORK PHYSIOLOGY

Harivanam, Sridhar; Marklin, Richard W.; Papanek, Paula E.; Cariapa, Vikram. *A Shovel With a Perforated Blade Reduces Energy Expenditure Required for Digging Wet Clay. s. 492-502(11).*

Objective: A shovel with a blade perforated with small holes was tested to see whether a worker would use less whole-body energy to dig wet clay than with a shovel with an

opaque blade. **Background:** A perforated shovel is hypothesized to require less whole-body energy on the basis of adhesion theory; a smaller surface area would require less physical effort to dig and release soil from the blade. **Method:** The study involved 13 workers from an electric utility who dug wet clay with two 1.5-m long-handled point shovels, which differed only in blade design (perforated and opaque). Oxygen consumption was measured with a portable system while each worker dug wet clay at a self-regulated pace for 10 min. **Results:** There was no significant difference in number of scoops dug during the 10-min sessions, but workers dug 9.5% more weight of clay with the perforated shovel than with the conventional shovel (404 kg vs. 369 kg, respectively). Furthermore, stable oxygen uptake normalized to weight of participant and to the weight of clay dug revealed that participants expended 11.7% less relative energy per kilogram of clay dug with the perforated shovel. **Conclusion:** A point shovel with a perforated blade is recommended for digging and shoveling wet clay. However, the extra weight that workers chose to dig with the perforated shovel may increase the loading on the spine and may offset the metabolic advantages. **Application:** Manual shoveling is a common task, and workers may experience less whole-body and muscle fatigue when using a perforated shovel.

- **Keywords:** MANUAL SHOVEL; PERFORATED SHOVEL; DIGGING AND SHOVELING; DIGGING WET CLAY; ENERGY EXPENDITURE; WORK PHYSIOLOGY; ELECTRIC UTILITY WORKERS; LONG-HANDLED POINT SHOVELS

COGNITIVE PROCESSES

Zeng, Liang; Proctor, Robert W.; Salvendy, Gavriel. *Creativity in Ergonomic Design : A Supplemental Value-Adding Source for Product and Service Development*. S. 503-525(23).

Objective: This article investigates the role of creativity in ergonomic design and the generic process of developing creative products and services. **Background:** Creativity is gaining increased emphasis in both academia and industry. More than 50 years of research in creativity indicates that creativity is key to product and service innovation. Nevertheless, there is scarcely any comprehensive review dedicated to appraising the complex construct of creativity, the underlying cognitive process, and the role of creativity in product and service development. **Method:** We review relevant literature regarding creativity, creative cognition, and the engineering design process to appraise the role of creativity in ergonomic design and to construct a conceptual model of creative product and service development. **Results:** A framework of ergodesign creativity is advanced that highlights the central role of creativity in synergistically addressing the four dimensions of ergonomic design: functionality, safety, usability, and affectivity. A conceptual model of creative design process is then constructed that is goal oriented and is initiated by active problem finding and problem formulating. This process is carried out in a recursive and dynamic way, facilitated by creative thinking strategies. **Conclusion:** It is proposed that ergodesign creativity can add supplemental value to products and services, which subsequently affects consumer behavior and helps organizations gain competitive advantage. **Application:** The proposed conceptual framework of ergodesign creativity and creative design process can serve as the ground for future theory development. Propositions advanced in this study should facilitate designers generating products and services that are creative and commercially competitive.

- **Keywords:** CREATIVE COGNITION; PRODUCT/SERVICE CREATIVITY; ERGONOMIC DESIGN; ENGINEERING DESIGN PROCESS; ERGODESIGN CREATIVITY

COMPUTER SYSTEMS

Kleij, Rick van der; Brake, Guido te. *Map-Mediated Dialogues : effects of Map Orientation Differences and Shared Reference Points on Map Location-Finding Speed and Accuracy. S. 526-536(11).*

Objective: The effects of individual differences in map orientation on a location-finding dyadic team task were examined in a controlled experimental setting. **Background:** Research on maps has been mainly directed at individuals navigating with cartographic maps. An important question remains about how to present information about others' locations to distributed team members. **Method:** In a repeated-measures factorial design, distributed dyad members had to reach a shared understanding through map-mediated human-to-human dialogues about specific preset locations on digitized maps. Maps were rotated independently to different degrees, which produced alignment differences of various magnitudes between both members. Some of these maps were complemented with additional geospatial information (i.e., landmarks, compass rose, and map grid) to provide for shared reference points. **Results:** Dyads using maps with identical orientations for both members performed the task more accurately than dyads using maps that varied in orientation between dyad members. The addition of geospatial information to maps providing for shared reference points helped the teamwork. Distributed dyads using maps that vary in orientation between dyad members benefit more from shared reference points than dyads using maps with orientations that are identical for both members. **Conclusion:** We conclude that shared reference points help distributed dyads using maps that vary in orientation between dyad members to perform as well as dyads using maps with identical alignment. **Application:** This article shows how to provide support for team coordination in distributed settings and facilitates the development of groupware to support distributed teamwork.

- **Keywords:** GROUPWARE; COMMUNICATION; DISTRIBUTED TEAMWORK; LOCATION FINDING; MAP ALIGNMENT DIFFERENCES

TRAINING, EDUCATION, INSTRUCTIONAL SYSTEMS

Helsdingen, Anne S.; van den Bosch, Karel; van Gog, Tamara; van Merriënboer, Jeroen J.G. *The Effects of Critical Thinking Instruction on Training Complex Decision Making. S. 537-545(9).*

Objective: Two field studies assessed the effects of critical thinking instruction on training and transfer of a complex decision-making skill. **Background:** Critical thinking instruction is based on studies of how experienced decision makers approach complex problems. **Method:** Participants conducted scenario-based exercises in both simplified (Study 1) and high-fidelity (Study 2) training environments. In both studies, half of the participants received instruction in critical thinking. The other half conducted the same exercises but without critical thinking instruction. After the training, test scenarios were administered to both groups. **Results:** The first study showed that critical thinking instruction enhanced decision outcomes during both training and the test. In the second study, critical thinking instruction benefited both decision outcomes and processes, specifically on the transfer to untrained problems. **Conclusion:** The results suggest that critical thinking instruction improves decision strategy and enhances understanding of the general principles of the domain. **Application:** The results of this study warrant the implementation of critical thinking instruction in training programs for professional decision makers that have to operate in complex and highly interactive, dynamic environments.

- **Keywords:** COMMAND-AND-CONTROL TRAINING; TACTICAL DECISION MAKING; DECISION STRATEGIES; TRANSFER OF TRAINING