SPECIAL ISSUE: Innovations in Cognitive Engineering and Decision Making, Part I

Editors' Introduction to the Special Issue on Innovations in Cognitive Engineering and Decision Making, Part I

Ann M. Bisantz
University at Buffalo
Ellen J. Bass
University of Virginia
Jennifer J. Ockerman
Johns Hopkins University Applied Physics Laboratory

The theme of this special issue and the continuation issue planned for June 2012 is "Innovations in Cognitive Engineering and Decision Making." In our roles as past and current program chairs for the Cognitive Engineering and Decision Making (CEDM) Technical Group of the Human Factors and Ergonomics Society, we have supported the publication and presentation of cutting edge CEDM-related research and practice employing a range of methodologies and spanning many application domains. This issue reflects such innovations in CEDM. The articles chosen for this issue represent a range of topics, from the study of basic psychological principles relevant to CEDM design, to studies of the interactions between humans and technology, to field studies in actual work environments, to cognitive engineering methodological enhancements. The domains are similarly diverse, including driving, engineering design, supervisory control, mining operations, and education. These articles also reflect the global nature of CEDM research and concerns, including papers from Australia, Europe, and North America.

The first article, "Natural Break Points: The Influence of Priorities and Cognitive Motor Cues on Dual-Task Interleaving" by Christian Janssen, Duncan Brumby, and Rae Garnett, illustrates the progressing work into understanding fundamental psychological phenomena that can inform technology design. Within the timely topic of multitasking while driving, the authors examine factors that can affect how humans interleave two simultaneous tasks. Their research shows that priorities, as well as cognitive and motor cues, affect dual-task performance in ways that do not optimally balance dialing and driving performance.

ADDRESS CORRESPONDENCE TO: Ann M. Bisantz, University at Buffalo, SUNY, Industrial and Systems Engineering, 438 Bell Hall, Amherst, NY 14260-2050, bisantz@buffalo.edu.

Journal of Cognitive Engineering and Decision Making, Volume 6, Number 1, March 2012, pp. 3-4.
DOI: 10.1177/1555343411434301.

The second article, "Uncertainty Visualizations: Helping Decision Makers Become More Aware of Uncertainty and Its Implications" by Xiao Dong and Caroline Hayes, investigates how providing an awareness of information uncertainty via visualizations can lead engineering designers to recognize ambiguities and the need to pursue additional data before making decisions. This work demonstrates the power of visualizations to affect design-oriented decision making as well as showcases a methodology that combines tasks representative of "real-world" design with a controlled comparison.

Next, Dietrich Manzey, Juliane Reichenbach, and Linda Onnasch, in their article "Human Performance Consequences of Automated Decision Aids: The Impact of Degree of Automation and System Experience," address the design of human-centered automation, an important and long-standing problem within CEDM. Their series of laboratory studies combined the investigation of different levels of automation support for fault diagnosis and recovery with aspects of automation reliability, complacency, and trust in automation use. Among other findings, they noted that experiencing an automation failure reduces subjective trust in and over reliance on an aid while simultaneously enabling users to more actively verify the aid's recommendations.

The fourth article, "Human Factors in Control Room Operations in Mineral Processing: Elevating Control From Reactive to Proactive" by Xilin Li, Malcolm Powell, and Tim Horberry, demonstrates the continued expansion of cognitive engineering methodologies to support understanding the work demands and cognitive challenges associated with novel domains. In this case, the authors have applied work domain modeling and related methods to the analysis of a mineral processing (mining) operation. Their analysis uncovered challenges consistent with those experienced in other, previously studied domains (e.g., excessive and nuisance alarms, insufficient display and understanding of the relationships among key process variables, information loss during shift change-over) as well as challenges that may be more unique (lack of any dedicated control room staff). As similar categories of complexity and demands are identified across diverse work domains, the universality of these demands is reinforced, and the potential for the cross-fertilization of design solutions (e.g., types of aids, visualization components) is enhanced.

The last article, "Work Action Analysis: A Cognitive Engineering Method to Examine Educational Systems" by George Nickles and Amy Pritchett, shows the ongoing efforts to extend and/or modify existing methodologies to address new needs in new domains. In this article, the authors describe a modification to cognitive work analysis to model educational systems to support their design and evaluation. They apply the methodology with an educational case study and suggest other domains in which it might also prove useful.