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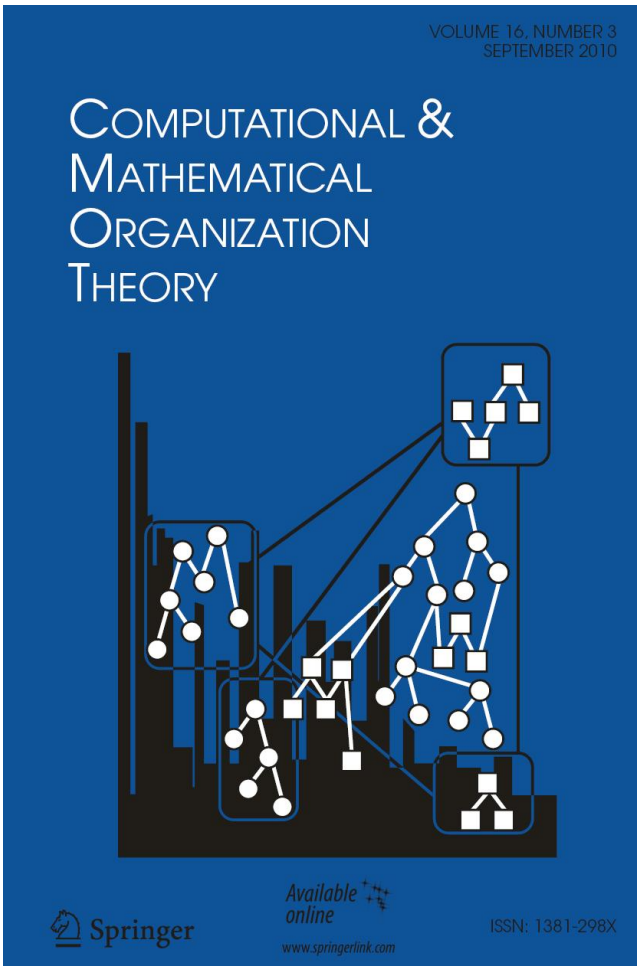

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Behavioral representation in modeling and simulation: Introduction to CMOT special issue—BRiMS 2009

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The BRiMS Society and Conference (Behavioral Representation in Modeling and Simulation (BRiMS, brimsconference.org)) promote cross-disciplinary communication for basic and applied scientific research in the realm of modeling and simulation of human behavior, with a particular emphasis on defense-related behavior. Thus, the BRiMS conference brings together scientists, engineers, practitioners, and application users to discuss modeling behavior ranging from that of individuals to the behavior of whole societies, their interactions, and their implications. For a few days each year, we meet to share ideas and experiences, identify gaps in current capabilities, discuss new directions, highlight promising technologies, and showcase applications.

This special issue includes four of the best papers representing the breadth of the 2009 annual conference, reviewed and extended to journal article length. The work described includes cognitive modeling of individuals' high and low-level processes, exploring the effects of small-group social factors on an individual, the building of a synthetic team member, and applying Bayesian modeling to search and rescue. These papers range from basic research to a potentially life-saving tool. Overall, they represent how the 2009 conference emphasized cultural and group models, with some emphasis on spatial modeling.

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At the basic research end of the range of these papers, David Reitter and Christian Lebiere discuss a cognitive model of path planning. Instead of developing a mathematically optimized algorithmic path planner, they have built a cognitively-based model that integrates top-down path planning with visually-based navigation. They compared their system to human subjects with two experiments of humans controlling multiple robots in a search and rescue mission within a building. Their work shows how memory and perception can work together in path planning.

The second paper is about teams, specifically, how small-group dynamics influence an individual's choice to act, and how to successfully model those dynamics. Jonathan Morgan, Geoffrey Morgan, and Frank Ritter present a model of participation set in a military domain, where participation refers to the tendency of an individual to contribute to a group effort. Previous models of combat have not been able to replicate the range of behavior documented in historical battle records. Their model describes how differences in physical location with respect to active teammates and adversaries along with an agent's awareness of their team's size contribute to individual differences in performance for each agent. Using this model, they were able to demonstrate the emergence of group outcomes through principled prediction of individual variation that correspond to historically observed variation in tendency to participate.

Understanding natural language, even in a very constrained military operations center, is a classically hard problem. Our third paper describes a project intended to simulate a human teammate well enough to support training humans in a simulated military team-training environment. This Synthetic Teammate Project is reported by Jerry Ball, Christopher Myers, Andrea Heiberg, Nancy Cooke, Michael Matessa, Mary Freiman, and Stuart Rodgers. They discuss the extensions needed for the ACT-R cognitive architecture to support language understanding and communicate effectively within the context of an Unmanned Aerial Vehicle (UAV) task environment.

Finally, our last example from the 2009 BRiMS conference is a report by Lanny Lin and Michael Goodrich on the application of a Bayesian reasoning model to the task of finding a lost person. They have developed a tool that could assist Wilderness Search and Rescue and save lives. Their approach employs terrain data and domain experts' uncertainty in their prior estimates to build a lost-person model and a temporal, posterior predictive probability distribution model for use by search and rescue personnel. This paper shows an application of behavioral models where they are embedded directly within a system.

While these papers represent the range of work associated with the BRiMS 2009 conference, the BRiMS community has subsequently undergone some notable changes. A newly formed society has been formalized and the 2010 conference had an even broader selection of good papers along with increased submissions and attendance. We are in the process of bringing the best of the BRiMS 2010 conference to a future issue of this journal.

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Frank E. Ritter is one of the founding faculty of the College of IST, an interdisciplinary academic unit at Penn State to study how people process information using technology. Frank Ritter's current research is in the development, application, and methodology of cognitive models, particularly as applied to interface design, predicting the effect of behavioral moderators, and understanding learning. He edits the Oxford Series on Cognitive Models and Architectures, is an editorial board member of Human Factors, AISBQ, and the Journal of Educational Psychology, and recently was the technical program co-chair for the BRiMS 2009 and BRiMS 2010 conferences.

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