

Modeling Human Performance of Situation Awareness in Constructive Simulations

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ABSTRACT

Highly advanced sensor technologies give our military commanders a significant command and control (C2) advantage over our enemies during conflicts, particularly with respect to situation awareness (SA). The use of advanced sensor technology models in synthetic battlespace gives war fighters parallel advantages. Two accepted simulation methodologies for analyzing the impact of sensor technologies are through HITL experiments, such as Joint Urban Operations (JUO), which utilize sensor capabilities to assist human participants, and Monte Carlo constructive (MCC) simulations, which can be used to model human performance. In HITL experiments using Joint Semi-Automated Forces (JSAF), participants describe their SA using Situation Awareness Objects (SAOs, which then can be reconstructed using Endsley's (1995) three levels of SA (perception, comprehension, and prediction). MCC experiments, which are dominated by algorithmically determined behaviors, can be used to model SA. Sensor measurements currently can be fused to perceive individual entities, but do not have the capability to recognize groupings of entities, resulting only in partial perceptual SA. Furthermore, current sensor data fusion models do not produce the second and third levels of SA, comprehension and prediction.

This paper will report research efforts to utilize both methodologies to expand the use of SAOs beyond player declarations to the automatic generation of SAOs. We develop a method to organize events drawn from scenarios taken from HITL experiments using SAOs in order to develop situation awareness algorithms for the MCC runs. A comparison of these model-generated synthetic SAOs (SSAOs) to SAOs generated by human players can identify strengths and weakness in the SA models as well as identifying ways in which player performance can be improved.

ABOUT THE AUTHORS

John J. Tran is a researcher at the Information Sciences Institute, University of Southern California. He received both his BS and MS Degrees in Computer Science and Engineering from the University of Notre Dame, where he focused on Object-oriented software engineering, large-scale software system design and implementation, and high performance parallel and scientific computing. He has worked at the Stanford Linear Accelerator Center, Safetopia, and Intel. His current research centers on Linux cluster engineering, effective control of parallel programs, and communications fabrics for large-scale computation. Capt Tran is also a member of the 129th Rescue Wing at Moffett FAF, California.

Philip Colon is an Analyst with Toyon Research Corp, supporting the USJFCOM J9 Experiment Engineering Department. He has supported numerous sensor systems analyses and also functions as Toyon's chief software engineer for distributed simulation experiments, including JUO Urban Resolve Phase 1. At Toyon, he focuses on technical analysis, modeling, and simulation of sensors and weapon systems operating in hostile environments. He received a BS with honors in Mathematics from the University of California at Santa Barbara.

Ke-Thia Yao is a research scientist in the Distributed Scalable Systems Division of the University of Southern California Information Sciences Institute. Currently, he is working on the JESPP project, which has the goal of supporting very large-scale distributed military simulation involving millions of entities. Within the JESPP project he is developing a suite of monitoring/logging/analysis tools to help users better understand the computational and behavioral properties of large-scale simulations. He received his B.S. degree in EECS from UC Berkeley, and his M.S. and Ph.D. degrees in Computer Science from Rutgers University.

Jacqueline M. Curiel is a research psychologist at Alion Science and Technology. She is also a co-founder of Behavioral Cognition and is a consultant to IdeaDaVinci, a technology incubator. Her prior academic experience includes teaching and research positions at the University of Texas at San Antonio and the University of Notre Dame,

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Michael D. Anhalt is retired Navy Surface Line Commander with over 23 years of operational experience, including specialties in Amphibious Warfare, Surface, Undersea, and Strike Warfare, and tactical training. Twelve years experience in planning and directing system-engineering efforts related to modeling & simulation and their integration with military command and control systems. Provides on-site technical support in planning for and conducting warfighting exercises and experiments, prototype development, and demonstration of advanced technologies for next generation C2 Systems and Command Centers. He holds a Master of Science degree in Educational Technology.