Conversationally Adept Virtual Humans Technologies: Autonomous Combat Team Members' "Incarnation"

Mark C. Davis
Wood Duck Research, Inc.
Mooresville, North Carolina
mark@woodduckresearch.org

Ke-Thia Yao & Dan M. Davis
Univ. of Southern California
Marina del Rey, California
kyao@isi.edu & dmdavis@acm.org

David H. Barnhill
Naval Postgraduate School
Monterey, California
david.barnill@nps.edu

ABSTRACT

This paper addresses the technological opportunities and organizational needs for the Modeling and Simulation (M&S) community to facilitate the extension of emerging M&S capabilities into non-human warfighters. The authors posit that these non-humans might take various forms, the nature of which is left to the passage of time to reveal. The various existing forms of autonomous devices and the degree of their autonomy are surveyed are. The next section briefly reviews the rapid and accelerating progress in virtual human behavior and adduces evaluative comments from users in the authors' research projects into virtual humans. Based on their operational and research experience, the future of such technology trends is extrapolated. A scenario is advanced in which various non-human operational entities would be infused with doctrinal guidance and controlled locally by a human with back-up, The man/machine interfaces are suggested and analyzed in light of current on-going research in which some of the authors are participating. The benefits of using non-humans for dangerous tasks is considered, as are the ethical and societal risks of loosing machines with lethal weapons into the confusion and tumult of the modern, often urban, warfare. The beneficial interface impacts of making the non-human entities respond to human control and appear human, via augmented reality, to human controllers would be major human factors research goals, which the paper will outline, and pursue in the abstract. They will discuss the avenues of research in Artificial Intelligence that will surely be applicable and raise issues of checks on learned behaviors becoming violative of civilized standards or US humanitarian mandates. These issues are considered in a way that should be extensible into other areas with similarly conundrumal issues, e.g. valuable unique critical benefits, but significant risks. The paper closes with an articulation of the needed community support and contributions.

ABOUT THE AUTHORS

Mark C. Davis, Ph.D. is the Chief Technical Officer at Wood Duck Research, Inc, and is semi retired after careers in the US Navy and as a computer design engineer for both IBM and Lenovo. Rising to the level of Distinguished Engineer at Lenovo, he was responsible for the design of laptop computer cross-disciplinary technology, including PC architecture, embedded systems, open source and virtualization. Previous work was with IBM in the areas of software development and architecture involving security, storage and virtualization. Dr. Davis has been granted well over fifty patents that were filed during his service at both companies. He is a graduate of the Duke University NROTC program and was commissioned as an Ensign, attended nuclear power school, and served as a Submarine Officer for twelve years, including one duty tour as a classroom instructor. He left the active duty as a Lieutenant Commander to pursue a PhD. Mark holds a BSEE degree from Duke University and a PhD in Computer Science from the University of North Carolina, Chapel Hill, where his advisor was Professor Fredrick P. Books.

Ke-Thia Yao is a Project Leader and Research Scientist in the Computational Systems and Technology Division of the University of Southern California (USC) Information Sciences Institute (ISI). His primary research interest is in under-standing large complex systems and data sets. He teaches data management classes at USC's Viterbi School of Engineering. He is part of the team investigating uses for USC's 2,000 Qubit Quantum Annealer. Dr, Yao was one of the leads on the JESPP project where he analyzed the computational and behavioral properties of large-scale simulations. That project had the goal of supporting very large-scale distributed military simulation involving millions of virtual and constructive entities. 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.

Dan M. Davis is active as a consultant at the Institute for Creative Technologies, University of Southern California (USC), focusing on large-scale DoD simulations and avatar uses. Prior to retirement, he was the Director of the JESPP project at USC for a decade. As the Assistant Director of Advanced Computing Research at Caltech, he ran Synthetic Forces Express, bringing HPC to DoD simulations. He also served as a Director at the Maui High Performance Computing Center and in computer research roles at the Jet Propulsion Laboratory and Martin

Marietta. He was the Chairman of the Coalition of Academic Supercomputing Centers and has taught at the undergraduate and graduate levels. As early as 1971, Dan was writing programs in FORTRAN on one of Seymour Cray's CDC 6500's. While in the Marine Corps, he saw duty in Vietnam as a Cryptologist and retired in 2002 as a Commander, U.S.N. He received B.A. and J.D. degrees from the University of Colorado in Boulder.

David H. Barnhill, LCDR, USN, is enrolled the US Naval Postgraduate School (NPS), in Monterey California. He is a student there in the Operations Research Department. He is particularly interested in the analysis of human behavior and command relationships of defense personnel. A topic of immediate concern is the imminent adoption of various levels of robotic and artificial intelligence-controlled weapons on unit cohesion and command functions. He is a Naval Aviator, and has flow rotary-wing aircraft from both land and vessel platforms. David has served in flying status leadership positions and has performed staff officer duties. He graduated from the US Naval Academy with a BS and is scheduled to complete an MS in Operations Research at NPS in the spring of 2021.