Robotic Reality in XR Domain: Interfaces, Sensors, Data-Flow and Standards

Dan M. Davis & Jennifer H. Nolan
Catholic Polytechnic University
1028 N Lake Ave MC 207
Pasadena, CA 91104
{ ddavis & jnolan } @catholicpolytechnic.org

Col. W. Walter Yates
Walter Yates and Associates, LLC
1516 Eagle Nest Circle
Winter Springs, FL 32708

Mark C. Davis & Robin G. Bitterlin
Wood Duck Research, Inc.
129 Wood Duck Loop
Mooresville, NC 28117
{ mark & rgb }@woodduckresearch.org

Judith L. Jacobus
Speech Analyst/Educator
1564 Merion Way.
Seal Beach, CA 90740
stately07@dslextreme.com

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ABSTRACT: *The primary thesis of this paper is that the inclusion of emerging robotics technology in live, virtual and constructive battlefield simulations requires thoughtful consideration of the adoption of cognizant standards of nomenclature, universal metrics and evaluative parameters. The special role of independent robotic forces in a combat simulation is elucidated by a description of the unique qualities of a physical entity that can provide real physical presence, valid voice inputs, observational inputs of both live and virtual entities and other observations not yet conceived. The loosely defined acronym "XR" is asserted to be a potentially optional locus for the placement of these parameters. Currently Robotic Reality and XR are only vaguely defined, but critical to the organization and utility of these nomenclatures. This hampers the recognition, inclusion and utility of both of these concepts. Resolution of the confusions relating to such tools would greatly enhance their utility, inclusion and acceptance. Some of the issues considered are: appropriate definitions, relationships of the terms, differing technical approaches, sensor configurations, interface modalities, telemetric data, and the need for standards. Also of interest are the inclusion of Robotic Players representing neutral (White) and opposing (Red) civilian personnel as well as Red Forces medical personnel to allow for realistic Law of War ethical issues in a real-time simulated combat environment. Current methods are cited and opportunities for improvement offered. Live voice generation and speech recognition would allow more valid assessment of oral communication parameters of concern. A vision of the benefits that may be realized by proceeding in a disciplined manner are discussed in some detail. As there are always costs and risks in perturbing current activities seeking to bring order to the process, these are identified and projected problems are addressed with mitigation suggestions. Importantly, a set of metrics is suggested to appropriately monitor the progress of the emergence of new technologies that will benefit the Combat service people and the DoD at large. A description of the constitution of a multi-disciplinary team that could most effectively conduct such an effort is set forth.*

Author Biographies

CDR DAN M. DAVIS, USN, Ret. is a Research Associate Professor at Catholic Polytechnic University (CPU) and is also active as a consultant at the Institute for Creative Technologies, University of Southern California (USC). He is currently focusing on large-scale DoD simulations and virtual human implementations. Prior to retirement, he was the Director of the JESPP project at USC for more than a decade. As the Assistant Director of Advanced Computing Research at Caltech, he ran Synthetic Forces Express, bringing HPC to DoD simulations. He has 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.

COL W. WALTER YATES, USMC, RET. Is a consultant at Walt Yates & Associates LLC Knowledge Based Service and serves on the Board of Advisors at Anamo Inc. He is a retired Colonel, US Marine Corps. On active duty, he served as the Deputy Lead for Modeling and Simulation and Project Manager for the Framework for the Assessment of Cost and Technology. As a company grade officer, he held billets in the artillery units in the Marine Corps, as well as recruitment duty. His later assignments focused on training innovations and assessments of efficacy. Currently, his focus is upon the use of robotic targets in level battlefield simulation exercises. The title to his Maters' Thesis was: A Training Transfer Study of the Indoor Simulated Marksmanship Trainer. Col Yates earned a BS in Mechanical Engineering from The Texas A & M University in College Station Texas and an MS in Simulation, Virtual Environments and Modeling from the Naval Post-Graduate School in Monterey California.

JENNIFER H. NOLAN, PH..D. is the President of Catholic Polytechnic University and Professor of Psychology in their College of Arts and Sciences. Her earlier work specialized in memory, dementias, stroke and insulin resistance. She is a brain plasticity specialist and certified Cogmed provider. Previously, she was the C.O.O. and co-founder of a stroke and brain injury rehabilitation center. Dr. Nolan has taught university courses at the University of California Irvine, Loyola Marymount University, and Glendale Community College. She has conducted local and nationwide clinical trials, and published in both scientific journals and popular magazines. She received a BA in Psychology from Loyola Marymount University, Los Angeles and a Ph.D. in Neuro-Psychology from the Dept. of Cognitive Science at the University of California, Irvine.

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.

ROBIN G. BITTERLIN is retired from surgical nursing. She is associated with Wood Duck Research, Inc as a Research Ethics Advisor and Consultant. Her research interests focus on Medical Ethics as shaped by theological precepts and daily professional practices. She has management experience in the field of commercial real estate development. Her professional life experience includes serving as a Registered Nurse (RN) Supervisor for operating rooms and school nursing. Robin earned a B. S. Degree in Health Sciences from the University of California Davis and then earned an additional B.S.N. degree from Mount St. Mary's College in Newburgh, New York state.

JUDITH L. JACOBUS is retired from conducting speech therapy as a Speech and Language Specialist for more than two decades. Her experiences were in public schools settings in Orange County. California. She also previously taught for 12 years as a classroom teacher in multi-cultural communities there. Judith currently volunteers her professional skills for a local police department, so has extensive experience with dysfunctional adults and children in a variety of both every-day and traumatic situations. Her participation in amateur theatrics has more fully familiarized her with the characteristics of human behavior as they are projected via verbal, facial and body-language cues. This experience has also exposed her to the skill and art of the selection of appropriate persons for specific on-screen roles. Judith holds a lifetime Special Education Credential in Speech and Hearing Therapy, K-12 from the State of California. She earned a B. A. Degree in

Speech Communications from the California State University Long Beach and an M. A. Degree in Teaching and Teacher Leadership from the Grand Canyon University in Glendale, Arizona.