Advancing Virtual Conversation Efficacy: Technologies to Enable Predictive Language Initiation

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ABSTRACT

The thrust of this paper is to analyze the emerging level of conversational interactions by virtual humans. The authors relate their experience with several projects using Natural Language Processing (NLP) in pure virtual humans or by using videotaped conversational answers from live humans on the topic to be addressed. They present data on "conversationality" of these computer managed interfaces that supports the increasing level of acceptance of the users as they relate to computers as if they were live human beings. Nevertheless, it has been observed that there are a number of instances when the conversation indicated a dramatic divergence from live human behavior due to the lack of the computer's ability to initiate new conversational topics in a natural and conversational way. Several effective aspects of virtual humans could profit greatly from the extensibility of NLP into a more proactive interface with users, The paper discusses a few of these opportunities as being critical in the face of the lack of good alternative approaches to vital concerns. What follows is a description of the overall goals of this research area and the impediments currently hampering progress. Then, there is a presentation of advances in high performance computing, *e.g.* new implementations of quantum computing, and breakthroughs in data management and artificial intelligence, *e.g*. Deep Learning developments, that will enable virtual human conversational improvements which were heretofore impossible. Quantification is offered and data is reported to support these contentions. The paper closes with a discussion, based on the authors' experience over decades, of ways in which this community can accelerate the emergence of the necessary capabilities and enhance the early adoption of the new implements and methods. The paper concludes with guided and guarded speculation about potential extensibilities of these insights into other related fields.

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.

Brian L. Morgan, CAPT, USN, Ret. is currently listed as a member of the Faculty at the Naval Postgraduate School in Monterey California. He has over six years of experience in the practical application of operations research at the Service headquarter level while assigned to the Assessment Division (OPNAV N81) in the Pentagon. He is a Naval Flight Officer with over 3,700 hours in the E-2C Hawkeye and served as Commanding Officer, VAW-117. His military assignments also include service on the Joint Staff as Chief of Operations Test and Evaluation Branch, National Military Command Center. Professionally, he is President-Elect, Military Operations Research Society and a Council Member, INFORMS Military and Security Society. Brian received a BS in Aeronautical Engineering from the University of Virginia and an MS in Operations Research from the Naval Postgraduate School.

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.