Dan M. Davis

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Dan Davis focuses his research and community activities on virtual human-conversational techniques, computer-generated therapeutic avatars, large-scale military simulations, educational uses of computing, globally distributed computing, and the use of high performance, parallel computers. He has been in academic research for decades as a member of the technical staff at Caltech, the University of Southern California, and the University of Hawai'i and as an independent consultant. Funded for a decade by the U.S. Joint Forces Command and RDECOM, his team has conceived, developed and delivered products that have been demonstrated to the Director of Defense Research and Engineering, the Deputy Under Secretary of Defense for Science and Technology, the late Senator Daniel Inouye, former Senator Hillary Clinton, former Speaker Newt Gingrich, numerous flag officers, and other major policy setters. He has published several peer-reviewed articles on this work (see below) and is frequently invited to speak on these and associated topics.

Educational achievements include a Bachelor of Arts in Psychology in 1973 and a Juris Doctors in 1975, both from the University of Colorado in Boulder. While at Boulder, he was a student in the Quantitative Psychology discipline and participated in computational science research on intelligent agents and computer-assisted learning. It was here that he first wrote programs to run on high-performance computers, conceiving and programming an experimental Operations Research program in FORTRAN on one of Seymour Cray's early machines, a CDC 6500.The program was designed to analyze and quantify the impact of various employment selection criteria with subsequent performance. Later work in the Graduate School of Business Administration at CU focused on Organizational Behavior and the quantification and computer analysis of management topics. His studies in Law School there were capped by a study on the impact of tax policy on social behavior.

He has taught at both the undergraduate and graduate levels. He taught primarily Introduction to Psychology and Business Law at Blair College, Colorado Springs, from 1980 to 1985, where he was once selected as Instructor of the Term. In 1986 he also taught a course in Negotiations to Masters candidates in Denver for the University of Phoenix. He was certified to teach Psychology, Business Law, Corporations, Statistics, and Personnel Management by the State of Colorado. As of the Summer of 2016, his articles have been cited 360 times by other authors. As a researcher, he has been active in High Performance Computing (HPC), focusing on agent-based models, since 1988.

His professional career includes practicing law with his father for 10 years, 1975-1985, (admitted to Colorado State, Federal and the US Supreme Courts), after which he was recruited by Martin Marietta to act as counsel and federal contracts manager on a large DoD classified contract. In 1988 he was transferred to JPL in Pasadena as a Software Engineer to act as Classification Manager and to advise on security and contractual issues. In 1992, he was appointed as the Assistant Director of the Center for Advanced Computing Research at Caltech, where he participated in research proposals, external relations, administrative and executive duties for a $15M/year supercomputer center. In 1999, he assumed the position of Associate Director for Strategic Development at the Information Sciences Institute, a 350-person research division of USC. He then was the Director for Finance and Contracts at the Maui Supercomputing Center, University of Hawai'i. In 2002, he returned to USC to become the Director of the JESPP Project, a DoD simulation project using HPC. He has been in semi-retirement since 2014, but actively engages is consulting work for USC's engineering institutes. His most recent work is reflected in the conference papers listed below.

Over the last two decades, he has led or participated in proposal efforts up to $600M and was a section-lead on a proposal that won $181M in 2001 and twice won a $600M award, only to have the project cancelled prior to execution. He has extensive experience with government, industry and foundation relations. He was engaged as an independent consultant acting as the Director of the Joint Experimentation on Scalable Parallel Processors project at the Information Sciences Institute, University of Southern California. This project provided scalable code to the U.S. Joint Forces Command allowing more than ten million individual vehicle and pedestrian independent agents to be simulated in a global-scale terrain database.

He has been active in design rule checking algorithm research, large-scale distributed simulations for the DoD and in researching supercomputer uses in education. He was the Chairman of the Coalition of Academic Supercomputing Centers for 1998 and Chaired the Coalition for Academic Scientific Computation in 1999. He was on several committees

at the University of Southern California and various professional conferences. Based largely on his extensive publication record and professional leadership positions, Dan was elevated to Senior Member status in the Association of Computer Machinery in 2009. He is an Erdős 3 via Laura Ekroot and Robert McEliece.

He has served as a cryptologist and linguist on active duty in the USMC, including two Vietnam War tours in Southeast Asia, one in-country at Phu Bai and Con Thien and one at Ramusan Station, Thailand. He retired with the rank of Commander, US Naval Reserve, in which he was commissioned in the Cryptologic Specialty area. He has served significant tours of active duty at Camp Pendleton, Camp Lejeune, Vietnam, Thailand, Pensacola, San Diego, Washington DC, Ft. Meade, Misawa Japan, Naples Italy, and London UK.

Journal Articles

Amburn, E.P., Burns, D.P., Davis, D.M. & Lucas, R.F. (2016). "Facilitating V-Model Analyses: Data Visualization for Test and Evaluation". *The ITEA Journal of Test and Evaluation*, 37(3), 246-256.

Tran, J.T., Yao, K-T., Lucas, R.F., Davis, D.M., & Burns, D.P. (2016). "System Engineering a Scalable Cyber Warfare Test Environment". *The ITEA Journal of Test and Evaluation*, *37*(1), 34-43.

Lucas, R.F., Davis, D.M., & Burns, D.P. (2015). "System of Systems Complexity Addressed by Practical Adiabatic Quantum Computing". *The ITEA Journal of Test and Evaluation*, *36(4)*, 311-321.

Davis, D. M., Wagenbreth, G., Lucas, R. F. & Gregory, P. C., (2011), "The Test and Evaluation Uses of Heterogeneous Computing: GPGPUs and Other Approaches, *The ITEA Journal of Test and Evaluation*, Fairfax, Virginia. 32(4)

Yao, K-T., Ward, C. E. & Davis, D. M., (2011), "Data Fusion of Geographically Dispersed Information: Experience with the Scalable Data Grid", *The ITEA Journal of Test and Evaluation*, Fairfax Virginia. 32(4)

Yao, K-T., Davis, D. & Lucas, R., (2006),"Supercomputing's Role in Data Problems and Its Contribution to Solutions," *The ITEA Journal of Test and Evaluation*, Fairfax, Virginia, Sep-Oct, 2006. 27(3), 57-59

Lucas, R., Davis, D. & Yao, K-T., (2006)," High Performance Computing Facilities for Joint Military Simulation Data Management," *The ITEA Journal of Test and Evaluation*, Fairfax, Virginia.

Gottschalk, T. D., Amburn, P., & Davis, D. M. (2005). Advanced message routing for scalable distributed simulations. *The Journal of Defense Modeling and Simulation: Applications*, Methodology, Technology, 2(1), 1h7-28.

Davis, D., Lucas, R., Amburn, P. & Gottschalk, T., (2005), "Joint Experimentation on Scalable Parallel Processors," *The ITEA Journal of Test and Evaluation,* Fairfax, Virginia, 2005

Conference Papers

(Most on-line via his web site: http://www.hpc-educ.org/Papers.html)

Beck, S., Carr, K., Davis, D. M., Nordhagen, J. N., and Nye, B. D. (2018). "Virtual Mentors in a Real STEM Fair: Experiences, Challenges, and Opportunities ".In *Third International Workshop on Intelligent Mentoring Systems (IMS 2016)* Proceedings.

Burns, D.P., Davis, D.M. & Nordhagen, J. N. (2018). "Systems Engineering: Optimizing Creation of Virtual Conversational Human ". In the Proceedings of the *ModSim World Conference,* Norfolk, Virginia.

Kaimakis, N.J., Davis, D.M., Breck, S. & Nye, B.D. (2018). "Domain-Specific Reduction of Language Model Databases: Overcoming Chatbot Implementation Obstacles". In the Proceedings of the *ModSim World Conference,* Norfolk, Virginia.

Davis, D.M., Kaimakis, N.J. & Spaulding, H. (2018). "Critical Thinking Training: Proven New Technologies for Engaging DoD Personnel". In the Proceedings of the *ModSim World Conference*, Norfolk, Virginia.

Yao, K-T., Davis, D. M., Liu, J. J., & Kaimakis, N. J.. (2018, Pending). "New Technologies to Enhance Computer Generated Interactive Virtual Humans ". In the Proceedings of the *SISO Fall Simulation Innovation Workshop*, Orlando, Florida: SISO

Davis, Mark C., Robinson, Douglas W., Kaimakis, Nicholas, J. & Davis, Dan M., (2017). "Patent Law and Defense Technology: Original Intent and Current Practice" in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2017

Nye, B., Swartout, W., Campbell, J., Krishnamachari, M., Kaimakis, N. and Davis,

D. (2017). "MentorPal: Interactive Virtual Mentors Based on Real -Life STEM Professionals ." in the Proceedings of the *Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2017

Elstad, E.C. and Davis, D.M. (2017). "Implementing Innovative Constructivism: An Architected Approach to Enhancing STEM Education." in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2017

Burns, D.P., Petersen, L. J., Davis, D.M. & Yao K-T. (2016). "Advanced Technologies to Enable Simulation of Life-Cycle Sustainment of Weapon Systems". In the Proceedings of the *SISO Fall Simulation Innovation Workshop*, Orlando, Florida:SISO

Davis, D.M., Lucas, R.F., & Burns, D.P. (2015). "Practical Adiabatic Quantum Computing: A New Capability for the Test and Evaluation Community". *ITEA Annual Technology Review*, Huntsville, Alabama: ITEA.

Amburn, E.P., Davis, D.M., Lucas, R.F., & Burns, D.P. (2015). "Data Visualization for Test and Evaluation: Challenges, Opportunities and Emerging Technologies". *ITEA Annual Technology Review*, Huntsville, Alabama.

Yao, K-T., Tran, J.T., Lucas, R.F., Davis, D.M., & Burns, D.P. (2015). "Implementing a Scalable Test Environment Simulation for Cyber Warfare". *ITEA Annual Technology Review, Huntsville*, Alabama.

Tran, J. J., Castello, B. R., Lucas, D. W. H. R. F., Yao, K. T., & Davis, D. M. (2015). "Employing High Performance Computing to Realize a Cyber Quick-Reaction Training Environment." in the *Proceedings of ModSIM World*, Norfolk, Virginia, March, 2015

Lucas, Robert F., Gene Wagenbreth, John J. Tran, David R. Pratt, and Dan M. Davis. (2013) "Practical Adiabatic Quantum Computing: Implications for the Simulation Community." in the *Proceedings of the Interservice/Industry Simulation,*

Training and Education Conference, Orlando, Florida, 2013

R.F. Lucas, G. Wagenbreth, D.M. Davis, and R.G. Grimes, (2012), "Multifrontal Factorization on Heterogeneous Multicore Systems", in the Proceedings of the *SIAM Conference on Applied Linear Algebra*, Valencia, Spain, June 22, 2012

Gottschalk, T. D., Yao, K-T., Wagenbreth, G. & Davis, D. M., (2010), "Implementing Emerging High Performance Computing and Data Management Technologies in Agent Based Simulations", in the *Proceedings of the WinterSim2010 Conference*, Baltimore, Maryland

Gottschalk, T. D., Yao, K-T., Wagenbreth, G. & Davis, D. M., (2010), "Distributed and Interactive Simulations Operating at Large Scale for Transcontinental Experimentation", in the *Proceedings of the IEEE/ACM Distributed Simulations and Real Time Applications 2010 Conference*, Fairfax, Virginia

Davis, D. M., Roberts, D. W. & Baer, G. D., (2010), "Developing a Research Administration Course for Academics: A Need Too Long Ignored", in the Proceedings of the *SISO Fall 2010Simulation Interoperability Workshop*, Orlando, Florida

Lucas, R. F., Wagenbreth, G., Yao, K-T., Davis, D. M., & Jeong, J. H., (2010), "Equation-Based Models in Discrete-Element and Agent-Based Simulations", in the Proceedings of the *SISO Fall 2010Simulation Interoperability Workshop* , Orlando, Florida

Davis, L. K., Curiel, J., & Davis, D. M., (2010), "HITL and Metacognition: Self Analysis and Leadership Enhancement During Simulations", in the Proceedings of the *SISO Fall 2010Simulation Interoperability Workshop*, Orlando, Florida

Wagenbreth, G., Lucas, R. F., Yao, K-T., Davis, D. M. & Ward, C. E., (2010), "Nondisruptive Data Logging: Tools for JFCOM Large-scale Simulations", in the Proceedings of the *SISO Fall 2010Simulation Interoperability Workshop*, Orlando, Florida

Tran, J. J., Davies, J. P. S. W. A., Adame, V. B., Davis, D. M., Andrews, J. B., & ANGS, S. (2010) Building a Technology Center for Iraqi Air Force Communications Training. in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2010

Davis, D. M., Wagenbreth, G., Lucas, R. F.& Gregory, P. C., (2010), "The Test and Evaluation Uses of Heterogeneous Computing: GPGPUs and Other Approaches", in the *Proceedings of the ITEA Annual Technology Review*, Charleston, South Carolina

Wagenbreth, G., Davis, D. M. & Lucas, R. F., (2010), "GPGPU Programming Courses:Getting the Word Out to the Test and Evaluation Community", in the *Proceedings of the ITEA Annual Technology Review*, Charleston, South Carolina

Lucas, R. F., Wagenbreth, G. & Davis, D. M., (2010), "System Analyses and Algorithmic Considerations in CUDA Implementations for Complex Simulations", in the *Proceedings of the ITEA Annual Technology Review*, Charleston, South Carolina

Yao, K-T., Ward, C. E. & Davis, D. M., (2010), "Data Fusion of Geographically Dispersed Information: Experience with the Scalable Data Grid", in the

Proceedings of the ITEA Annual Technology Review, Charleston, South Carolina

Lucas, R. F., Wagenbreth, G., Davis, D. M. & Yao, K-T. (2010), "Potential Uses of GPGPU-Enhanced Cluster Computing in MCAE Simulations for Non-linear Mechanical Dynamics", in the *Proceedings of the HPCMP Users Group Conference*, Schaumburg, Illinois

Davis, D. M., Lucas, R. F., Wagenbreth, G., Roberts, D. W. & Brewton, C., (2010), "The Future Uses for the GPGPU-Enhanced Cluster at JFCOM", in the *Proceedings of the HPCMP Users Group Conference*, Schaumburg, Illinois

Lucas, R. F., Wagenbreth, G., Davis, D. M. & Grimes, R. G., (2010), "Multifrontal Computations on GPUs and Their Multi-core Hosts", In the *Proceedings of VECPAR'10*, Berkeley, California

Davis, D. M., Baer, A.M., Davis, L. M.,& Gottschalk, T. D., (2010), "Applying HPCC Technology to Systemic Diversity Dilemmas ," in the *Proceedings of the Australian Computers in Education Conference*, Melbourne, Australia, April 2010

Davis, D. M., Lucas, R. F., Gottschalk, T. D., Wagenbreth, G., & Agalsoff, J., (2009), "FLOPS per Watt: Heterogeneous-Computing's Approach to DoD Imperatives," in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2009

Lucas, R. F., Davis, D. M., Wagenbreth, G., & Tran, J. J., (2009), "Operational Use of a Large GPGPU-Enhanced Linux Cluster" in the *Proceedings of the High Performance Computing Modernization Program Users' Group Conference*, San Diego, California, 2009

Lucas, R. F., Davis, D. M., Wagenbreth, G., Tran, J. J. & Ceranowicz, A. (2009). "Experimental Use of a Large GPGPU-Enhanced Linux Cluster." in the *Proceedings of the High Performance Computing Modernization Program Users' Group Conference*, San Diego, California, 2009

Tran, J. J., Lucas, R. F., Yao, K-T, Wagenbreth, G., Davis, D. M., & Bakeman, D. J., (2008), "A High Performance Route-Planning Technique for Dense Urban Simulations", in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2008

Davis, D. M., Lucas, R. F., Wagenbreth, G., & Tran, J. J., (2008), "Effectively using a Large GPGPU-Enhanced Linux Cluster" in the *Proceedings of the High Performance Computing Modernization Program Users' Group Conference*, Seattle, WA, 2008

Davis, D.& Moore, J., (2007), "FPGA and GPUs as Accelerators for Linux Clusters," in the *Proceedings of the International Test and Evaluation Association M&S Conference*, Las Cruces, New Mexico, 2007

Davis, D., Gottschalk, T. & Davis, L., (2007), "High Performance Computing Allows Simulation to Transform Education ," in the *Proceedings of the Winter Simulation Conference*, Washington, DC, 2007

Davis, L. K. & Davis, D. M., (2007), "Implementing New Educational Technology for 21st Century DoD Leadership Development," in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2007

Davis, D., Lucas, R., Wagenbreth, G., Tran, J., & Moore, J. (2007, June). A GPU-enhanced cluster for accelerated FMS. In *DoD High Performance Computing Modernization Program Users Group Conferenc*e, 2007 (pp. 305-309). IEEE.

Lucas, R. F., Davis, D. M. & Wagenbreth, G., (2007), "Implementing a GPU-Enhanced Cluster for Large-Scale Simulations," in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2007

Gottschalk, T. & Davis, D. (2006), "Application of Proven Parallel Programming Algorithmic Design to Aggregation-Deaggregation Problems," in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2006

Davis, D. and Davis, L, (2006), "Educational Extensions of Large-Scale Simulations Enabled by High Performance Computing in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2006

Davis, D. (2006), "Large-Scale Simulations and Transcontinental Data Management and Analysis", *4th Cluster Symposium On the Use of Commodity Clusters for Large-Scale Scientific Applications 2006*, Baltimore, Maryland, July 2006

Pratt, D.R., Amburn, P., Lucas, R.F., & Davis, D.M., (2006), "Petascale Computing for Military Operations", Proceedings of the *Simulation Interoperability Workshop*, Baltimore, Maryland, July, 2006

Davis, D. & Lucas, R., (2006), "Joint Experimentation, Data Management and Analysis Enabled by Trans-Continentally Distributed Linux Clusters", *HPCMP Users' Group Conference*, Denver, Colorado. June, 2006

Davis, D. & Baer, G.(2006),"Providing Scalable Simulations, Environments and Data Structures for Theatre of War Analysis and Training ," presented at *International Training and Education Conference*, London, UK

Davis, D., & Baer, G., (2005)," High Performance Computing Facilities for Joint Military Simulation Data Management," presented at *ITEA Modeling and Simulation Conference*, Las Cruces, NM, 2005

Wagenbreth, G., Yao, K-T., Davis, D., Lucas, R., and Gottschalk, T., (2005),"Enabling 1,000,000-Entity Simulations on Distributed Linux Clusters," *WSC05-The Winter Simulation Conference*, Orlando, Florida,

Davis, D., Baer, G., & Gottschalk, T., (2004), "21st Century Simulation: Exploiting High Performance Parallel Computing and Advanced Data Analysis,"in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida

Davis, D.M., Lucas, R.F. Gottschalk T.D., & Amburn E.P. (2004). " Upgrading to Large Linux Clusters: JESPP's Experience in Scaling up to 512 Processors ". *HPCMP Symposium - On the Use of Commodity Clusters for Large-Scale Scientific Applications - 2004*, Annapolis Maryland

Lucas, R., & Davis, D., "Joint Experimentation on Scalable Parallel Processors," (2003), in the *Proceedings of the Interservice/Industry Simulation, Training and Education Conference*, Orlando, Florida, 2003

Brunett, S., Davis, D., Gottschalk, T., Messina, P., & Kesselman, C., (1998) "Implementing Distributed Synthetic Forces Simulations in Metacomputing Environments," in the *Proceedings of the Seventh Heterogeneous Computing Workshop*, Orlando, Florida, March 1998

Messina, P., Brunett, S., Davis, D., Gottschalk, T., Curkendall, D., & Seigel, H., (1997) "Distributed Interactive Simulation for Synthetic Forces," in the *Proceedings of the 11th International Parallel Processing Symposium*, Geneva, Switzerland, April 97

Messina, P., Davis, D., Brunette, S., Gottschalk, T., Curkendall, D., Ekroot, L., ... & Lawson, C. , (1997) "Synthetic Forces Express: A New Initiative in Scalable Computing for Military Simulations.", in the *Proceedings of the Simulation Interoperability Workshop*, Orlando, March 1997

Invited Speaker

Davis, D. M., (2016), "The Need for Better Technical Writing Education: Why Can't Our Scientists and Engineers Write Better? ," at the Sato Academy of Mathematics and Science, Long Beach, CA, 2016

Davis, D. M., Gottschalk, T. D., & Lucas, R. F., (2007), "Consistency between Various Abstraction Layers: Approaches to the Aggregation/De-aggregation Problem," at the DARPA Future of Constructive Simulation Workshop, San Diego, CA, 2007

Lucas, R. F., Gottschalk, T. D., & Davis, D. M., (2007),"Scalable Distributed Systems and Data Management: Advanced Architectures and Individual Entity Parallelization ," at the DARPA Future of Constructive Simulation Workshop, San Diego, CA, 2007

Davis, D. M., "Interactive High Performance Computing: Lessons Learned ,", in the Interactive Computing Birds of a Feather, at the 4th Cluster Symposium On the Use of Commodity Clusters for Large-Scale Scientific Applications 2006, Baltimore, Maryland, July, 2006

Davis, D., "Scoping, Specifying and Satisfying the Need for Large-Scale Distributed Data Management," at the 3rd Cluster Symposium On the Use of Commodity Clusters for Large-Scale Scientific Applications 2005, Arlington, Virginia, July, 2005

Davis, D., "Interactive HPC for Forces Modeling and Simulation: HPCMP's Distributed Center for JFCOM's JESPP Project," at the HPCMP User Group Conference, Nashville, Tennessee, June, 2005

Davis, D., "Joint Experimentation on Scalable Parallel Processors," at the International Test and Evaluation Association (ITEA), Modeling and Simulation Workshop, Las Cruces, New Mexico, December, 2004

Davis, D., "Large-Scale Military Simulations on Linux Clusters: Update, Remote DCs and Interactive Ops," at the 2nd Annual Symposium on the On the Use of Commodity Clusters for Large-Scale Scientific Applications, Arlington, Virginia,

July, 2004

Davis, D., "Large-Scale Intelligent Agent Simulations on Linux Clusters: Applications, Implementations, and Implications," at the Symposium on the On the Use of Commodity Clusters for Large-Scale Scientific Applications, Arlington, Virginia, July, 2003

Technical Reports

Lucas, R. F., Wagenbreth, G., Tran, J. J., & Davis, D. M. (2012). "Multifrontal sparse matrix factorization on graphics processing units." Technical Report, Information Sciences Institute, University of Southern California, Los Angeles, CA, USA, Tech. Rep. ISI-TR-677.

Davis, D. M., & Lucas, R. F. (2010). "Joint Experiment on Scalable Parallel Processor Supercomputers." AFRL-RI-RS-TR-2010-075 Final Technical Report, Air Force Research Laboratory/IFTC, Rome, New York. DTIC ADA516717.

Davis, D. M., & Lucas, R. F. (2006). "Joint Experiment on Scalable Parallel Processors (JESPP) Parallel Data Management". AFRL-IF-RS-TR-2006-164 Final Report, Air Force Research Laboratory/IFTC, Rome, New York. DTIC ADA451492.

Lucas, R.F., Wagenbreth, G., & Davis, D., (2006) "Polymorphous Computer Architectures (PCA) Technology Transition to Joint Semi Automated Forces (JSAF)," AFRL-IF-RS-TR-2006-255 Final Technical Report, DARPA, Arlington, Virginia DTIC ADA456918