

Hughes, Charles E.

December 2020

Pegasus Professor: Department of Computer Science
Secondary Appointments in the School of Modeling, Simulation & Training Graduate Program,
College of Community Innovation & Education, and Department of Games & Interactive Media

Interim Director: School of Modeling Simulation & Training Graduate Programs

Co-Lead: Learning Sciences Cluster

Member: Disabilities, Aging and Technology Cluster

Co-Lead: Center for Research in Education Simulation Technology

Contributing Faculty: Institute for Simulation & Training

Co-Director: Synthetic Reality Laboratory: <http://sreal.ucf.edu/>

University of Central Florida (<http://www.ucf.edu>)

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TeachLive Project: <http://teachlive.org>

Member of Computational Imaging Lab: <http://cil.cs.ucf.edu>

BIOGRAPHICAL DATA

Education:

Ph.D. December 1970, Computer Science; Penn State Univ., University Park, PA

M. S. December 1968, Computer Science; Penn State Univ., University Park, PA

B.A. June 1966, Mathematics; Northeastern Univ., *Boston*, MA

Academic Experience:

1980-Present: Professor, Electrical Engineering and Computer Science, University of Central Florida

2020-Present: Interim Director, School of Modeling Simulation & Training Graduate Programs

2019-Present: Professor, College of Community Innovation and Education

2019-Present: Professor, School of Modeling, Simulation and Training

2018-Present: Co-Director, Center for Research in Education Simulation technology (CREST)

2017-Present: Co-Lead of Learning Sciences Faculty Cluster

2010-Present: Founding Director and Current Co-Director, Synthetic Reality Laboratory

2007-Present: UCF Pegasus Professor

2005-Present: Professor, Games and Interactive Media

1982-Present: Contributing Faculty, Institute for Simulation & Training

2006-2010: Director, Media Convergence Laboratory

2007-2008: Associate Director, School of EECS

2007-2009: Cognitive Sciences Faculty

2001-2009: Affiliate Faculty, Text & Technology PhD Program

1974-1980: Assoc. Prof. (74-78); Prof. and Assoc. Chair (78-80), Computer Science, Univ. of Tennessee

1972-1974: Assistant Professor of Computer Science, Pennsylvania State Univ.

1971-1972: Postdoctoral Research Associate – National Research Council/NIST, Washington, D.C.

1968-1971: Instructor of Computer Science, Pennsylvania State Univ.

1967-1968: Research Assistant, Computer Science, Pennsylvania State Univ.

Industrial Experience:

1966-1968: Computer Programmer – Applied Research Lab., State College, PA

1962-1966: Computer Programmer – Radio Corp. of America, Burlington, MA

TEACHING

Teaching Interests:

Theory of Computation, Design & Analysis of Algorithms, Systems Programming

Teaching Recognitions at UCF:

Teaching Incentive Awards: 2015, 2009, 2002, 1995

College Award for Excellence in Undergraduate Teaching: 2001, 1992

University Award for Excellence in Undergraduate Teaching: 2001

Ph.D. Direction (Completed):

1. Anthony Wehrer, *Multi-Modal Interface for Sensemaking of Graph-Connected Datasets*, December 2019, Simetr, Inc., Winter Park, FL.
2. Thomas Carbone, *Psychomotor Skill Measurement of Video Game Players*, December 2018, Florida Interactive Entertainment Academy, University of Central Florida, and Iron Galaxy Studios, Orlando, FL.
3. Sungchul Jung, *Personalized Digital Body: Enhancing Body Ownership and Spatial Presence in Virtual Reality*, May 2018, HIT Lab NZ, University of Canterbury, Christ Church, NZ.
4. Ahmad Abualsamid, *Applied Software Tools for Supporting Children with Intellectual Disabilities*, May 2018, Reach Beyond Academy, Winter Springs, FL.
5. Behnaz Nojavanasghari, *Complex Affect Recognition in the Wild*, December 2017 (co-director: L. P. Morency, Carnegie Mellon University), Cognitiv, Bellevue, WA.
6. Antoniya Petkova, *Network Partitioning in Distributed Agent-Based Models*, December 2017 (co-director: Narsingh Deo).
7. Roghayeh Barmaki, *Gesture Assessment of Teachers in an Immersive Rehearsal Environment*, August 2016, Assistant Professor, University of Delaware, Newark, DE.
8. Alyssa Tanaka, *The Effect of Videogame Play on Robotics Surgery Skill Acquisition*, December 2015, Research Scientist, Soartech, Orlando, FL.
9. Aleshia Hayes, *The Experience of Presence and Social Presence in a Virtual Learning Environment as Impacted by the Affordance of Movement Enabled Motion Tracking*, August 2015, Assistant Professor University of North Texas, Denton, TX.
10. Yiyang Xiong, *Automatic 3D Human Modeling: An Initial Stage towards 2-Way Inside Interaction in Mixed Reality*, May 2014. Member of Technical Staff, Advanced Micro Devices, Orlando, FL.
11. Emiko Charbonneau, *Bridging the Gap between Fun and Fitness: Instructional Techniques and Real-World Applications for Full-Body Dance Game*, August 2013 (co-director: Joseph LaViola). Microsoft, Redmond, WA.
12. Nicholas Beato, *Towards Real-Time Mixed Reality Matting in Natural Scenes*, December 2012. Software Engineer III, Google, Mountain View, CA.
13. Jared Johnson, *Algorithms for Rendering Optimization*, University of Central Florida, May 2012. Software Engineer III, Google, Mountain View, CA.
14. Glenn Martin, *Automatic Scenario Generation Using Procedural Modeling Techniques*, University of Central Florida, May 2012. Director, Interactive Realities Lab, Institute for Simulation & Training, University of Central Florida, Orlando, FL.
15. Paul Varcholik, *Multitouch for General Purpose Computing: An Examination of Text Entry*, University of Central Florida, May 2011 (co-director: Joseph LaViola). Programming Faculty, Florida Interactive Entertainment Academy, University of Central Florida, Orlando, FL.
16. Sameer Joshi, *Automation of Concept Acquisition*, University of Central Florida, December 2008. CEO, Datanova Scientific LLC, Washington, DC.
17. Mark Colbert, *Appearance-Driven Material Design*, University of Central Florida, August 2008 (co-director: Erik Reinhard). Google Search Front-End Experience Lead Manager, Google, Mountain View, CA.
18. Yunjun Zhang, *Augmentation in Visual Reality*, University of Central Florida, August 2007. Member of Technical Staff, Advanced Micro Devices, Orlando, FL.

19. Keith Garfield, *A Sparse Program Dependence Graph for Object-Oriented Programming Languages*, University of Central Florida, December 2006 (co-director: Rebecca Parsons). Assistant Professor, Electrical, Computer, Software & Sys. Eng., Embry-Riddle Aeronautical University, Daytona Beach, FL.
20. Felix Hamza-Lup, *Dynamic Shared State Maintenance in Distributed Virtual and Mixed Reality Environments*, University of Central Florida, July 2004 (co-director: Jannick Rolland). Professor, Computer Science, Georgia Southern University, Savannah, GA.
21. Marc Smith, *View-centric Reasoning about Parallel and Distributed Computation*, Univ. of Central Florida, December 2000 (co-director: Rebecca J. Parsons). Associate Professor, Computer Science, Vassar College, Poughkeepsie, NY.
22. Jennifer Burg, *Parallel Execution Models and Algorithms for Constraint Logic Programming over a Real-Number Domain*, Univ. of Central Florida, May 1992 (co-director: Sheau-Dong Lang). Professor, Computer Science, Wake Forest University, Winston-Salem, NC.
23. Farah Arefi, *Automatically Generating Syntax-Directed Editors for Graphical Languages*, Univ. of Central Florida, August 1988 (co-director: David A. Workman). Unknown.
24. Kathryn Kinsley, *An Analytical Model for Evaluating Database Update Schemes*, Univ. of Central Florida, May 1983. President, Datawise Inc., Orlando, FL.
25. Vida Ghodssi, *Incremental Data Flow Analysis*, Univ. of Central Florida, December 1983. Director of Software Development, Oracle, Sunnyvale, CA.
26. John R. Mashey, *Semantic Error Detection in Programming Languages*, Penn State University, May 1974. Venture Capitalist and Consultant to VC Firms; Trustee, Computer History Museum; Former Chief Scientist at Silicon Graphics, Mountain View, CA.

Ph.D. Direction (Active):

Post-Candidacy:

Julie Kent (M&S Program)
Kamran Ali (CpE Program)

Pre-Candidacy:

Erik Sands (M&S Program)

Other Student Research Mentoring:

Current Undergraduates

Itzik Efraim
Will English
Ronit Luthra
Sachin Shah

Current & Recent High School Students

Neel Patel (2009-12); Harvard Class of 2016; Placed 6th in Intel Science Talent Search Competition (ISEF); published several papers while in high school, including one in *ACM Interactions*, January 2012.

Nikhil Patel (2013-17); Yale Class of 2021; 2015 Regional Grand Prize Science & Engineering Fair Winner; 4th Award 2015 ISEF; 2nd Award 2016 ISEF, 1st place award from the International Honor Society in Psychology, Psi Chi, 3rd place from the American Psychological Association, and 1st place from the US Patent and Trademark Office Society; Awarded Congress-Bundestag Youth Exchange Scholarship for 2016-17; published several papers while in high school, including one at the *Interservice/Industry Training, Simulation and Education Conference*, November 2016.

Sapna Patel (2014-2018); Columbia Class of 2022, awarded Rabi Scholar award (one of only ten per year); 2015 Florida Engineering Science Fair recognition -- Intel Excellence in Computer Science and Florida Department of Agriculture and Consumer Services Awards; 3rd Award 2015, 4th Award 2016 and 3rd Award 2017 ISEF; 1st place 2016 and 3rd place 2017 American Psychological Association; 2018 Semi-Finalist in Regeneron Science Talent Search; published several papers while in high school, including one in the *Workshop on Child Computer Interaction*, September 2016.

Donald Lisle (2015-16); UCF Class of 2021; Member of UCF Honor College.

Ronald Xu (2016-); Senior at Winter Springs High School; 2nd Place 2018 Florida Engineering Science Fair; 1st Place 2019 Florida Engineering Science Fair; 4th Place Award 2019 ISEF and 3rd place 2019 American Psychological Association

Text and Educational Books:

Hughes C. E., & Moshell J. M. (1985). *Visible Pascal*, John Wiley & Sons, Inc., New York.

Hughes, C. E., & Moshell J. M. (1984). *Imagination: Picture Programming*, John Wiley & Sons, Inc., New York.

Moshell J. M., & **Hughes, C. E.** (1984). *Imagination: Quilt*, John Wiley & Sons, Inc., New York.

Moshell, J. M., **Hughes C. E.** et al. (1982). *Computer Power: A First Course in Using the Computer*, McGraw-Hill, New York, Teacher's Text – 340 pages, Student's Text – 193 pages, plus software.

Hughes, C. E., Pfleeger C. P., & Rose, L. (1978). *Advanced Programming Techniques: A Second Course in Programming Using FORTRAN*, John Wiley & Sons, Inc., New York, 287 pages. Russian Translation, 1981.

Forsythe, A. I., **Hughes, C. E.**, Aiken R. M., & Organick, E. I. (1976). *Computer Science: Programming in BASIC*, John Wiley & Sons, Inc., New York, 148 pages. Japanese Translation, 1981.

Forsythe, A. I., Aiken R. M., **Hughes, C. E.**, & Organick, E. I. (1975). *Computer Science: Programming in FORTRAN with WATFOR/WATFIV*, John Wiley & Sons, Inc., New York, 200 pages. Japanese Translation, 1980.

RESEARCH

Current Research Interests (Keywords):

Affective Computing, Human-Centered Computing, Mixed/Virtual Reality, Theory of Computation, Tree of Life, Virtual Learning Environments

Recent Research Recognitions

2020 NCS Modeling and Simulation Hall of Fame Inductee

2018 Best Paper Award, *ACM Symposium on Spatial User Interaction (SUI 2018)*

2016 Best Paper Award, *IEEE International Conference on Serious Games and Applications for Health*

2015 Grand Challenge People's Choice Award, *International Conference on Multimodal Interaction*

2015 Publication Award from the *Teacher Education Division of the Council for Exceptional Children*

2014 Keynote speaker at ACM Multimedia 2014 EMASC-2014 Workshop

2014 TeachLivE selected for *2014 Learning to Teach Impact Award*

2013 TeachLivE selected for NTSA *Governor's Award for Outstanding Achievement in Modeling & Simulation*

2013-14 CECS Excellence in Research

2013, 2007 Research Incentive Award, 1995 Professional Excellence Program Award

2013 CECS Advisory Board Award for Faculty Excellence

2013 Dean's Research Professorship Award

2013 Invited Participant Dagstuhl Seminars – Virtual Reality

2012 UCF Fellow of the Academy for Teaching, Learning and Leadership

2012 TeachLivE Selected for AACTE *2012 Best Practice Award for Innovations in Technology*

2009 Best Paper Award, *Genetic and Evolutionary Computation Conference (GECCO 2009)*

Publications: (* reflects current or former student co-authors)

Preprints (arXiv):

1. Ali, K.*, & Hughes, C. E. (2020). An Efficient Integration of Disentangled Attended Expression and Identity Features For Facial Expression Transfer and Synthesis. *arXiv:2005.00499v1 [cs.CV]*.
2. Ali, K.*, & **Hughes, C. E.** (2019). Facial Expression Representation Learning by Synthesizing Expression Images. *arXiv:1912.01456v1 [cs.CV]*.
3. Ali, K.*, & **Hughes, C. E.** (2019). All-In-One: Facial Expression Transfer, Editing and Recognition Using A Single Network. *arXiv:1911.07050v1 [cs.CV]*.

4. Ali, K.*, Isler, I.*, & **Hughes, C. E.** (2019). Facial Expression Recognition Using Human to Animated-Character Expression Translation. *arXiv: 1910.05595v1* [cs.CV].
5. Ali, K.*, & **Hughes, C. E.** (2019). Facial Expression Recognition Using Disentangled Adversarial Learning. *arXiv: 1909.13135v1* [cs.CV].
6. Hamza-Lup*, F. G., Rolland, J. P., & **Hughes, C. E.** (2018). A Distributed Augmented Reality System for Medical Training and Simulation. *arXiv:1811.12815* [cs.DC].
7. Hamza-Lup*, F. G., **Hughes, C. E.** & Rolland, J. P. (2018). Sensors in Distributed Mixed Reality. *arXiv:1811.11955* [cs.DC].

Journals:

1. Dieker, L. A., Straub, C., Hynes, M., Hughes, C. E., Bukaty, C., Bousfield, T., & Mrstik, S. (2019). Using Virtual Rehearsal in a Simulator to Impact Performance of Science Teachers. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS)*, 11(4), 1-20.
2. Barmaki, R.*, & **Hughes, C. E.** (2018). Embodiment Analytics of Practicing Teachers in a Virtual Rehearsal Environment. *Journal of Computer Assisted Learning*, 34(4), 387-396.
3. Abualsamid A.*, & Hughes C.E. (2018). Using a Mobile App to Reduce Off-Task Behaviors in Classrooms: A Pilot Study. *Journal on Technology and Persons with Disabilities*, Vol. 6, 378-384.
4. Dieker, L. A., **Hughes, C. E.**, Hynes, M. C., & Straub, C. (2017). Using simulated virtual environments to improve teacher performance. *School University Partnerships (Journal of the National Association for Professional Development Schools): Special Issue: Technology to Enhance PDS*, 10(3), 62-81.
5. Taylor, M.*, Tucker, J., Donehower, C.*, Pabian, P., Dieker, L. A., Hynes, M. C., & **Hughes, C.** (2017). Impact of virtual simulation on the interprofessional communication skills of physical therapy students. *Journal of Physical Therapy Education*, 31(3), 83-90.
6. Wehrer, A.*, Yee, A.*, Lisle, C., & **Hughes, C. E.** (2015). PhyloPen: Phylogenetic tree browsing using a pen and touch interface. *PLOS Currents: Tree of Life*. 2015 Nov 23, Edition 1.
7. Dieker, L. A., Hynes, M. C., **Hughes, C. E.**, Hardin, S. *, & Becht, K. * (2015). TLE TeachLivE (TM): Using Technology to Provide Quality Professional Development in Rural Schools. *Rural Special Education Quarterly* 34(3), 11-16.
8. Nagendran, A., Pillat, R.*, Kavanaugh, A.*, Welch, G., & **Hughes, C. E.** (2014). A Unified Framework for Individualized Avatar-Based Interactions. *Presence: Teleoperators and Virtual Environments*, 23(2), 109-132.
9. Dieker, L. A., Straub, C., **Hughes, C. E.**, Hynes M. C., & Hardin, S. E.* (2014). Virtual environments can take us virtually anywhere. *Educational Leadership*, 71(8), 54-58.
10. Dieker, L. A., Rodriguez, J.*, Lingnugaris-Kraft, B., Hynes, M., & **Hughes C. E.** (2014). The Future of Simulated Environments in Teacher Education: Current Potential and Future Possibilities. *Teacher Education and Special Education*, 37(1), 21-33. **(2015 Publication Award from the Teacher Education Division of the Council for Exceptional Children)**.
11. Hayes, A. T.*, Straub, C. L., Dieker, L. A., **Hughes, C. E.**, & Hynes, M. C. (2013). Ludic Learning: Exploration of TLE TeachLivE™ and Effective Teacher Training. *International Journal of Gaming and Computer-Mediated Simulations*, 5(2), 2013, 23-36.
12. Harmon, L. J., Baumes, J., **Hughes, C.**, Soberon, J., Specht, C. D., Turner, W., Lisle C., & Thacker, R. W. (2013). Arbor: Comparative Analysis Workflows for the Tree of Life. *PLOS Currents: Tree of Life*, 2013 Jun 21 [last modified: 2013 Jun 21]. Edition 1.
13. Norris, A. E., **Hughes, C.**, Hecht, M. L., Peragallo N. P., & Nickerson, D. (2013). Randomized trial of a peer resistance skill-building game for Hispanic early adolescent girls. *Nursing Research*, 62(1), 25-35.
14. Varcholik, P.*, LaViola, J. J., & **Hughes, C. E.** (2011). Establishing a baseline for text entry for a multi-touch virtual keyboard. *International Journal of Human-Computer Studies*, 70(10), October 2012, 657-672.
15. Walters, L. C., Hughes D. E., & **Hughes, C. E.** (2011). Interconnections: Revisiting the Future. *Game and Culture*, 6(6), 538-559.
16. Risi, S. *, **Hughes, C. E.**, & Stanley, K. O. (2010). Evolving plastic neural networks with novelty search. *Adaptive Behavior*, 18(6), 470-491.

17. Beato, N.*, Colbert, M.*, Zhang, Y.*, Yamazawa, K., & **Hughes, C. E.** (2009). Interactive Chroma-keying for Mixed Reality. *Computer Animation and Virtual Worlds*, 20(2-3), 405-415. (US Patent No. 8,477,149 B2).
18. Fiore, S. M., Harrison, G. W., **Hughes, C. E.**, & Rutström, E. (2009). Virtual Experiments and Environmental Policy. *Journal of Environmental Economics and Management* 57(1), 65-86.
19. Dieker, L., Hynes, M., **Hughes, C. E.**, & Smith E. (2008). Implications of Mixed Reality and Simulation Technologies on Special Education and Teacher Preparation. *Focus on Exceptional Children*, 40(6), 1-20.
20. Colbert, M.*, Reinhard E., & **Hughes, C. E.** (2007). Painting in High Dynamic Range. *Journal of Visual Communication and Image Representation*, 18(5), 387-396.
21. Micikevicius, P., & **C. E. Hughes** (2007). Visibility-based Forest Walk-through Using Inertial Level of Detail Model. *Journal of Defense Modeling and Simulation*, 4(2), April 2007, 80-96.
22. Fidopiastis, C. M., Stapleton, C. B., Whiteside, J. D., **Hughes, C. E.**, Fiore, S. M., Martin, G. A.*, Rolland J. P., & Smith, E. M. (2006). Human Experience Modeler: Context Driven Cognitive Retraining to Facilitate Transfer of Training. *CyberPsychology and Behavior*, 9(2), 183-187.
23. Stapleton, C. B., & **Hughes, C. E.** (2006). Believing is Seeing. *IEEE Computer Graphics and Applications* 27(1), January/February 2006, 80-85.
24. Xu, R.*, Pattanaik S. N., & **Hughes, C. E.** (2005). HDR Still Image Encoding in JPEG 2000. *IEEE Computer Graphics and Applications*, 26(6), 69-76.
25. **Hughes, C. E.**, Stapleton, C. B., Hughes, D. E., & Smith, E. (2005). Mixed Reality in Education, Entertainment and Training: An Interdisciplinary Approach. *IEEE Computer Graphics and Applications*, 26(6), 24-30.
26. Kontinen*, J., **Hughes, C. E.**, & Pattanaik, S. N. (2005). The Future of Mixed Reality: Issues in Illumination and Shadows. *Journal of Defense Modeling and Simulation* 2(1), January 2005, 51-59.
27. Stapleton, C. B., & **Hughes, C. E.** (2003). Interactive Imagination: Tapping the Emotions through Interactive Story for Compelling Simulations. *IEEE Computer Graphics and Applications* 24(5), September/October 2003, 11-15.
28. Smith, M. L.*, Parsons R. J., & **Hughes C. E.** (2003). View-centric Reasoning for Linda and Tuple Space Computation. *IEE Proceedings-Software* 150(2), April 2003, 71-84.
29. Stapleton C. B., **Hughes, C. E.**, Moshell, J. M., Micikevicius P., & Altman, M.* (2002). Applying Mixed Reality to Entertainment. *IEEE Computer* 35(12), December 2002, 122-124.
30. **Hughes, C. E.**, Moshell, J. M., Reed, D.*, Chase, D. Z., & Chase, A. F. (2001). The Caracol Time Travel Project. *The Journal of Visualization and Computer Animation* 12(4), September, 2001, 203-214.
31. Chen, J. X.*, Lobo, N., **Hughes, C. E.**, & Moshell, J. M. (1997). Real-time Fluid Simulation in a Networked Virtual Environment. *IEEE Computer Graphics and Applications* 17(3), 52-61.
32. **Hughes, C. E.**, & Moshell, J. M. (1997). Shared Virtual Worlds for Education: The ExploreNet Experiment. *Multimedia Systems*, 5(2), 145-154.
33. Burg, J.*, Lang, S. D., & **Hughes, C. E.** (1996). Intelligent Backtracking in CLP(R). *Annals of Artificial Intelligence and Mathematics* 17(3-4), 1996, 189-212.
34. Moshell, J. M., & **Hughes, C. E.** (1996). The Virtual Academy: A Simulated Environment for Constructionist Learning. *International Journal of Human-Computer Interaction* 8(1), 1996, 95-110.
35. Chen, J. X.*, Moshell, J. M., **Hughes, C. E.**, Blau, B.*, & Li, X.* (1994). Distributed Virtual Environment Real-Time Simulation Network. *Advances in Modeling and Analysis B*, 31(1), 1994, 1-7.
36. Kinsley, K.*, & **Hughes, C. E.** (1992). Analysis of a Virtual Memory Model for Maintaining Database Views. *IEEE Transactions on Software Engineering*, May 1992, 402-409.
37. Arefi, F.*, Workman, D., & **Hughes, C. E.** (1990). Automatically Generating Visual Syntax-Directed Editors. *Communications of the ACM*, 1990, 349-360.
38. Kinsley, K.*, & **Hughes, C. E.** (1988). Evaluating Database Update Schemes: A Methodology and its Applications to Distributive Systems. *IEEE Transactions on Software Engineering*, 1081-1089.
39. Petty, M. D.*, Moshell, J. M., & **Hughes, C. E.** (1988). Tactical Simulation in an Object-Oriented Animated Graphics Environment. *ACM SIGSIM Simulation Digest* 19(2), June 1988, 31-46.

40. **Hughes, C. E.**, Moshell, J. M., Lacy, L. W.*, & Lewis, R. L.* (1988). Action Graphics: An Interactive Spreadsheet-Based Animation System for Simulation and Training. *Simulators V*, The Society for Computer Simulation International, Simulation Series, 19, 4, 1988, 474-478.
41. Petty, M.*, Moshell, J. M., & **Hughes, C. E.** (1988). Tactical Simulation in an Object-Oriented Animated Graphics Environment. *ACM SIGSIM Simulation Digest* 19(2, June 1988), 31-46.
42. **Hughes, C. E.**, & Selkow, S. M. (1981). The Finite Power Property for Context-Free Languages. *Journal of Theoretical Computer Science*, 15, 111-114.
43. **Hughes, C. E.**, & Straight, D. W. (1980). Word Problems for Bidirectional, Single Premise Post Systems. *Notre Dame Journal of Formal Logic*, 21, 1980, 501-508.
44. **Hughes, C. E.** (1980). Derivatives and Quotients of Prefix-Free Context-Free Languages. *Information and Control*, 45, 1980, 229-235.
45. **Hughes, C. E.**, & Pfleeger, C. P. (1978). ASSIST-V: An Environment Simulator for Systems Software Development. *IEEE Transactions on Software Engineering*, 4, 526-530.
46. **Hughes, C. E.** (1978). The Equivalence of Vector Addition Systems to a Subclass of Post Canonical Forms. *Information Processing Letters*, 7, 1978, 201-204.
47. **Hughes, C. E.**, & Singletary, W. E. (1977). The One-One Equivalence of Some General Decision Problems. *Notre Dame Journal of Formal Logic*, 18, 1977, 305-309.
48. **Hughes, C. E.** (1976). Two Variable Implicational Calculi of Prescribed Many-One Degrees of Unsolvability. *Journal of Symbolic Logic*, 41, 1976, 35-44.
49. **Hughes, C. E.** (1976). A Reduction Class Containing Formulas with One Monadic Predicate and One Binary Function Symbol. *Journal of Symbolic Logic*, 4, 1976, 45-49.
50. **Hughes, C. E.** (1975). The General Decision Problem for Markov Algorithms with Axiom. *Notre Dame Journal of Formal Logic*, 16, 1975, 208-216.
51. **Hughes, C. E.**, & Singletary, W. E. (1975). Triadic Partial Implicational Propositional Calculi. *Z. Math Logik und Grundlagen*, 21, 1975, 21-28.
52. **Hughes, C. E.** (1975). Sets Derived by Deterministic Systems with Axiom. *Z. Math Logik und Grundlagen*, 21, pp. 71-80, 1975.
53. **Hughes, C. E.**, & Singletary, W. E. (1975). Combinatorial Systems Defined Over One- and Two-Letter Alphabets. *Archiv Math. Logik und Grundlagenforschung*, 17, 1975, 25-33.
54. **Hughes, C. E.** (1974). Single Premise Post Canonical Forms Defined Over One-Letter Alphabets. *Journal of Symbolic Logic*, 39, 1974, 489-495.
55. **Hughes, C. E.** (1973). Many-One Degrees Associated with Problems of Tag. *Journal of Symbolic Logic*, 38, pp. 1-17, 1973.
56. **Hughes, C. E.**, & Singletary, W. E. (1973). Combinatorial Systems with Axiom. *Notre Dame Journal of Formal Logic*, 14, 1973, 354-260.
57. **Hughes, C. E.** (1973). Many-One Degrees Associated with Semi-Thue Systems. *Journal of Computer and Systems Sciences*, 7, 1973, 497-505.
58. **Hughes, C. E.** (1972). Degrees of Unsolvability Associated with Markov Algorithms. *International Journal of Computer and Information Sciences*, 1, 1972, 355-365.
59. **Hughes, C. E.**, Overbeek, R., & Singletary, W. E. (1971). The Many-One Equivalence of Some General Combinatorial Decision Problems. *Bulletin of the American Mathematical Society* 77, 467-472.

Refereed Book Chapters:

1. Ingraham, K. M., Romualdo, A., Fulchini Scruggs, A., Imperiale, E., Dieker, L. A., & **Hughes, C. E.** (2021). Developing an Immersive Virtual Classroom: TeachLive – A Case Study. In Choi, D. H., Dailey-Hebert, A., & Estes, J. S. (Ed.), *Current and Prospective Applications of Virtual Reality in Higher Education* (pp. 118-144). IGI Global. <http://doi:10.4018/978-1-7998-4960-5.ch006>
2. Ingraham, K., **Hughes, C. E.**, Taliaferro, L., Westers, N., Dieker, L., & Hynes, M. (2019). Using Digital Puppetry to Prepare Physicians to Address Non-Suicidal Self-Injury Among Teens. In: Antona M., Stephanidis C. (eds) *Universal Access in Human-Computer Interaction. Theory, Methods and Tools. HCII 2019. Lecture Notes in Computer Science*, vol 11572. Springer, Cham., 555-568.
3. Abualsamid, A.*, & **Hughes, C. E.** (2018). Modeling Augmentative Communication with Amazon Lex and Polly. In: Ahram T., Falcão C. (eds) *Advances in Usability, User Experience and Assistive Technology. AHFE 2018. Advances in Intelligent Systems and Computing*, vol 794. Springer, Cham., 871-879.

4. Abualsamid A.*, **Hughes C.E.** (2017). Why Is Video Modeling Not Used in Special Needs Classrooms? In: Andre T. (eds.) *Advances in Human Factors in Training, Education, and Learning Sciences. AHFE 2017. Advances in Intelligent Systems and Computing*, vol 596. Springer, Cham., 123-130.
5. Abualsamid A.*, & **Hughes C.E.** (2017). Language Sample Analysis Framework Utilizing the Natural Language Toolkit and Social Media. In: Duffy V., Lightner N. (eds) *Advances in Human Factors and Ergonomics in Healthcare. Advances in Intelligent Systems and Computing*, vol 482. Springer, Cham., 445-456.
6. Dieker, L. A., Lignugaris-Kraft, B., Hynes, M., & **Hughes, C. E.** (2016). Mixed reality environments in teacher education: Development and future applications. *Online in Real Time: Using WEB 2.0 for Distance Education in Rural Special Education*, Eds. B. Collins & B. Ludlow, American Council for Rural Special Educators, Chapter 12, 122-131.
7. Abualsamid, A.*, & **Hughes, C. E.** (2016). Language sample analysis framework utilizing the Natural Language Toolkit and Facebook. In: Duffy V., Lightner N. (eds.) *Advances in Intelligent Systems and Computing*, Volume 482, 445-456.
8. **Hughes, C. E.**, Nagendran, A., Dieker, L., Hynes M., & Welch, G. (2015). Applications of Avatar-Mediated Interaction to Teaching, Training, Job Skills and Wellness. *Virtual Realities – Dagstuhl Seminar 2013*, Eds. G. Burnett, S. Coquillard, R VanLiere & G. Welch, Springer LNCS, 8844. 133-146.
9. Nagendran, A., Welch, G., **Hughes, C. E.**, & Pillat, R.* (2015). Exploring human surrogate characteristics. *Virtual Realities: Lecture Notes in Computer Science*, 8844, Eds. G. Burnett, S. Coquillard, R VanLiere & G. Welch, Springer LNCS, 215-238.
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National Science Foundation, GRA VRMC Fellowship, (UCF PIs: **C. E. Hughes**, E. Smith), 2007-2010.

National Science Foundation, STTR Phase I: Developing a Mixed Reality Rehabilitation System, (UCF PIs: **C. E. Hughes**, E. Smith), joint with Virtual Reality Medical Center, 2007.

I4 High Tech Corridor, Developing a Mixed Reality Rehabilitation System, (PIs: **C. E. Hughes**, E. Smith), 2007- 2010.

Army RDECOM via IST, MR MOUT Revitalization, (PIs: E. Smith, **C. E. Hughes**, D. Mapes, D. Hughes), 2008-2009.

ARI via NAVAIR, Virtual Technologies and Environments (VIRTE) for Advanced Research on Agents and Teams, (PIs: D. Nicholson, S. Burke, S. Fiore, **C. E. Hughes**, G. Martin, J. Rolland, E. Salas, E. Smith), 2006-2009.

National Endowment for the Humanities, Come Back to the Fair, (PIs: L. Walters, **C. E. Hughes**, K. Kitalong), 2007-2008.

Air Force Office of Scientific Research, SBIR Phase I: A Mixed Reality System for Cognitive Rehabilitation of Traumatic Brain Injuries, (UCF PIs: **C. E. Hughes**, C. Fidopiastis, D. Hughes, D. Mapes, E. Smith), joint with Virtual Reality Medical Center, 2007-2008.

I4 High Tech Corridor, Developing a Mixed Reality Rehabilitation System for Stroke Patients, (PIs: **C. E. Hughes**, E. Smith), 2007-2008.

Army RDE Command, Evaluating the Impact of Mixed Reality on Human Performance and Interaction with Adolescents and Young Adults, (PIs: **C. E. Hughes**, E. Smith, C. Stapleton), 2007.

Department of Education, SBIR Phase I: The Virtual STAR Classroom Simulator, (UCF PIs: E. Smith, **C. E. Hughes**, L. Dieker, M. Hynes), subcontract from Simiosys LLC, 2006.

Army Research Institute, ARI Virtual Environment Research Testbed, (PIs: G. Martin, **C. E. Hughes**, J. Daly, E. Smith), 2005-2006.

Office of Naval Research DURIP (Defense University Research Instrumentation Program), Mixed Reality: Anytime, Anywhere, (PIs: **C. E. Hughes**, J. M. Moshell, S. Pattanaik, C. Stapleton, H. Foroosh), 2004-2005.

Office of Naval Research, Research in Augmented and Virtual Environment Systems: Pervasive Computing in Augmented and Mixed Reality, (PIs: **C. E. Hughes**, B. Goldiez, S. Teicher), 2003-2005.

Office of Naval Research, Research in Augmented and Virtual Environment Systems: Rendering, (PIs: S. N. Pattanaik, **C. E. Hughes**, J. P. Rolland, V. Sims, E. Reinhard), 2003-2005.

Office of Naval Research, *Research in Augmented and Virtual Environment Systems: Content*, (PIs: C. B. Stapleton, **C. E. Hughes**), 2003-2005.

Office of Naval Research, *Research in Augmented and Virtual Environment Systems: Battlefield Augmented Reality System*, (PIs: B. Goldiez, **C. E. Hughes**, C. B. Stapleton, K. Garfield), 2003-2005.

Army RDE Command, *The Enhancement of MOUT Training with Mixed Reality and Theme Park Technology*, (PIs: C. Stapleton, **C. E. Hughes**, J. M. Moshell), 2001-2005.

Association to Preserve Eatonville Community, *Carol Mundy Digital Archive Prototype Project*, (PIs: **C. E. Hughes**, J. M. Moshell), 2003-2004.

Silicon Graphics, *OpenIR Development*, (PIs: J. M. Moshell, **C. E. Hughes**), 2003.

Canon Mixed Reality Labs, *Mixed Reality Infotainment*, (PIs: C. Stapleton, **C. E. Hughes**, J. M. Moshell, C. Ford), 2003.

Canon Mixed Reality Labs, *MR Canon IAAPA*, (PIs: C. Stapleton, **C. E. Hughes**, J. M. Moshell), 2002.

Canon Mixed Reality Labs, *Mixed Reality Tests for Nickelodeon Studios*, (PIs: C. Stapleton, **C. E. Hughes**, J. M. Moshell), 2002.

Army STRICOM, *The Enhancement of Training in Virtual and Mixed Reality Environments with Realistic Vegetation*, (PIs: **C. E. Hughes**, J. M. Moshell, V. Sims, J. Weishampel), 2002-2003.

Army STRICOM, *Populating a MOUT Facility with Spatially Registered Features: The Virtual Backlot*, (PIs: **C. E. Hughes**, J. M. Moshell, C. Stapleton, A. Cortes), 2002-2003.

Army STRICOM, *Tracking Systems for Multiplayer Mixed Reality*, (PIs: C. Stapleton, **C. E. Hughes**, J. M. Moshell, A. Cortes), 2002-2003.

Army STRICOM, *Virtual Object Rendering and Registration for Mixed Reality MOUT*, (PIs: J. M. Moshell, **C. E. Hughes**, C. Stapleton, S. Pattanaik, J. Malala), 2002-2003.

National Science Foundation, *Augmented Reality and Interactive Distributed Physical Modeling*, (PIs: J. Rolland, **C. E. Hughes**, R. Parsons), 2000-2003.

Army STRICOM, *Automatic Construction and Evaluation of Efficient Databases for Virtual Simulation from SEDRIS Data*, (PIs: J. M. Moshell, **C. E. Hughes**, A. Cortes, V. Sims, G. Schiavone), 2000-2002.

Orlando Science Center, *Measure Me - An Interactive Exhibit*, (PIs: J. M. Moshell, **C. E. Hughes**, C. Stapleton), 2000-2002.

I-4 Corridor Initiative and Real3D, *Developing Content for the Virtual Theme Park*, (PIs: J. M. Moshell, **C. E. Hughes**), 1999-2000.

Real3D, *Empirical Studies of Graphics Acceleration for PC Environments*, (PIs: J. M. Moshell, **C. E. Hughes**), 1998.

Advanced Research Projects Agency, *ExploreNet*, (PIs: J. M. Moshell, **C. E. Hughes**), 1995-97.

National Science Foundation, *Undergraduate Parallel Processing*, (PIs: R. K. Guha, **C. E. Hughes**, Narsingh Deo, T. J. Frederick and A. Mukherjee), NSF Grant #CDA9115281. 1991-96.

ARI-PM-TRADE, *Visual Display Technologies for Simulation*, (PIs: J. M. Moshell, **C. E. Hughes**, E. Smart), 1990-92.

Florida High Technology and Industry Council, *Constraint-Based Declarative Programming for Modeling Complex Motions*, (PIs: J. M. Moshell, **C. E. Hughes**), 1990-91.

Florida High Technology and Industry Council, *A Graphical Simulation Environment for Problem Solving Based on Parallel Processing*, (PIs: J. M. Moshell, **C. E. Hughes**), 1988-90.

ARI-PM-TRADE, *Time Varying Visual Features for Low Cost Simulation Systems*, (PIs: J. M. Moshell, **C. E. Hughes**, E. Smart), 1988-89.

ARI-PM-TRADE, *Rapidly Reconfigurable Object-Oriented Databases for Simulation*, (PIs: A. Orooji, **C. E. Hughes**, J. M. Moshell), 1988-90

Naval Training Systems Center, *Action Graphics*, (PIs: J. M. Moshell, **C. E. Hughes**), 1987-88.

Naval Training Systems Center, *Ada Risk Assessment*, (PIs: **C. E. Hughes**, C. Bauer), 1985-1986.

National Science Foundation, *Computer System/VLSI Design Laboratory*, (PIs: T. Frederick, **C. E. Hughes**, R. Guha and A. Mukherjee), 1982.

National Science Foundation, *High School Microcomputer Science Education*, (PIs: J. M. Moshell, **C. E. Hughes**, R. M. Aiken), NSF Grant #SED79-18992, 1979-1982.

National Bureau of Standards, *Program Optimization and Specialization*, (PI: C. E. Hughes), 1979-1981.

National Bureau of Standards, *Incremental Program Analysis*, (PIs: C. E. Hughes, C. P. Pfleeger), 1979.

National Science Foundation, *Systematic Debugging*, (PIs: C. E. Hughes, C. P. Pfleeger), NSF Grant #MCS77-03308, 1977-1978.

National Science Foundation, *Development of a Machine Simulator for Teaching Operating Systems Concepts*, (PIs: C. E. Hughes, C. P. Pfleeger), NSF Grant #SED76-14494, 1976-1978.

Recent Internal or State of Florida Grants:

UCF Quality Enhancement Plan, QEP Assessing UCF Student's Interviewing Skills using Simulation, J. Andreasen, F. Safi, L. Dieker, C. E. Hughes), May 2016- April 2017.

Support for Mixed Reality Learning Project (NSF-funded), *Metaphor-Based Learning of Physics Concepts through Whole-Body Interaction in a Mixed Reality Science Center Exhibit*, (PIs: R. Lindgren, **C. E. Hughes**, J. M. Moshell, E. Smith, S. Gallagher). 7/1/2012-6/30/2015.

Matching to National Science Foundation, *Interconnections: Revisiting the Future*, (PIs: L. Walters, **C. E. Hughes**, D. Hughes, J. M. Moshell, S. Fiore, M. Adams, D. Mapes, E. Smith). 9/1/2009-8/31/2013.

Matching to National Science Foundation, *Water's Journey through the Everglades*, (PIs: E. Smith, **C. E. Hughes**, L. Walters, K. Kitalong, M. Johnson). 5/15/2007-7/31/2012.

Florida Board of Governors, *Florida Biomedical Engineering Partnership*, (PI: Tony Waldrop; Proposal Writers: L. Chow, **C. E. Hughes**, A. Kassab, V. Patel, Z. Qu). New Florida 2010 Clustering, 7/1/2010-12/31/2011.

UCF/IST SHELL Grant, *Haptic Feedback Architecture for Remote Surgical Procedures*, (PIs: Remo Pillat, **C. E. Hughes**, A. Nagendran), 2011.

Current and Recent Professional Service:

Societies, Journals and Conferences

Frontiers in Virtual Reality, Editorial Board of Virtual Reality in Industry 2020-

IEEE VR Program Committee, 2011-2015, 2017-

IEEE SEGAH 2017 Program Committee, 2016-

IEEE VR 2016 Best Paper and Best Demo Selection Committee, Member

Entertainment Computing, Associate Editor, 2011-

IEEE VR 2013 Research Demos Committee, Co-Chair

HCI Program Committee, 2008-

Journal of Cybertherapy and Rehabilitation, Member of Scientific Board, 2009-

ISMAR 2010 Program Committee (Science and Arts&Humanities reviewer), 2009-2010

ISMAR 2009 Tutorial Chair, 2009

Eurographics 2008 Short Papers Program Committee, 2007-2008

International Conference on Information and Knowledge Sharing Program Committee, 2002-2006

Reviewer for Transactions on Computer-Human Interaction, IEEE CG&A, IEEE VR, PLOS ONE,

International Journal of Human-Computer Studies, Entertainment Computing, Virtual Reality,

Eurographics Symposium on Rendering, International Symposium on Mixed and Augmented Reality,

Spatial User Interaction, Virtual Reality Software and Technology, International Conference on

Digital Media and Digital Content Management, Journal of Cybertherapy and Rehabilitation,

Advances in Computer Entertainment Technology

UCF Computer Science

Computer Science Promotion & Tenure Committee, Chair, 2017-2018.

Computer Science Division Executive Committee, 2011-2015

Computer Science Graduate Committee, 2003-2006, 2010-2015
Computer Science Division Instructor Search Committee, 2012
Computer Science Promotion & Tenure, Chair, 2010-2011, member 1980-
Associate Director, 2007-2008
ABET Accreditation Team Member, 2007-2008
Computer Science Graduate Coordinator, 2003-2007
Computer Science Self-Assessment Committee, Chair, 2003-.2007
Information Technology Advisory Committee, 2003-2007
NRC CS Graduate Program Assessment, 2006-2007
Undergraduate Curriculum Development Committee, Member, 2005-2006
Computer Science Budget Advisory Committee, Member, 2003-2005
Computer Science Director's Search Committee, 2003-2004
Computer Science Undergraduate Coordinator and Program Committee Chair, 1999-2001
CSAB Accreditation Committee, Member, 2000-2001
Accountability Committee, Member, 2000-2001
Information Technology Program Founding Director and Program Committee Chair, 2000-2001
Strategic Planning Review Committee, Chair 2001

UCF College of Engineering and Computer Science

RIA Selection Committee, Chair, 2009-2011, 2016-2020, Member, 2021
AECR Research Committee, Member, 2018-
50th Anniversary Committee, Member, 2018
TIP Awards Committee, Chair, 2006, 2016-2017, Member, 2018
CECS Provost Professor Search Committee, Member 2013-2014
CECS Research Committee, Member, 2011-2013
In-House Research Committee, Chair, 2010, 2011, 2012
Bioengineering Minor Admission Committee, 2009-
Graduate Program Coordinators Committee, Member, 2003-2007
I2Labs Fellowship Selection Committee, Member, 2005-2007
I2Lab Steering Committee, Member 2006-2007
Civil and Environmental Engineering Chair Search Committee, Chair, 2004-2005
Director of Development Search Committee, Member 2001
ABET Accreditation Committee, Member, 2000

UCF College of Community Innovation and Education

Co-Director, Center for Research in Education Simulation, 2018-
Co-PI, TeachLivE Project, 2006-
College of Education TeachLivE Research Director Search Committee, 2017
Provost Faculty Cluster Research Proposal Evaluation Committee, 2014-2015
College of Education Interactor Search Committee, 2014
College of Education Director of Research for Gates Grant, 2013

UCF School of Modeling, Simulation & Training (SMST)

Interim Director, SMST Graduate Programs 2020-
MST P&T Committee, Chair, 2019, Member 2019-
IST Contributing Faculty, 1982-
MST Graduate Program Faculty Member, 2004-
MST Promotion & Tenure Committee, Chair, 2017-2018.
MST Program Director Search Committee, Member, 2018-
Faculty Search Committee for M&S Program, Member, 2015-2019
Research Professor Search Committees, Member, 2013-2015
Synthetic Reality Laboratory, Co-Director 2010-
Media Convergence Laboratory, Chief Scientist, 2001-2010; Director, 2006-2010
Research Associate Search Committee, 2006-2007

UCF Nicholson School of Communication and Media

Games and Interactive Media Promotion and Tenure Committee, Member, 2019-

UCF School of Visual Arts and Design, and Florida Interactive Entertainment Academy

SVAD Promotion and Tenure Committee, Member, 2005-2018

Film Faculty Search Committee, Chair, 2006
School of Film and Digital Media Promotion/Tenure Review Committee, Chair, 2005
Florida Interactive Entertainment Academy Faculty Search Committee, 2005
Florida Interactive Entertainment Academy Planning Committee, 2004-2005
Digital Media Faculty Search Committee, 2002-2005
Digital Media Industrial Affiliates Committee, Member, 2000-2005
Arts and Sciences Digital Media Director Search Committee, Member, 2000-2001

UCF (other)

Co-Lead, Learning Sciences Faculty Cluster 2017-
Learning Science Faculty Cluster Search Committee, Chair, 2017-2020
Disability, Aging and Technology Cluster, Member, 2021-
Marchioli Collective Awards Committee, 2017-
STEM Research and Education Council, Member, 2010, 2011
Nanoscience Director Review Committee, 2009
Cognitive Sciences Faculty Member, 2007-
Commencement and Convocation Committee, Member, 2004-2011
University Promotion/Tenure Review Committee, Member, 2005-2007; Chair, 2006-2007
Text and Technology Ph.D. Program Affiliate Faculty Member, 2000-.2007
Task Force on International Student Services. 2004-2005
Interdisciplinary Council, 1998-2000
UCF Strategic Planning Council, Chair 1991-94, Executive Comm., 1990-2001
Chaired Review of All UCF Academic Programs, 1995-1997

Selected Recognitions and Awards:

Modeling & Simulation Hall of Fame, 2020 Inductee
Senior Life Member, Institute of Electrical and Electronics Engineers (IEEE) & IEEE Computer Society
Senior Life Member, Association for Computing Machinery (ACM)
ACM SIGGRAPH Computer Graphics Pioneer
UCF Teaching Incentive Award, 2015, 2009, 2002, 1985
TeachLivE Selected by New Schools Summit for *2014 Learning to Teach Impact Award*
2014 CECS Excellence in Research, UCF College of Engineering and Computer Science
UCF Research Incentive Award, 2013, 2007, 1995 (under Professional Excellence Program Award)
2013 CECS Advisory Board Award for Faculty Excellence.
2013 Dean's Research Professorship Award
TeachLivE Selected by National Simulation & Training Association (NTSA) for *2013 Governor's Award for Excellence in Modeling and Simulation*
TeachLivE Selected by National Simulation & Training Association (NTSA) for *2013 Excellence in Modeling and Simulation (Training Category)*
2012 UCF Fellow of the Academy for Teaching, Learning and Leadership
TeachLivE Selected for Honorable Mention Winner of National Consortium for Continuous Improvement in Higher Education (NCCI) *2012 Leveraging Excellence Award*.
TeachLivE Selected by American Association of Colleges of Teacher Education for *2012 Best Practice Award for Innovations in Technology*
Pegasus Professor, 2007-
Excellence in Undergraduate Teaching, UCF, 2001 (top university teaching award)