

EXHIBIT A

Curriculum Vita

Norman I. Badler

September 8, 2009

Professor
Department of Computer and Information Science
University of Pennsylvania
Philadelphia, PA 19104-6389
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123 Buck Lane
Haverford, PA 19041
(215)-642-5134

Born: Los Angeles, CA: May 3, 1948
Married: June 14, 1968
Two children

Citizen of the United States of America

Research Interests

Computer Graphics
 Human movement simulation and animation
 Crowd simulation
 Kinematics and dynamics
 Embodied agent models
 Interactive software and systems design
 Facial expression synthesis
Virtual training systems
Instruction generation and presentation
Artificial Intelligence
 Process simulation and reasoning
 Semantics of motion and action
 Integrated graphics and language systems
Archaeological site reconstruction

Employment History

2001–2005: Associate Dean, SEAS, UPenn.

1987–present: Professor, Department of Computer and Information Science, UPenn.

1989–1994: Cecilia Fidler Moore Chair of Computer and Information Science, UPenn.

1979–1986: Associate Professor, Department of Computer and Information Science, UPenn.

1986–present: Graduate Group, Department of Bioengineering, UPenn.

1985–1991: Graduate Group, Department of Mechanical Engineering and Applied Mechanics, UPenn.

1974–1979: Assistant Professor, Department of Computer and Information Science, UPenn.

1973–1974: Lecturer, Department of Computer Science, University of Toronto.

1970–1973: Teaching Assistant, University of Toronto; Departments of Mathematics and Computer Science.

1969–1970: Programmer, then Programming Supervisor for Optical Character Recognition project at Kramer Research, Inc., Santa Barbara, CA.

Education (post secondary)

Ph.D. in Computer Science, University of Toronto, 1975. Dissertation title: “Temporal Scene Analysis: Conceptual Descriptions of Object Movements.” Dissertation supervisor: Dr. John Mylopoulos. Primary thesis readers: Dr. Ron Baecker, University of Toronto, and Dr. Jerome Feldman, University of Rochester.

M.A. (Honorary), University of Pennsylvania, 1979.

MSc. in Mathematics, University of Toronto, 1971.

BA (with highest honors) in College of Creative Studies, emphasis in Mathematics; University of California, Santa Barbara, 1966-1970.

Grants and Contracts

1. 2009 Lockheed-Martin: “SHIPMATE: Streamlining Human Integration Processes by Managing Automated Techniques for Evaluating Ship Design, Visualizing Crew Tasks, and Facilitating Training”, \$75,000 (4-09 to 12-09).
2. 2008 U.S. Air Force: “Virtual Coaching Agent for Team Training”, \$172,000 (3-08 to 6-09).
3. 2007 U.S. Air Force: “Extending Interactive Electronic Technical Manuals (IETMs) with Real and Virtual Animated Content for Maintenance Task Training”, \$165,000 (11-07 to 3-09).
4. 2007 U.S. Army MURI (with M. Marcus and other partners): “SUBTLE: Situation Understanding Bot Through Language and Environment”, ~\$1,200,000 (7-07 to 6-10).
5. 2007 U.S. Air Force: “Untethered Motion Capture Evaluation for Flightline Maintenance”, \$137,000 (5-07 to 7-08).
6. 2006 NSF SGER (with M. Marcus): “ASL Classifier Predicates and Animations”, ~\$80,000 (10-05 to 9-06).

7. 2005 Navy Special Warfare: "Realistic Computer Generated Paper Targets", \$89,200 (1-06 to 12-06).
8. 2005 U.S. Air Force: "Advanced Visual and Instruction Systems for Maintenance Support", \$200,000 (7-05 to 9-06).
9. 2005 NASA (with NASA and Orbitec partners): RIVET: Rapid Interactive Visualization for Extensible Training", \$450K 7-05 to 5-07.
10. 2005 U.S. Army (with B. Silverman and R. Eidelson): "Modeling of Crowd and Leader Behavior", \$591,109 (7-05 to 6-07).
11. 2005 Lockheed-Martin: "Virtual Human Testbed Extensions", \$35,000 (4-05 to 12-05).
12. 2005 NSF REU Supplement: Synthesis and Analysis of Communicative Gestures", \$15,000
13. 2004 Lockheed-Martin: "Virtual Human Testbed Extensions", \$80,000 (1-04 to 12-04).
14. 2004 NASA (with NASA and Orbitec partners): RIVET: Rapid Interactive Visualization for Extensible Training", \$150,000 7-04 to 6-05.
15. 2004 NSF REU Supplement: Synthesis and Analysis of Communicative Gestures", \$12,000
16. 2004 ONR: VIRTE: Enhanced real and virtual player actions", \$270K (1-04 to 9-06).
17. 2003 Lockheed-Martin: "Virtual Human Testbed", \$100,000 (1-03 to 12-03).
18. 2002 NSF (with D. Metaxas): "Synthesis and Analysis of Communicative Gestures", \$400,000 (9-02 to 8-05).
19. 2002 Eon Reality: Software match, ~\$200,000.
20. 2002 NSF: "LiveActor Facility", \$150,000 (9-02 to 8-05)
21. 2002 Lockheed-Martin: "New Motion Control Tools for Virtual Human Simulations", \$100,000 (3-02 to 12-02)
22. 2002 Air Force: TASC Delivery Order #8: "Haptics Experiments", \$78,000 (1-02 to 9-02)
23. 2001 Army STRICOM via ICT, USC: "Personalized Motion Generation: Integrating EMOTE with DI Guy", \$75,000 (4-01 to 4-02).
24. 2001 NASA (with M. Palmer and A. Joshi): "Crew Task Simulation for Maintenance, Training, and Safety" \$250,000 (1-01 to 3-04).
25. 2001 Air Force: TASC Delivery Order #8: "Haptics Investigation", \$84,000 (1-01 to 9-01)
26. 2000 Alias-Wavefront MAYA software donation to support HMS research: ~\$50,000 value (9-00 to 9-01)
27. 2000 Air Force HRGA Delivery Order #8 through TASC: "Automating the Validation of Maintenance Orders." \$100,000 (1-00 to 12-00).

28. 1999 NSF (with D. Metaxas): "Sign Language and Gesture Resource Center," ~\$300,000 (9-99 to 8-02)
29. 1999 Fulbright: Joint US-Spain cooperative research agreement, ~\$8,000 (5-99 to 6-01).
30. 1999 Air Force HRGA through TASC: "Automating Maintenance Instructions." \$100,000 (3-99 to 12-99).
31. 1999 National Science Foundation (with M. Palmer and A. Joshi): "The Actionary." \$540,000 (6-99 to 5-02).
32. 1998 Air Force HRGA through TASC: "Maintenance Action Representation." \$85,000 (1-98 to 10-98).
33. 1998 NSF ILI (with D. Metaxas, J. Smith, and D. Kessler): "LIVE: The Laboratory for Visual Environments." \$60,000 (plus \$60,000 matching).
34. 1998 Army Research Office AASERT (with D. Metaxas): "Accurate Parametric Simulation of Human Gait." \$150,000 (6-98 to 5-01).
35. 1998 National Science Foundation, Research Experience for Undergraduates: (N. Badler and M. Steedman): "Synthesizing Conversation between Human-Like Cooperative Agents." \$10,000 (10-97 to 12-98).
36. 1998 ONR (Consortium with University of Houston and Engineering Animation, Inc.) (N. Badler, co-PI): "Developing Virtual Environments for Training." \$500,000 (5-98 to 2-01).
37. 1997 Army TRADOC: "Large Scale Crowd Simulation." \$50,000 (11-97 to 2-98).
38. 1997 ONR AASERT: "Virtual Environments for Training: Personalized Motion." \$156,645 (6-97 to 5-00).
39. 1997 ONR AASERT: "Real-Time Inverse Kinematics for Human Animation." \$156,645 (6-97 to 5-00).
40. 1997 ONR DURIP: "Hand Tool Manipulation and Self-Presence in VR." \$110,000 (3-97 to 3-98).
41. 1997 National Institute of Standards and Technology (with D. Metaxas): "Investigations into Creating, Authoring, and Instructing Virtual Humans." \$125,000 (7-97 to 7-98).
42. 1997 Air Force through TASC and BBN: "Automated Maintenance Instruction Study." \$86,000 (5-97 to 2-98).
43. 1997 NASA (with D. Metaxas and D. Newman [MIT]): "Performance Assessment using Dynamic Simulation and Human Factors." \$600,000 (3-97 to 3-00).
44. 1997 Army Research Lab/HRED: "Human Figure Performance Modeling." \$100,000 (2-97 to 7-97).
45. 1997 NSF, Research Experience for Undergraduates: (N. Badler and M. Steedman): "Synthesizing Conversation between Human-Like Cooperative Agents." \$10,000 (3-97 to 10-97).

46. 1997 National Institute of Standards and Technology: "Towards an Integration of Jack and VRML: Joint Hierarchy Implementation and Child Database." \$40,000 (11-96 to 9-97).
47. 1996 Air Force through BBN: "Jack/OMAR Demonstration." \$36,000 (5-96 to 12-96).
48. 1996 Army HRED through ARPA: "Jack extensions" \$75,000 (5-96 to 12-96).
49. 1995 Air Force: "DEPTH Technical Order Generation." \$140,000 (7-95 to 4-97)
50. 1995 NSF (with M. Steedman): "Synthesizing Conversation between Human-Like Cooperative Agents." \$540,000 (6-1-95 to 5-31-98).
51. 1995 Litton Data Systems: "Jack Analyses for Soldier Equipment Design Evaluation." ~\$8,373 (1-95 to 6-95).
52. 1995 Air Force: "A Task Networking and Visual Programming Language for Jack." \$108,088 (4-1-95 to 8-31-96).
53. 1995 ARPA (Consortium with Frankin Institute, UNISYS, etc.): "Advanced Education and Training Technologies Consortium." ~\$750,000 (4-95 to 3-99).
54. 1995 ONR (Consortium with University of Houston, Transom Technologies, Inc., and LinCom Corp.) (N. Badler, co-PI): "Developing Virtual Environments for Training." \$250,000 (3-95 to 2-97).
55. 1994 ARO DURIP (with R. Bajcsy): "Real-Time Human Motion Simulation and Analysis" \$150,000 (11-94 to 11-95).
56. 1994 ARPA (with B. Webber, J. Clarke, S. Stansfield, M. Zyda, and D. Pratt): "MediSim: Simulated Medical Corpsmen for Medical Forces Planning and Training." ~\$600,000 (8-94 to 8-96).
57. 1994 Defense Modeling and Simulation Office (with B. Webber): "Dismounted Soldier Simulation," \$409,000 (8-94 to 5-95).
58. 1994 National Library of Medicine (with D. Metaxas, B. Webber, and J. Clarke): "Organ Modeling in Support of Virtual Surgery." \$484,000 (3-94 to 2-96).
59. 1994 AASERT, Army Research Office: "Building Better Anthropometric Models." \$100,000 (6-94 to 5-97).
60. 1994 AASERT, ARPA (with B. Webber): "Micro-Terrain Navigation and Reasoning." \$100,000 (6-94 to 5-97).
61. 1994 Army Research Lab: "Jack Software." \$326,000 (1-94 to 12-94).
62. 1994 Sandia National Labs: "Jack in Virtual Environments." \$50,000 (1-94 to 10-94).
63. 1993 NASA Kennedy Space Center: "Accessibility Animation with Graphical Human Models." \$50,000 (9-93 to 6-94).
64. 1993 NSF: "Standards for Facial Models Workshop." \$15,000 (9-93 to 1-94).
65. 1993 Naval Training Systems Center: "Marksmanship Trainer." \$100,000 (10-93 to 9-94).

66. 1993 MOCO, Inc.: "Visualization of Human Movements." Sub-contract to NASA SBIR. \$30,000 (10-93 to 9-94).
67. 1993 Army Research Lab: "Jack Software." \$200,000 (5-93 to 12-93).
68. 1993 Sandia National Labs: "Jack in Virtual Environments." \$15,000 (5-93 to 10-93).
69. 1993 Robotics Research Harvesting: "Real Time Collision Avoidance" Sub-contract to NASA SBIR. \$7,500 (2-93 to 7-93).
70. 1993 Naval Training Systems Center: "Marksmanship Trainer." \$30,000 (4-93 to 10-93).
71. 1993 ARO through Institute for Simulation and Training: "Hostage Rescue Movie." \$10,000 (3-93 to 6-93).
72. 1993 Defense Modeling and Simulation Office through U. of Iowa: "Anthropometrics for CALS." \$200,000 (1-93 to 12-94).
73. 1992 NASA Ames: "Human Simulation Software" \$30,000 (10-92 to 4-93).
74. 1992 Army Research Institute: "Virtual Reality Explorations." \$20,000 (9-92 to 12-92).
75. 1992 NSF (with M. Steedman): "Communication, Coarticulation, and Dialog Gesture in Facial Animation." \$180,000 (7-92 to 6-95).
76. 1992 U.S. Army Natick Lab: "Modeling Clothed Figures." \$115,000 (5-92 to 5-93).
77. 1992 U.S. Army Human Engineering Lab: "Human Figure Modeling." \$600,000 (6-92 to 5-93).
78. 1992 U.S. Air Force through Hughes Missile Systems (with B. Webber): "DEPTH Program." ~\$600,000 (5-92 to 5-96).
79. 1992 DARPA through GE Moorestown: "3D Tactical Display Techniques." \$64,000 (2-92 to 9-93).
80. 1991 NSF Instrumentation and Laboratory Improvement Grant: "Undergraduate Scientific and Engineering Visualization Laboratory." \$50,000 (9-91 to 8-92) (plus \$50,000 matching from Silicon Graphics, Inc.).
81. 1991 MOCO, Inc.: "Body motion studies." \$30,000 (8-91 to 3-93).
82. 1991 U.S. Army Human Engineering Lab: "Human Figure Modeling." \$200,000 (5-91 to 4-92).
83. 1991 U.S. Army Tank Automotive Command: "Interfacing Jack with Army TACOM Software." \$50,000 (5-91 to 4-92).
84. 1991 U.S. Army Natick Lab: "Modeling Clothed Figures." \$105,000 (5-91 to 4-92).
85. 1991 NASA Ames: "Human Simulation Software" \$20,000 (5-91 to 4-92).
86. 1990 University of Iowa, National Science Foundation Industry/University Cooperative Research Center on Simulation and Design Optimization of Mechanical Systems (funded through NASA Goddard Space Flight Center): "Man-Machine Interaction Dynamics." \$50,000 (5-90 through 12-90).

87. 1990 FMC Corporation: "Jack Software." \$40,000 (5-90 to 4-91).
88. 1990 Lockheed Engineering and Management Co.: "Man-Modeling Software." \$45,000 (10-90 to 9-91).
89. 1990 Siemens Corporation Research: "Voice Command Input for Human Animation." 100,000 DM (\$59,990) (6-90 to 5-91).
90. 1990 U.S. Army Natick Labs: "Clothing and Equipment Models." \$30,000 (7-90 to 6-91).
91. 1990 NASA Ames Research Center: "Human Factors Simulation Research: Addendum." \$40,000 (5-90 to 9-90).
92. 1990 Pixar Corp.: Renderman software gift.
93. 1989 Martin-Marietta Denver Aerospace Corp.: "Jack Software." \$40,000 (11-89 to 11-90).
94. 1989 FMC Corp.: "Jack Software." \$15,000 (10-89 to 10-90).
95. 1989 Wavefront Technologies, Inc.: Wavefront Software provided free on 6 Silicon Graphics Iris 4D Workstations. The University of Pennsylvania named a member of their "National Academic Advisory Committee."
96. 1989 Lockheed Engineering and Management Co.: "Man-Modeling Software." \$135,000 (9-89 to 9-90).
97. 1989 U.S. Army Human Engineering Lab: "Human Body Modeling and Simulation." \$345,000 (10-89 to 9-90).
98. 1989 NSF CISE grant (with R. Bajcsy, A. Joshi, and D. Farber): \$1,500,000 (6-89 to 6-92).
99. 1988 ARO AI Center grant (with R. Bajcsy, A. Joshi, and P. Buneman): \$8,100,000 (10-89 to 9-94).
100. 1988 Lockheed Engineering and Management Services: "Man Modeling Software." \$131,600 (1-88 to 12-88).
101. 1988 U.S. Army Human Engineering Lab: "Human Body Modeling and Simulation." \$122,600 (7-88 to 12-88).
102. 1988 Pacific Northwest Labs (Battelle): "Articulated Robotic Mannequin Graphics Workstation." \$99,517 (4-88 to 11-88).
103. 1988 NASA Training Grant (with Diana Dadamo): \$36,000 (9-88 to 9-90).
104. 1988 NASA Ames: "Human Factors Simulation Research." ~\$300,000 (1-88 to 12-90).
105. 1988 Advanced Technology Center, Pennsylvania (with A.K. Joshi): Artificial Intelligence Center of Excellence.
106. 1987 Lockheed Engineering and Management Services: "Man Modeling Software." \$272,055 (6-87 to 12-87).

- 107.1987 U.S. Army Human Engineering Lab: "Human Body Modeling and Simulation." \$125,000 (7-87 to 12-87).
- 108.1987 NASA Ames: "Human Factors Simulation Research." \$121,700 (1-87 to 10-87).
- 109.1987 NSF: "A Representation for Natural Human Movement." \$162,700 (1-87 to 12-88).
- 110.1986 NASA Training Grant (with David Cebula): \$36,000 (9-86 to 9-88).
- 111.1986 Lockheed Engineering and Management Services: "Man Modeling Software." \$155,000 (7-86 to 5-87).
- 112.1986 Army Research Office: "Human Body Modeling and Simulation," addendum to ARO AI grant. \$95,000 (7-86 to 1-87).
- 113.1986 NASA Contract: "Operator Station Design System: Man-Modeling Enhancements." \$73,000 (2-86 to 6-86).
- 114.1986 NSF Research Grant (with J. M. McCarthy): "A Formal Methodology for the Graphical Synthesis of Spatial Mechanisms." \$163,000 (3-86 to 8-88).
- 115.1985 Army Research Office: "Human Body Modeling and Simulation," addendum to ARO AI grant. \$70,000 (10-85 to 3-86).
- 116.1984 NASA Contract: "Processing Task Descriptions for Animation." \$300,000 (9-84 to 5-86).
- 117.1984 Army Research Office Research Grant (with A. K. Joshi and R. Bajcsy): "Artificial Intelligence Research." Approximately \$7,700,000 (9-84 to 9-90).
- 118.1983 NSF Coordinated Experimental Research Grant: "Modeling Interactive Processes: Flexible Communication with Knowledge Bases; Computer Interaction in Three Dimensions." Grant participant. Approximately \$3,700,000 (10-83 to 9-89).
- 119.1982 NASA Contract: "Integrated Human Body Modeling System for Workstation Design Evaluation." Approximately \$195,000 (6-1-82 to 5-31-83); \$319,000 (6-1-83 to 5-31-84).
- 120.1978 NSF Research Grant (with R. Bajcsy and A. K. Joshi): "Scene Understanding." Approximately \$300,000 (10-1-78 to 10-1-81).
- 121.1978 U. Office of Education Grant: "A Microprocessor-Based Education, Communication, and Control System for Severely Handicapped Children." (with I. Laefsky, Graduate student). Student Award program, \$9654 (9-1-78 to 9-1-79).
- 122.1978 ONR Contract: "Analysis and Validation of Human Biodynamic Models." \$7000 (12-1-77 to 6-30-78).
- 123.1977 NSF Research Equipment Grant: "Interactive Vector Graphics Facility." \$32,000 (10-1-77 to 9-30-78).
- 124.1976 NSF Research Grant MCS76-19464 (with S. Smoliar): "Techniques for the Representation of Movement-Related Information." \$90,000 (9-1-76 to 9-1-78).

125.1975 NSF Research Grant ENG75-10535 (Engineering Initiation Grant): "Motion Picture Analysis by Computer." \$17,000 (4-1-75 to 3-31-77).

Honors, Awards, Fellowships and Scholarships

1998 Innovation award (UPenn and Transom Technologies).
1997-1998 Head of Technical Advisory Committee, Transom Technologies, Inc., Ann Arbor, MI.
1995-1996 Technical Advisory Board, Industrial Design, University of the Arts, Philadelphia, PA.
1994-2000 Technical Advisory Board, Center for Advanced Technology, Columbia University.
1994-2001 External Advisory Group, NSF STC for Computer Graphics and Scientific Visualization.
1992 NASA Space Act Tech Brief Award (ARC-12758).
1990-1994 Scientific Advisory Board, Biomechanics Corporation of America, Melville, NY.
1989-1991 National Academic Advisory Committee, Wavefront Technologies, Inc., Santa Barbara, CA.
1981 "Quest for Technology" Award, for "Bubbleman" system (with J. O'Rourke).
1971-1974 Three year National Research Council of Canada Fellowship for Graduate studies at the University of Toronto.
1970-1971 One year Open Fellowship to University of Toronto.
1969 Woodrow Wilson Fellow.
1969 Elected to Phi Beta Kappa in Junior year.
1967-1970 One of inaugural class of 50 students admitted to the College of Creative Studies at the University of California, Santa Barbara.
1966-1970 Four year Regents' Scholarship to University of California.

Professional Society Memberships

Association for Computing Machinery (ACM)
Special Interest Group on Computer Graphics (SIGGRAPH)
Computer Graphics Pioneers
Special Interest Group on Artificial Intelligence (SIGART)
Cognitive Science Society
American Association for Artificial Intelligence (AAAI)
IEEE Computer Society
Phi Beta Kappa
Dance Notation Bureau

Professional Activities

1. Co-Editor of *Graphical Models* Journal, 1990-present (with Ingrid Carlbom).
2. Senior Editor, *Computer Vision, Graphics and Image Processing* Journal, 1982-1990 (with L. Shapiro, A. Rosenfeld, T. Huang, and H. Freeman).
3. Editorial Board member, *Presence Journal*, MIT Press, 2007-.

4. Editorial Board member, *Visualization and Computer Animation*, John Wiley and Sons, 1990-.
5. Member of Editorial Board, *IEEE Computer Graphics and Applications*, 1980-90; Associate Editor, 1985-90.
6. Guest Co-Editor (with Carol O'Sullivan) of Special Issue on "Virtual Populace", *IEEE CG&A* July/August 2009.
7. General Co-Chair, Symposium on Computer Animation, Grenoble, France, August 27-29, 2004.
8. External Examiner, Swarthmore College, 2002.
9. General Co-Chair, Computer Animation '02, Geneva, Switzerland, June 19-21, 2002.
10. Program Co-Chair, Computer Animation '01, Seoul, Korea, November 6-8, 2001.
11. General Co-Chair, Human Modeling and Animation Workshop, Seoul, South Korea, June 2000.
12. General co-Chair, Computer Animation '00, Philadelphia, PA.
13. General co-Chair, Computer Animation '99, Geneva, Switzerland.
14. General co-Chair, Computer Animation '98, Philadelphia, PA.
15. National Academy of Sciences Committee: Human Support in Space. NASA review, 1996.
16. Program Committee: "First Workshop on Simulation and Interaction in Virtual Environments," July, 1995.
17. Sub-committee Chair (Software Standards) for Society of Automotive Engineers Computer Graphics Human Models standards effort.
18. Program Committee, Symposium on Interactive 3D Graphics, March 1992.
19. Program Committee, Second Eurographics Workshop on Animation and Simulation, Vienna, Austria, 1991.
20. NASA panelist, Exercise Countermeasure Project's Extended Duration Orbiter Discipline Implementation Team, Houston, TX, October 1990.
21. ARO Short Course organizer: "Man-Machine Interaction," 1985-1990.
22. Program Committee, Symposium on Interactive 3D Graphics, Snowbird, Utah, March 1990.
23. External Examiner, Swarthmore College, 1989.
24. Program Chair, NSF Workshop on "Mechanics, Control and Animation of Articulated Figures," April 1989. (David Zeltzer, MIT, Chair and Principal Investigator.)
25. Editor of Special Issue of *IEEE Computer Graphics and Applications* on Articulated Figure Animation, June 1987.

26. Department of Defense Human Factors Engineering Technical Advisory Group, Boston, May 1987.
27. Program Committee, Workshop on Interactive 3D Graphics, Univ. of North Carolina, 1986.
28. Invited participant in NASA Johnson Space Center "Design Knowledge Base" Workshop, September 1985.
29. Co-Editor of Special Issue of *IEEE Computer Graphics and Applications* on Expert Systems and Computer Graphics, November 1985.
30. Program Committee, SIGGRAPH '85, San Francisco, CA.
31. Program Chairman, Interdisciplinary Workshop on Motion: Perception and Representation. Jointly sponsored by ACM SIGGRAPH and SIGART, April 1983.
32. Editor of Special Issue of *IEEE Computer Graphics and Applications* on Human Body Modeling and Animation Systems, November 1982.
33. Vision Session Chairman, Second Annual Conference of the American Association for Artificial Intelligence, 1982.
34. Program Committee, Canadian Society for Computational Studies of Intelligence Conference 1982.
35. Computer Graphics course instructor, Integrated Computer Systems, Inc., (San Diego, Valley Forge, Baltimore) 1982-1984.
36. Chairman of Special Invited Session on Motion Analysis at Pattern Recognition and Image Processing Conference, 1981.
37. Program Committee, Pattern Recognition and Image Processing Conference, 1981.
38. Guest Co-Editor for a Special Issue of *IEEE Transactions on Pattern Analysis and Machine Intelligence* on Computer Analysis of Time-Varying Imagery, November 1980.
39. Elected SIGGRAPH Vice-Chairperson 1979-1981. Re-elected for second term 1981-1983.
40. SIGGRAPH Conference Oversight Committee Chairperson 1979-1982.
41. Tutorials and Workshops Chairperson for SIGGRAPH Conferences 1976-1979.
42. Member of Steering Committee, NSF sponsored Workshop on Three-Dimensional Object Representations, University of Pennsylvania, May 1979.
43. General Chairperson for IEEE Workshop on Computer Analysis of Time-Varying Imagery, Philadelphia, April 1979.
44. Listed in *American Men and Women of Science*; *Who's Who in Computer Graphics*; *Who's Who in Science and Engineering*; *Who's Who in the East*; *Who's Who in American Education*; *The International Directory of Computer Animation Producers*.

Consulting

Wilmerhale (Expert witness, 2008-)
McKool-Smith (Patent advice)
Northrup-Grumman (research roadmap, 2008)
Zajac & Arias (Expert witness, 2008)
US Department of Justice (Expert witness, 2007)
Dorsey and Whitney (Expert witness, 2006-07)
Snider Capital (due diligence, 2000)
University Ventures. (EMOTE, 1999)
Transom Technologies, Inc. (Human modeling, 1997-8)
American Bureau of Shipping. (Ergonomics evaluation, 1998)
DRaW Computing. (Computer Graphics, 1996-9)
Litton Defense Systems. (Human performance, 1995)
Systems Exploration, Inc. (Task simulation, 1990)
Biomechanics Corporation of America (Body modeling software, 1990)
IDT, Inc. (GIS software, 1989)
AMP Corp. (3D modeling and display, 1988)
U.S. Army, Ft. Monmouth, NJ (Interactive system design, 1985-87)
Digital Productions (Animation languages and control, 1982-83)
Argus Microsystems (Core system, 1985)
Dunnington Co. (Interactive Systems, 1983-84)
PlanPrint Co. (Computer aided plant layout, 1983)
Lankenau Hospital (Cardiology data presentation, 1981)
Advanced Technology Systems (anti-aliasing, 1981)
Smith, Kline and French Labs (data presentation, 1981)
Bridgeport/Textron (interactive system design, 1980)
Institute For Cancer Research (molecular modelling, 1978)

Refereed Journal Publications

1. "The impact of the OCEAN personality model on the perception of crowds." IEEE Computer Graphics and Applications, accepted, to appear late 2009. (F. Durupinar, N. Pelechano, J. Allbeck, U. Gudukbay and N. Badler)
2. "Virtual training via vibrotactile arrays." Presence J. 17(2), April 2008, pp. 103-120. (A. Bloomfield and N. Badler)
3. "Modeling crowd communication and trained leaders during maze-like building evacuation." *IEEE Computer Graphics and Applications* 26, Nov. 2006, pp. 80-86. (N. Pelechano and N. Badler)
4. "Applying empirical data on upper torso movement to real-time collision-free reach tasks." SAE Digital Human Modeling Conference, Iowa City, IA , 2005 (published as paper 2005-01-2685, *SAE Transactions Journal of Passenger Cars - Mechanical Systems*). (L. Zhao, Y. Liu and N. Badler)
5. "New behavioral paradigms for virtual human models." SAE Digital Human Modeling Conference, Iowa City, IA , 2005 (published as paper 2005-01-2689, *SAE*

- Transactions Journal of Passenger Cars - Electronic and Electrical Systems*). (N. Badler, J. Allbeck, S.-J. Lee, R. Rabbitz, T. Broderick and K. Mulkern)
6. "Acquiring and validating motion qualities from live limb gestures." *Graphical Models* 67(1), Jan. 2005, pp. 1-16. (L. Zhao and N. Badler)
 7. "Virtual humans for automating maintenance task validation," *Communications of the ACM* 45(7), July 2002. (N. Badler, C. Erignac, and Y. Liu)
 8. "Creating interactive virtual humans: Some assembly required." *IEEE Intelligent Systems*, Fall 2002. (J. Gratch, J. Rickel, E. Andre, N. Badler, J. Cassell, and E. Petajan)
 9. "Eyes Alive", *ACM Transactions on Graphics*, Special Issue on ACM SIGGRAPH '02, San Antonio, TX, 21(3), July 2002. (S. P. Lee, J. Badler, and N. Badler)
 10. "Virtual Beings." *Communications of the ACM* 44(3), March 2001. pp. 33-35. (N. Badler)
 11. "Real-time inverse kinematics techniques for anthropomorphic limbs." *Graphical Models* 62, 2000, pp. 353-388. (D. Tolani, A. Goswami, and N. Badler)
 12. "Design of a virtual human presenter." *IEEE Computer Graphics and Applications* 20(4), July/August 2000, pp. 79-85. (T. Noma, L. Zhao, and N. Badler)
 13. "Animation 2000++." *IEEE Computer Graphics and Applications* 20(1), Jan.-Feb. 2000, pp. 28-29. (N. Badler).
 14. "Where to look? Automating attending behaviors of virtual human characters" *International Journal on Agents and Multiagent Systems*, 2000. (S. Chopra-Khullar and N. Badler)
 15. "Animation control for real-time virtual humans," *Comm. of the ACM* 42(8), August 1999, pp. 65-73. (N. Badler, M. Palmer and R. Bindiganavale)
 16. "Multi-level shape representation using global deformations and locally adaptive finite elements," *International Journal of Computer Vision* 25(1), pp. 49-61, 1997 (D. Metaxas, E. Koh, N. Badler).
 17. "Casualty modeling for real-time medical training," *Presence* 5(4), pp. 359-366, 1996 (D. Chi, J. Clarke, B. Webber, N. Badler).
 18. "Task Level object grasping for simulated agents," *Presence* 5(4), pp. 416-430, 1996 (B. Douville, L. Levison, N. Badler).
 19. "Real time human arm inverse kinematics," *Presence* 5(4), pp. 393-401, 1996. (D. Tolani, N. Badler).
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75. "Virtual interactive collaborators for simulation and training." 3rd Conf. on Computer Generated Forces and Behavior Representation, Orlando, FL, March 1993 (N. Badler and B. Webber).
76. "Integrated behavioral agent architecture." 3rd Conf. on Computer Generated Forces and Behavior Representation, Orlando, FL, pp. 57-68, March 1993 (W. Becket and N. Badler).

77. "Motion planning for redundant branching articulated figures with many degrees of freedom," Proc. IEEE/RSJ International Conf. on Intelligent Robots and Systems, pp. 1044-1052, 1992 (W. Ching and N. Badler).
78. "Human-like agents with posture planning ability," SPIE OE/Technology '92, Boston, MA, Nov. 1992 (M. Jung and N. Badler).
79. "Posture planning for agent animation," (abstract and poster) First AI Planning Conference, College Park, MD, May 1992 (M. Jung and N. Badler).
80. "Fast motion planning for anthropometric figures with many degrees of freedom," Proceedings of IEEE International Conference on Robotics and Automation, pp. 1052-1061, May 1992 (W. Ching and N. Badler).
81. "Correlation of facial and vocal expressions for facial movement," Interface to Real and Virtual Worlds, Montpellier, France, March 1992 (C. Pelachaud, N. Badler, and M. Steedman).
82. "Automatic viewing control for 3D direct manipulation," 1992 Symposium on Interactive 3D Graphics, *Computer Graphics* Special Issue, pp. 71-74, 1992 (C. Phillips, J. Granieri, and N. Badler).
83. "Simulating human tasks using simple natural language instructions," Winter Simulation Conf. Proc., 1991 (M. R. Jung, J. K. Kalita, W. Ching, and N. Badler).
84. "Interpreting prepositions physically," AAI-91, Anaheim, CA, July 1991 (J. Kalita and N. Badler).
85. "Converting BRL-CAD objects to surface representation and adding articulation and *Jack* ergonomic analysis," BRL-CAD Symposium '91, May 1991 (O. Niazi and N. Badler).
86. "Issues in facial animation," Computer Animation '91, Geneva, Switzerland, June 1991 (C. Pelachaud, N. Badler, and M. Steedman).
87. "Human factors simulation research," Workshop on Human-Centered Design Technology for Maintainability, Dayton OH, September 1990 (N. Badler).
88. "Semantic analysis of action verbs based on physical primitives," Cognitive Science Society 12th Annual Conference, Lawrence Erlbaum Associates, Hillsdale, NJ, 1990, pp. 412-419 (J. Kalita and N. Badler).
89. "On the complexity of computing reachable workspaces for redundant manipulators," SPIE International Symposia on Applications in Optical Science and Engineering: OE/Boston'90 Symposium on Advances in Intelligent Systems; Intelligent Robots and Computer Vision IX: Algorithms and Complexity, 1990 (T. Alameldin, N. Badler, M. Palis, and S. Rajasekaran).
90. "An adaptive and efficient system for computing the 3-D reachable workspace," IEEE International Conf. on Systems Engineering, Pittsburgh, PA, Aug. 1990, pp. 503-506 (T. Alameldin, T. Sobh, and N. Badler).
91. "Narrated animation: A case for generation," ACL Workshop on Natural Language Generation, Dawson, PA, June 1990 (B. Webber, M. Steedman, and N. Badler).

92. "The *Jack* interactive human model," Concurrent Engineering of Mechanical Systems, Vol. 1, First Annual Symposium on Mechanical Design in a Concurrent Engineering Environment, Univ. of Iowa, Iowa City, IA, October 1989, pp. 179-198 (N. Badler, P. Lee, C. Phillips, and E. Otani). (Selected for republication as a "Best Paper" in the 16th Design Automation Conference, Detroit, MI, September 1990.)
93. "Designing, evaluating, and monitoring human activities," Space Human Factors Workshop, NASA Johnson Space Center, Houston, TX, September 1989 (N. Badler).
94. "An investigation of language input and performance timing for task animation," Graphics Interface '89, Morgan-Kaufmann, Palo Alto, CA, June 1989, pp. 86-93 (J. Esakov, N. Badler, and M. Jung).
95. "Anthropometry for computer animated human figures," in *State-of-the Art in Computer Animation*, N. Magnenat-Thalmann and D. Thalmann (eds.), Springer-Verlag, 1989, pp. 83-96. (M. Grosso, R. Quach, and N. Badler).
96. "Task-driven human figure animation," Proc. NCGA '89, National Computer Graphics Assoc., Philadelphia, PA, 1989 (N. Badler).
97. "Human task animation from performance models and natural language input," Graphics Technology in Space Applications, NASA JSC Conference Publication 3045, April 1989 (J. Esakov, M. Jung, and N. Badler).
98. "The Implementation of a Design Knowledge Capturing System," Second IFIP Working Group 5.2 Workshop on Intelligent CAD, Cambridge, England, September 1988 (P. Pu and N. Badler).
99. "*Jack*: A toolkit for manipulating articulated figures," ACM/SIGGRAPH Symposium on User Interface Software, Banff, Canada, October 1988, pp. 221-229 (C. Phillips and N. Badler).
100. "Design knowledge capture for device behavior," Third International Conference on Applications of AI in Engineering, Stanford, CA, August 1988, pp. 37-56 (P. Pu and N. Badler).
101. "Computer animation techniques," (invited) 2nd International Gesellschaft für Informatik Congress on Knowledge-Based Systems, Munich, Germany, October 1987, Springer-Verlag, pp. 22-34 (N. Badler).
102. "Modeling and animating human task performance," Space Life Sciences Symposium, NASA, Washington, D.C., June 1987, pp. 288-291 (N. Badler).
103. "Modeling and Animating Human Figures in a CAD Environment," Proc. NCGA '87; Tutorials, Vol. 1, National Computer Graphics Assoc., Philadelphia, PA, 1987, pp. 93-111 (N. Badler).
104. "Animation of Human Figure Dynamics," 13th Northeast Bioengineering Conf., Univ. of Pennsylvania, Philadelphia, PA, March 1987, pp. 273-275 (P. Lee, M. McCarthy, and N. Badler).
105. "Combining Position and Orientation Goals in a Multiple Constraint-Based Articulated Figure Posing System" 13th Northeast Bioengineering Conf., Univ. of

- Pennsylvania, Philadelphia, PA, March 1987, pp. 276-278 (G. Walters and N. Badler).
106. "An Anthropometric Database for Computer Graphics Human Figures," 13th Northeast Bioengineering Conf., Univ. of Pennsylvania, Philadelphia, PA, March 1987, pp. 628-631 (M. Grosso, R. Gonda, and N. Badler).
 107. "Articulated Figure Positioning by Multiple Constraints and 6-axis Input," Workshop on Interactive 3D Graphics, Univ. of North Carolina, Chapel Hill, NC, Oct. 1986 (N. Badler, K. Manoochehri, and D. Baraff).
 108. "Incorporating Application Semantics in a User Interface Management System," 1986 Workshop on Interactive Systems Design, Seattle, WA, Nov. 1986 (T. Granor and N. Badler).
 109. "Animation of Human Figures: Perspectives and Directions," (Extended Abstract, invited) Proc. Graphics Interface Conference, Vancouver, BC, Canada, May 1986, pp. 115-120 (N. Badler).
 110. "Natural Language Input for Human Task Animation," Second Annual Workshop on Robotics and Expert Systems, Instrument Society of America, Houston, TX, June 1986, pp.137-148 (N. Badler and J. Gangel).
 111. "GUIDE: Graphical User Interface Development Environment," Trends and Applications Conference, IEEE, Washington, DC, 1985, pp. 37-41 (T. Granor and N. Badler).
 112. "Hierarchical reasoning: simulating complex processes over multiple levels of abstraction," First Annual Workshop on Robotics and Expert Systems, Instrument Society of America, Houston, TX, 1985, pp. 73-80 (P. Fishwick and N. Badler).
 113. "TEMPUS: A system for the design and simulation of human figures in a task-oriented environment," First Annual Workshop on Robotics and Expert Systems, Instrument Society of America, Houston, TX, 1985, pp. 251-257 (N. Badler, Jon Korein, James Korein, G. Radack, L. Brotman).
 114. "Modeling and animating the human form," (Abstract only, invited) Proc. Graphics Interface Conference, Ottawa, ON, Canada, 1984 (N. Badler).
 115. "TEMPUS: A system for the design and simulation of mobile agents in a workstation and task environment," Proc. Trends and Applications Conference, IEEE, Washington, DC, 1983, pp. 263-269 (N. Badler, B. Webber, J. Korein, and J. Korein).
 116. "Modelling flexible articulated objects," Proc. Computer Graphics 82, ONLINE Conferences, Northwood, UK, 1982, pp. 305-314 (N. Badler and M. Morris).
 117. "Understanding human movement: Synthesis and analysis," Proc. 15th Annual Conf. on Information Sciences and Systems, Johns Hopkins Univ., Baltimore, MD, 1981, pp. 297-300 (N. Badler).
 118. "Animating facial expressions," Proc. 15th Annual Conf. on Information Sciences and Systems, Johns Hopkins Univ., Baltimore, MD, 1981, pp. 221-225 (S. Platt and N. Badler).

119. "A new boundary encoding with applications to jigsaw puzzles," Proc. Fifth International Joint Conf. on Pattern Recognition, Miami, FL, Dec. 1980 (G. Radack and N. Badler).
120. "Human movement understanding: A variety of perspectives," Proc. First Annual National Conf. on Artificial Intelligence, Stanford, CA, August 1980, pp. 53-55 (N. Badler, J. O'Rourke, S. Platt, and M. Morris).
121. "Interpolating pixel values from arbitrary initial seed points," Proc. Asilomar Workshop on Picture Data Description and Management, Monterey, CA, 1980, pp. 177-183 (N. Badler and C. Werner).
122. "Providing automatic graphic displays through defaults," Proc. CSCSI Conf., Victoria, BC, Canada, Summer 1980 (S. Gnanamgari, H. Morgan, N. Badler, and B. Webber).
123. "The medial axis of a coarse binary image using boundary smoothing," Proc. PRIP Conf., Chicago, IL, August 1979, pp.286-291 (C. Dane and N. Badler).
124. "An architecture for the simulation of human movement," Proc. ACM National Conf., Washington, DC, Dec. 1978, pp. 737-745 (L. Weber, S. Smoliar, and N. Badler).
125. "Towards a formal model for pseudo-color selection," Proc. PRIP Conf., Troy, NY, 1977, pp. 261-265 (N. Badler and L. Miller).
126. "A concept model for the description of image sequences," Proc. Milwaukee Symposium on Automatic Computation and Control, Milwaukee, WI, March 1976, pp. 377-381.
127. "Three-dimensional motion from two-dimensional picture sequences," Proc. Second International Joint Conf. on Pattern Recognition, Copenhagen, Denmark, August 1974, pp. 157-161 (N. Badler).
128. "An introduction to *l.pak*, A programming language for artificial intelligence applications," Proc. Third International Joint Conf. on Artificial Intelligence, Stanford, CA, August 1973, pp. 691-695 (J. Mylopoulos, N. Badler, L. Melli, and N. Roussopoulos).

Other Publications

1. "SIGGRAPH VRML 3D Ph.D. Conetree," Computer Graphics 28(3), pp. 43-44, August 1998. (N. Badler and R. Webster)
2. "Efforts in Preparation for *Jack* Validation." Published as Army Research Laboratory ARL-CR-418, Dec. 1997. (Azoula, Badler, Ho, Huh, Kokkevis, Ting)
3. "Automating Maintenance Instructions Study." Published as Air Force Logistics Technology Research Support D.O.#8 Report, Feb. 1998 (Badler, Webber, Palmer, Bourne, Chopra, Stone, Dang, Blead).
4. "A virtual human presenter," Animated Interface Agents Workshop, IJCAI-97, Japan. (T. Noma and N. Badler).

5. "Researchers design MediSim to train battlefield medics," *Silicon Graphics World*, pp. 30-31, June, 1996 (N. Badler)
6. "Animation through reactions, transition nets and plans," International Workshop on Human Interface Technology, Aizu, Japan, September, 1995 (B. Webber and N. Badler).
7. "A workshop on standards for facial animation," *Computer Graphics* 29(2):66-67, May 1995 (N. Badler and C. Pelachaud).
8. "Modeling humans from the outside in," Interactive Technology in Surgery and Medicine, Leeds, UK, 1995 (N. Badler, B. Webber, D. Metaxas and J. Clarke).
9. "Instructions – Language and Behavior," Panel abstract, IJCAI, 1993 (B. Webber and N. Badler).
10. "Graphical behaviors and animated agents," Proc. US-Japan Workshop on Integrated Systems in Perceptually Grounded Environments, Las Cruces NM, December 1991 (N. Badler).
11. "Instructing animated agents," Proc. US-Japan Workshop on Integrated Systems in Perceptually Grounded Environments, Las Cruces NM, December 1991 (B. Webber, N. Badler, B. DiEugenio, L. Levison and M. White).
12. "Task communication through natural language and graphics," *AI Magazine*, 11(5):71-73, 1991 (B. Webber and N. Badler).
13. "Task training through narrated animation," AAAI Workshop on "Simulated Reality", 1990 (M. Steedman, B. Webber, and N. Badler).
14. "Designing with PLAID," SIGGRAPH Video Review Issue #32, 1987. (With NASA Johnson Space Center.)
15. "Creating computer animated human figure models anthropometrically," Graduate Conference on Computer Science, SUNY Buffalo, March 1989 (M. Grosso, R. Quach, and N. Badler).
16. "Articulated Figure Animation," Guest Editor's Introduction, *IEEE Computer Graphics and Applications*, June 1987 (N. Badler).
17. "Computer Graphics and Expert Systems," Guest Editors' Introduction, *IEEE Computer Graphics and Applications*, November 1985 (T. Finin and N. Badler).
18. "Motion Graphics, Description and Control," Workshop summary, *Computer Graphics* 18(1), January 1984. Reprinted in *Motion: Representation and Perception*, N. Badler and J. Tsotsos (eds.), Elsevier Science Publishers, North Holland, 1986.
19. "The Computer Graphics Scene in America," invited paper for Eurographics 1984, Copenhagen, Denmark (N. Badler and I. Carlbom).
20. "Human Body Models and Animation," Guest Editor's Introduction, *IEEE Computer Graphics and Applications*, November 1982, pp. 6-7 (N. Badler).
21. Review of *Fundamentals of Interactive Computer Graphics* (James Foley and Andries van Dam) in *IEEE Computer Graphics and Applications*, 1982 (N. Badler).

22. "State of the Art in Computer Graphics; A SIGGRAPH Perspective," Proc. Eurographics '81 Conf. (N. Badler and R. Ellis), Invited.
23. Review of *String and List Processing in SNOBOL4* (Ralph E. Griswold) in *American Journal of Computational Linguistics* 21, 1975 (N. Badler).
24. "More on Price's Tutorial," *SIGART Newsletter*, No. 52, June 1975, p. 2 (N. Badler).

Popular Articles, News Items, Covers, and Graphic Images

1. Penn Gazette article May 2009
2. Penn DP article on SIG Center Opening, April 2009
3. Penn Parents Magazine, DMD program, 2006.
4. Penn Current, October 2004.
5. UPenn Gazette, September 2002
6. CNN July, 2003
7. NY Times, October, 2002
8. *Fortune*, June 24, 2002
9. NY Times, May 10, 2000
10. *Discover Magazine*, June 1994.
11. *Aerospace Engineering*, August 1993, cover.
12. *Scientific American*, Nov. 1991, "Science and Business" column.
13. *Computer Graphics World*, March 1991.
14. "Computer Images" Art Show, 250th Birthday Celebration, Faculty Club, Univ. of Pennsylvania, April 1990. Planned by Badler; executed by Welton Becket and Dawn Vigliotti.
15. Computer Graphics slide by Catherine Pelachaud and Richard Quach accepted for Technical Slide Set, SIGGRAPH '89. Published as Chapter opener in college textbook *Introduction to Computers and Information Systems* by Szymanski, 1990.
16. Computer Graphics slides (3) by Welton Becket and Dawn Vigliotti accepted for Technical Slide Set, SIGGRAPH '90.
17. Cover image for Mathematical Association of America, 1990 Anniversary Publications Catalog; image by Cary Phillips.
18. Significant discussion in *Computer Animation*, N. Magnenat-Thalmann and D. Thalmann, Springer-Verlag, New York, 1985.
19. *Immagini con il Computer: le tecniche, l'arte*, A. Abbado, C. Morda, G. Rocca, Arnoldo Mondadori Editore, Milano, Italy, 1985.
20. *Computer Graphics-Computer Art*, Herbert Franke, 2nd Ed., Springer-Verlag, New York, 1985.
21. *SELF Magazine*, September 1984.

22. *Computer Images: State of the Art*, Joseph Deken. Stewart, Tabori and Chang, New York, 1983.
23. *Computer Graphics News*, October 1983.
24. *Popular Computing*, July 1983.
25. *Science*, May 1982. (Reprinted in *USIA Dialogue* No. 59, 1983.)
26. *Computer Bulletin*, December 1980. (cover)
27. SIGGRAPH '80 Preliminary Program Announcement. (cover)
28. *IEEE Proceedings*, October 1979. (cover)
29. *Computer Graphics World*, October 1978. (cover)

Invited Colloquia and Meetings

1. Invited Speaker, IGDA (Institute for Defense & Government Advancement), October 2008, Arlington, VA.
2. Invited Speaker, Distributed Video Sensor Networks Workshop, UC Riverside, May 2009.
3. Invited Speaker, Brunel University, Uxbridge, UK, May 2009
4. Speaker, Talk20, ICA, Philadelphia, PA, December 2008.
5. Invited Panelist (First Speaker of Conference), Digital Human Modeling for Design and Engineering, SAE, June 2008.
6. Invited Speaker, DGP is 40, University of Toronto, Toronto, Canada, May 2008.
7. Invited Speaker, IEEE Virtual Reality Workshop on Cityscapes, Reno, NV, March 2008.
8. Keynote Speaker, RAVE (Real Action, Virtual Environments) February 2008, Barcelona, Spain.
9. Invited Speaker, AAAI Fall Workshop, October 2007.
10. Invited Speaker, KAIST Symposium on Emerging Technology, Daejeon, South Korea, September 2007.
11. Invited Keynote Speaker invitations, *declined*: Cyberworlds 2005 (Nanyang, Singapore), International Workshop on Conversational Informatics 2005 (Kita-Kyushu, Japan), IVA 2005 (Kos, Greece), Pacific Graphics 2004 (Seoul, Korea).
12. Invited Speaker, Temple University Computer Science Colloquium, March, 2007.
13. Invited Speaker, MIT CSAIL Colloquium, September, 2006.
14. Lower Merion High School Gifted Program, March 2006.
15. Keynote Speaker, Digital Human Modeling, Simulation and Analysis Workshop, US Army TACOM, Detroit, MI, November 2005.
16. Invited Speaker, Dartmouth College, May 2005.

17. Invited Speaker, Reykjavik University, Iceland, April 2005.
18. Invited Speaker, Advanced Training Technologies, Old Dominion University, VA, March 2005.
19. Invited Speaker, Lockheed-Martin Advanced Technology Labs, March 2005.
20. Invited Speaker, NASA Training for Tomorrow, JSC, NASA, Houston, TX, October 2004.
21. Keynote Speaker: TIDSE, Darmstadt, Germany, June 2004
22. Invited Speaker, NSF Workshop on Perceptive Embodied Agents, April 2004.
23. Invited Speaker, Microsoft Research, Redmond, Seattle, November 2003.
24. Invited Speaker, Boeing Commercial Airplane, Seattle, November 2003.
25. Invited Speaker, Intelligent Motion and Interaction within Virtual Environments, London, UK, September 2003.
26. Invited Speaker, EON Reality Homeland Security Workshop, Irvine CA, May 2003.
27. Invited Speaker, IBM Research (Yorktown Heights), April 2003.
28. Colloquium Speaker, Ohio State University, March 2003.
29. "Towards Representing Agent Behaviors Modified by Personality and Emotion Workshop on Embodied Conversational Agents, Autonomous Agents and Multi-Agent Systems, Bologna, Italy, June 2002. " (J. Allbeck and N. Badler)
30. Invited speaker, Virtual Humans Workshop, ICT/USC, Feb. 2002.
31. Invited Speaker, IRISA, Rennes, France, February 12, 2002.
32. Invited Speaker, IMAGINA, Monte Carlo, February 13, 2002.
33. Colloquium Speaker, Stanford University, 2002.
34. Presentation (with Jan Allbeck) Scientists Helping America, Arlington, VA, March 2002.
35. Presentation (with Jan Allbeck) DARPA Augmented Cognition Workshop, Austin, TX, December 2001.
36. Distinguished Speaker, New York University, Computer Science, November 15, 2001.
37. "Consistent communication with control," Workshop on Non-Verbal and Verbal Communicative Acts to Achieve Contextual Embodied Agents, Autonomous Agents 2001. (J. Allbeck and N. Badler)
38. Keynote Speaker: Autonomous Agents 2001, Montreal, Canada, May 30, 2001.
39. Keynote Speaker, STWing Annual Banquet, UPenn, May 11, 2001.
40. Keynote Speaker. Learning to Behave, Workshop (TWLT 17) University of Twente, The Netherlands, October 19, 2000.
41. Invited Speaker, Computer Graphics International, Geneva, Switzerland, June 2000.

42. Army TACOM Industry Logistic Data Symposium, April 2000.
43. Human Modeling and Animation Workshop, Seoul, South Korea, June 2000.
44. Tutorial, Computer Animation 2000, Philadelphia, PA, May 2000.
45. Keynote Speaker, Digital Human Modeling Conference, Society of Automotive Engineers, Warren, MI, June 2000.
46. Invited speaker: Computer Graphics International, Geneva, Switzerland, June, 2000.
47. Keynote speaker: Chinagraph 2000, Hangzhou, P.R.China, September 2000.
48. SIGGRAPH '00 Course Organizer and Speaker: "Smart Animated Agents", July 2000.
49. "Parameterized Action Representation and Natural Language Instructions for Dynamic Behavior Modification of Embodied Agents." AAAI Spring Symposium 2000. (N. Badler, R. Bindiganavale, J. Allbeck, W. Schuler, L. Zhao, S.-J. Lee, H. Shin, and M. Palmer)
50. "Key Problems for Creating Real-Time Embodied Autonomous Agents." Fourth International Workshop on Autonomous Agents: Achieving Human-Like Behavior in Interactive Animated Agents, Barcelona, Spain, June, 2000. (N. Badler)
51. "Authoring Embodied Agents' Behaviors through Natural Language and Planning", Fourth International Workshop on Autonomous Agents: Achieving Human-Like Behavior in Interactive Animated Agents, Barcelona, Spain, June, 2000. (J. Allbeck, R. Bindiganavale, K. Kipper, M. Moore, W. Schuler, N. Badler, A. Joshi, and M. Palmer).
52. Colloquium Speaker, University Jaume-I, Castellon, Spain, June 1, 2000
53. Dartmouth University, April 27, 1999.
54. SIGGRAPH '99 Course Organizer and Speaker: "Smart(er) Animated Agents," August, 1999.
55. Colloquium Speaker, University of Edinburgh, 1999
56. Computer Animation Tutorial Speaker: "Real-Time Virtual Humans," Philadelphia, PA, June 1998.
57. SIGGRAPH '98 Course Organizer: "Virtual Humans: Behaviors and Physics, Acting and Reacting," July 21, 1998.
58. Distinguished Lecturer, Rice University, Feb. 25, 1998.
59. Distinguished Lecturer, University of Houston, Feb. 26, 1998.
60. Distinguished Lecturer, Oregon Graduate Institute, Dec. 5, 1997.
61. Colloquium Speaker, AT&T Research Labs, Newman Springs, NJ, May 28, 1998.
62. Colloquium Speaker, OPIM Dept, Wharton School, UPenn, Jan. 21, 1998.
63. Keynote Speaker: Transom *Jack* User Conference, May 19, 1998.
64. Keynote Speaker: Virtual Humans 3 Conference, June 16, 1998.

65. Keynote Speaker: Pacific Graphics, Seoul, Korea, October 1997.
66. SIGGRAPH Course organizer and speaker: "Virtual Humans: Behaviors and Physics, Acting and Reacting," SIGGRAPH '97, Los Angeles, CA, 1997.
67. AAAI Tutorial Speaker: "Physics-Based Models for Vision and Virtual Human Animation," Providence, RI, July 1997.
68. Keynote Speaker: Current Issues in the Use and Development of Anthropometric Data, NIST/CPSC, June, 1997.
69. National Institute for Standards and Technology, Gaithersburg, MD, February, 1997.
70. Session leader and three-time panelist: Virtual Humans 2, Los Angeles, CA, June 1997.
71. Plenary Speaker, Computacion Visual '97, Ciudad Universitaria, Mexico City, Mexico, March 1997.
72. General Electric Corporate Research and Development Center, Schenectady, NY, October, 1996.
73. Lockheed-Martin Supportability Workshop, Nashua, NH, October, 1996.
74. Automobile Designers, Silicon Graphics, Inc., Irvine, CA, September, 1996.
75. JustSystem Japan, Tokushima, Japan, March, 1996.
76. Keynote Speaker: SIBGRAPI '96, Caxambu, Brazil, October 1996.
77. Co-Moderator and speaker: Virtual Humans '96, Anaheim, CA, June 1996.
78. Invited Speaker: ATR Workshop on Intelligent Agents, ATR, Japan, March 1996.
79. Invited Speaker: NCAL-OECD International Roundtable on Adult Learning and Technology, February, 1996.
80. Reliability and Maintainability Symposium, Las Vegas, NV, January 1996.
81. Institute for Learning Sciences, Northwestern University, Evanston, IL, November 1995.
82. Smithsonian Institute, Washington, DC, June 1995.
83. Keynote Speaker: Symposium on "Human Interaction with Complex Systems," Greensboro, NC, September 18-19, 1995.
84. Keynote Speaker: Pacific Graphics '95, Seoul, South Korea, August 1995.
85. Invited Speaker: Workshop on "Designing Personalities for Synthetic Actors," Vienna, Austria, June 23-24, 1995.
86. Invited Panelist: Alumni Day, School of Nursing, University of Pennsylvania, May, 1995.
87. Invited Speaker: "National Forum: Military Telemedicine On-Line Today," McLean VA, March 27, 1995.

88. Panelist, "The Role of Telepresence and Virtual Reality in Medical Informatics," Healthcare Informatics Telecom Network, April 19, 1995.
89. CAIP Center, Rutgers University, March 1995.
90. University of Michigan, Center for Ergonomics, Ann Arbor, MI, Nov. 1994.
91. "Improving Health through High Performance Computing and Communications: Realities Beyond the Promise." Friends of the National Library of Medicine, Washington, DC, Sept. 1994.
92. University of Delaware, Newark, DE, April 1994.
93. New York University, NY, NY, March 1994.
94. Kimberly-Clark, Neenah, WI, February 1994.
95. Symposium on Minimally-Invasive Procedures, Medical School, University of Pennsylvania, Philadelphia, PA, June 1993.
96. Keynote Speaker, Eurographics '93, Barcelona, Spain, September 1993.
97. Tutorial: "Virtual Humans and Simulated Agents," Eurographics '93, Barcelona, Spain.
98. Invited Speaker, First Bilkent Computer Graphics Conference, Ankara, Turkey, July 1993.
99. MEDSIG 1993, Tucson, AZ, June 1993.
100. Sandia National Laboratory, Albuquerque, NM, June 1993.
101. Smithsonian Institute, Washington, DC, June 1993.
102. Panelist, Virtual Distributed Simulation Environments, U.S. Army Research Office, Research Triangle Park, NC., June 1993.
103. "Morphing and More" Panel, NCGA '93, Philadelphia, PA, April 1993.
104. New Computer Science Building Dedication Special Lecture, Columbia University, January 1993.
105. "Virtual Reality/Simulated Environments in Army Training," Durham, NC, October 1992.
106. "Artists Shaping Future Tools" Panel, Small Computers and the Arts Network Symposium, Philadelphia, PA, November 1992.
107. First Hellenic Symposium on Film and Technology, Athens, Greece, October 1992.
108. University of Pennsylvania, Engineering Pender Award Day faculty lecture, Philadelphia, PA, February 1992.
109. SIGGRAPH Course speaker: "Modeling and Animation" in Introduction to Computer Graphics course; also "Advanced Techniques in Human Modeling, Animation, and Rendering" course, SIGGRAPH '92, Chicago, IL, 1992.

110. SIGGRAPH Course speaker: "Modeling and Animation" in Introduction to Computer Graphics course; also "Advanced Techniques in Human Modeling, Animation, and Rendering" course, SIGGRAPH '91, Las Vegas, NV, 1991.
111. Tutorial: "Human Modeling in Visualization" Lausanne, Switzerland, June 1991.
112. Presenter, Army Research Office Mathematical and Computer Science Program Review, April 1991.
113. Distinguished Lecturer, Ohio State University, Columbus, OH, October 1991.
114. "Distinguished Lecturer, University of Toronto, Toronto, Canada, October 1991.
115. Caterpillar Tractor, Aurora, IL, September 1991.
116. Siemens-Nixdorf Corporate Research Center, Munich, Germany, June 1991.
117. Fifth International Conference on Advanced Robotics, Pisa, Italy, June 1991.
118. Air Force Human Research Lab, Wright-Patterson AFB, Dayton, OH, June 1991.
119. U.S. Army Tank and Automotive Command (TACOM), Warren, MI, October 1990.
120. Biomechanics Corporation of America, Melville, NY, September 1990.
121. SIGGRAPH Course speaker: "Modeling and Animation" in Introduction to Computer Graphics course; also "High Level Animation Techniques" in Human Figure Animation course, SIGGRAPH '90, Dallas, TX, 1990.
122. Deere and Company, Corporate Research Center, Moline, IL, May 1990.
123. Air Force Human Research Lab, Wright-Patterson AFB, Dayton, OH, May 1990.
124. Siemens Corporate Research Center – University of Pennsylvania Seminar, May 1990.
125. Wavefront Technologies, Inc., Santa Barbara, CA, January 1990.
126. University of California at Santa Barbara, CA, January 1990.
127. NASA Goddard Space Flight Center, Greenbelt, MD, November 1989.
128. General Electric, Moorestown, NJ, Fall 1989.
129. SIGGRAPH Course speaker: "Modeling and Animation" in Introduction to Computer Graphics course, SIGGRAPH '89, Boston, MA, 1989.
130. University of Pennsylvania, Dept. of Bioengineering, October 1989.
131. Invited Tutorial speaker: "AI, Natural Language, and Simulation for Human Animation," Computer Animation '89, Geneva, Switzerland, June 1989.
132. Invited speaker, Third Annual Hewlett-Packard Graphics Symposium, Ft. Collins, CO, June 1989.
133. SIGGRAPH Course speaker: "Modeling" in Introduction to Computer Graphics course, SIGGRAPH '88, Atlanta, GA, 1988.
134. Invited speaker, Second Annual Hewlett-Packard Graphics Symposium, Ft. Collins, CO, June 1988.

135. Invited speaker, NATO Workshop on Applications of Human Performance Models, Orlando, FL, Spring 1988.
136. Princeton University, Princeton, NJ, May 1988.
137. Invited speaker, German Computer Congress, Munich, Germany, October 1987.
138. Invited tutorial on "Computer Animation," University of Darmstadt, Darmstadt, West Germany, October 1987.
139. SIGGRAPH Course speaker: "Modeling" in Introduction to Computer Graphics course, SIGGRAPH '87, Anaheim, CA, 1987.
140. SIGGRAPH Course speaker: "Animation Survey" in Advanced Computer Animation course SIGGRAPH '87, Anaheim, CA, 1987.
141. Invited speaker, First Annual Hewlett-Packard Graphics Symposium, Menlo Park, CA, June 1987.
142. Keynote speaker, 13th Northeast Bioengineering Conference, Philadelphia, March 1987.
143. Invited speaker, Regional Symposium for Artificial Intelligence in Fundamental and Applied Research, Villanova University, January 1987.
144. Invited Speaker, Workshop on Industrial Applications of Large Scale Computing, Lafayette College, January 1987.
145. "Computer Animation in the Fifth Generation," (Panel Summary) Proc. SIGGRAPH '86, August 1986.
146. "Directions in Three-Dimensional Computer Graphics Applications in Archaeology," Society for Biblical Archaeology Annual Conference, Atlanta, November 1986.
147. Temple University, Philadelphia, PA, November 1986.
148. Massachusetts Institute of Technology, Arts and Media Technology Forum Series, Cambridge, MA, May 1986.
149. Invited speaker, Computer Graphics Interface '86, Vancouver, B.C., Canada, May 1986.
150. University of Michigan, Ann Arbor, MI, December 1985.
151. University of Toronto, Toronto, Canada, November 1985.
152. Tutorial on "Computer Graphics and Animation," sponsored by ACM Tutorial Series, Boston, MA, December 1985.
153. ACM Delaware Valley Chapter, Philadelphia, PA, February 1985.
154. IEEE Delaware Valley Chapter, Philadelphia, PA, May 1984.
155. Invited Speaker on Computer Graphics in America, Eurographics, Copenhagen, Denmark, September 1984.

156. Tutorial speaker, "Introduction to Raster Graphics" and "Animation" Tutorials, Eurographics, Copenhagen, Denmark, September 1984.
157. Invited speaker, Graphics Interface 1984, Ottawa, Canada, May 1984.
158. International Forum of New Images, Monte Carlo, Monaco, February 1984.
159. University of Waterloo, Waterloo, Ontario, Canada, November 1983.
160. International Council Kinetography Laban, Tarrytown, NY, August 1983.
161. Advanced Technology Series, Burroughs Corp., April 1983.
162. Bell Laboratories, Murray Hill, April 1983.
163. Columbia University, March 1983.
164. Invited plenary session speaker, First Quebec Computer Graphics Symposium, University of Montreal, Montreal, 1983.
165. Brown University, April 1982.
166. Invited speaker, Seminar in Three-Dimensional Computer Animation, SIGGRAPH '82 Conference.
167. Invited plenary session speaker, ONLINE 82, London.
168. Veterans Administration Research and Development Center, Stanford, CA, February 1982.
169. University of Toronto, February 1982.
170. Stanford Research Institute, January 1982.
171. Cornell University, April 1981.
172. Princeton Chapters ACM, ACM SIGGRAPH, and IEEE Computer Society joint meeting, April 1981.
173. Tutorial "Introduction to Computer Graphics" at Industrial Applications Society of IEEE, October 1981.
174. Invited speaker, Seminar in Three-Dimensional Computer Animation, SIGGRAPH '81 Conference.
175. SIGGRAPH liaison to EUROGRAPHICS Society. Invited speaker on "State of the Art in Computer Graphics" at Eurographics '81 Conference.
176. Tutorial organizer "Systems for Simulation" at Eurographics '81 Conference.
177. Main Line ACM Chapter, April 1981.
178. Carnegie-Mellon University, March 1981.
179. Smith, Kline and French Laboratories, March 1981.
180. American Association for the Advancement of Science, Annual Meeting, January 1981.
181. Sloan Workshop on "Models for the Coordination of Action," University of California at San Diego, January 1981.

182. Delaware Valley Chapter, IEEE Computer Society, October 1980.
183. Salk Institute, August 1980.
184. State University of New York at Buffalo, April 1980.
185. University of Massachusetts at Amherst, March 1980.
186. Visiting Lecturer for one week at University of Toronto, October, 1979.
187. Mathematics Association of America, meeting on "Computer Graphics in Undergraduate Education, Philadelphia, PA, April 1979.
188. American Institute of Architects, Philadelphia Chapter Seminar on "Computer Graphics in Architectural Practice," Philadelphia, PA, April 1979.
189. Delaware Valley ACM Chapter, March 1979.
190. Germantown Science and Art Club, February 1979.
191. Symposium for High School students, SEAS, UPenn, November 1978.
192. Sperry-Univac, November 1978.
193. Workshop on "Molecular Modelling," Fox Chase, PA, May 1978.
194. University of Toronto, April 1978.
195. Princeton Workshop on "Pattern Recognition and Artificial Intelligence," April 1978.
196. Transportation Research Board, Annual Meeting, Washington, DC, January 1978.
197. Archaeological Institute of America, Annual Conference, Atlanta, GA, December 1977.
198. Visiting Lecturer for one week at College of Creative Studies, University of California at Santa Barbara, February 1977.
199. SIGCSE 6th Annual Technical Symposium, Williamsburg, VA, Summer 1976.
200. Workshop on "Cognitive Robotic Systems," Pasadena, CA, March 1975.
201. Moore School Research Symposium, Philadelphia, PA, October 1975.
202. "Near Future Prospects for Image Pattern Recognition," Silver Spring, MD, November 1974.

Patents

Patent applied for: "Methods and Systems for Simulation and Representation of Agents in a High-Density Autonomous Crowd," April 8, 2009 (N. Badler, N. Pelechano-Gomez, J. Allbeck).

Unpublished Technical Reports - Selections

University of Pennsylvania, Department of Computer and Information Science

- “Design Concepts for Automating Maintenance Instructions” (N. Badler and C. Erignac), Final Report to the Air Force on Delivery Order #1 January 2000. (Reproduced as an official Air Force Technical Report.)
- “Anthropometry for computer graphics human figures,” 1989 (with M. R. Grosso, R. D. Quach, E. Otani, J. Zhao, S. Wei, P. Ho and J. Lu).
- “Constraint-based temporal planning,” 1988 (with S. Kushnier and J. Kalita).
- “Handwaving in computer graphics: Efficient methods for interactive input using a six-axis digitizer,” 1986 (with D. Baraff).
- “An interactive sound synchronization system,” 1984 (with S. David Eisenberg).
- Abstracts of the “Workshop on Computer Analysis of Time-Varying Imagery,” edited by N. Badler and J. K. Aggarwal, 1979.
- “An integrated systems approach to computer-aided architectural design,” 1979 (with B. Ozguc). Reprinted as Research Report No. 4, Middle East Technical University, Department of Building Science and Environmental Design.
- “The simulation of human movement by computer,” Movement Project Report No. 14, August 1978 (with J. O’Rourke, S. Smoliar, and L. Weber).
- “SITE: A color computer graphics system for the display of archaeological sites and artifacts,” August 1977 (with V. Badler).

University of Toronto, Department of Computer Science

- “Temporal scene analysis: Conceptual descriptions of object movements,” (Ph.D. Dissertation) Tech. Report No. 80, February 1975. Reprinted as Univ. of Penn. CIS Tech. Report MS-CIS-76-4.
- “The *1.pak* reference manual,” Tech. Report No. 55, August 1973 (with W. Berndl, L. Melli, and J. Mylopoulos).

Teaching

Graduate

- Computer Graphics (CIS580A=CIS560=CSE460), 1976-present.
- Advanced Computer Graphics (CIS685=CIS660), 1984-2001.
- Computer-Aided Design (CIS532), 1988
- Seminar in Artificial Intelligence (CIS680B), 1975-1982.
- Numerous Independent Studies (CIS899/CIS999).
- Computer Visualization (EXEN500=EMTM500), 1991-present
- Pattern Recognition (Univ. of Toronto), 1973.
- Picture Processing (Univ. of Toronto), 1974.
- Introduction to Computer Systems (Univ. of Toronto), 1973-74.

Undergraduate

- Introduction to Computer Graphics Techniques (CIS277), 2007-
- Virtual World Design (CSE 377), 1999-2006

DMD Senior Project (EAS499=DMD499), 1999-.
Scientific Visualization (CSE280), 1990.
Programming Language Techniques (CSE120), 1982-1986.
Intro. to Computing (CSE110), 1974-1982, 1994.
General Honors CSE110, 1977-1982 (by invitation).
General Honors CSE120, 1983.
Interactive Systems Design (CSE280), 1980, 1982
Senior Project (CSE400-401), 1975-1977.
Numerous Independent Studies (CSE99).

Academic Activities

- Director, SIG Center for Computer Graphics
- Provost's Committee on Study Abroad
- Associate Dean, SEAS
- Provost's Staff Sub-Committee on Faculty Appointments
- Faculty co-Director, Computer Graphics and Game Technology MSE degree
- Director, Center for Human Modeling and Simulation
- Director, Undergraduate degree program in Digital Media Design.
- CIS Chair 1990-94
- Annenberg Dean Search Committee
- Provost's Strategic Planning Committee – Graduate Research
- SEAS Task Force on Bioengineering.
- Architecture Graduate Group Review Committee
- CIS Undergraduate Chair.
- CIS Space Allocation Committee (Chair).
- CIS Strategic Plan Committee.
- Chemical Engineering Chair Search Committee.
- MEAM Chair Search Committee.
- SEAS Faculty Council.
- Executive Masters' Degree, Executive Committee.
- Acting CIS Graduate Chair.
- CIS Department Chair Search Committee.
- CIS Development Plan Review Committee (Chair).
- Computer Advisory Committee (SEAS).
- Computer Graphics Subcommittee of Computer Advisory Committee.
- Undergraduate Curriculum Committee (CIS).
- Foreign Language Exam Committee (CIS).
- Written Preliminary Exam Committee (CIS).
- Library Committee (SEAS).
- Colloquium Committee (CIS).
- CIS Salvatori Chaired Professorship Search Committee.
- Supercomputer Committee (SEAS)
- University Museum Task Force on Computer/AV Exhibition Tech.
- Personnel Committee (SEAS)

PhD Students

In progress: (anticipated completion)

Chris Czyzewicz (2010)

Joseph Kider (2009)

Catherine Stocker (2010)

Benjamin Sunshine-Hill (2010)

Liming Zhao (2009)

Completed:

1. PhD 2009: Jan Allbeck – Creating 3D animated human behaviors for virtual worlds. (George Mason University)
2. PhD 2008: Durell Bouchard – Automated Motion Capture Segmentation Using Laban Movement Analysis. (Roanoke College)
3. PhD 2007: Michael Johns (co-supervised with Barry Silverman) – Human Behavior Modeling Within an Integrative Framework.
4. PhD 2006: Erdan Gu – Multiple influences on gaze and attention behavior for embodied agents.
5. PhD 2006: Seung-Joo Lee – PAGO: Pelvis analysis and gait output.
6. PhD 2006: Nuria Pelechano – Modeling realistic autonomous agent crowd movement: Social forces, communication, roles and psychological influences.
7. PhD 2004: Aaron Bloomfield – Using factors to experience physicality in virtual worlds. (University of Virginia)
8. PhD 2003: Ying Liu – Interactive reach planning for animated characters using hardware acceleration. (Sony Inc.)
9. PhD 2003: Koji Ashida – Adaptive construction of manifold meshes. (Nvidia Inc.)
10. PhD 2002: Suejung Huh (co-supervised with Dimitris Metaxas) – Deformable cloth modeling with physics-based collision response. (Rutgers University)
11. PhD 2002: Sooha Park Lee - Facial animation system with realistic eye movement based on a cognitive model for virtual agents. (HUP)
12. PhD 2001: Liwei Zhao - Synthesis and acquisition of Laban Movement Analysis qualitative parameters for communicative gestures. [Co-recipient of Rubinoff PhD Award] (Synergy Inc.)
13. PhD 2001: Rebecca Mercuri - Electronic vote tabulation checks and balances. (Harvard)
14. PhD 2000: Charles Erignac - Interactive semi-qualitative simulation in virtual environments. (Boeing Commercial Airplane)
15. PhD 2000: Ramamani Bindiganavale - Building parameterized action representations from observation. (Susquehanna Partners)

16. PhD 2000: Jianping Shi - Techniques for mitigating lag time when joining interest groups in real-time simulations (Oracle Systems)
17. PhD 2000: John Granieri - Time-critical human figure animation for interactive 3D visual simulation. (Susquehanna Partners)
18. PhD 1999: Diane Chi - A motion control scheme for animating expressive arm movements. (Susquehanna Partners)
19. PhD 1999: Sonu Chopra - Where to look? Automating certain visual attending behaviors of human characters. (Susquehanna Partners)
20. PhD 1998: Deepak Tolani - Analytic inverse kinematics techniques for anthropometric limbs. (Pacific Data Images)
21. PhD 1998: Pei-Hwa Ho - Anthropometric scaling of computer graphic human bodies. (Enterprise.com)
22. PhD 1998: Bond-Jay Ting - Real time human model design. (Walt Disney Feature Films)
23. PhD 1997: Barry Reich - An architecture for behavioral locomotion. (ImpLair.com)
24. PhD 1996: Xinmin Zhao - Kinematic control of human postures for task simulation. (Walt Disney Feature Films)
25. PhD 1996: Min-Zhi Shao - Computational methods for realistic image synthesis. (Sony Picture ImageWorks)
26. PhD 1996: Francisco Azuola - Error in representation of standard anthropometric data by human figure models. (Intel Inc.)
27. PhD 1996: Paul Diefenbach - Pipeline rendering: Interaction and realism through hardware-based multi-pass rendering. (OpenWorlds Inc.)
28. PhD 1996: Libby Levison - Connecting planning and acting via object-specific reasoning. (Peace Corps)
29. PhD 1996: Welton Becket - Reinforcement learning of reactive navigation for computer animation of simulated agents. (Susquehanna Partners)
30. PhD 1994: Hyeongseok Ko - Kinematic and dynamic techniques for analyzing, predicting, and animating human locomotion. (Seoul National University)
31. PhD 1993: Eunyong Koh - Automatic synthesis of simplified 3D models from detailed data. (Goldman, Sacks)
32. PhD 1993: Jianmin Zhao - Moving posture reconstruction from perspective projections of jointed figure motion. (Alias Research)
33. PhD 1993: Philip Lee [MEAM] - Modeling articulated figure motion with physically-based constraints. (Goldman, Sacks)
34. PhD 1992: Wallace Ching - Motion planning for redundant branching articulated figures. (Pacific Investments)

35. PhD 1992: Moon Jung - Human-like agents with posture planning ability. (Sogang Univ., South Korea)
36. PhD 1991: Cary Phillips - Interactive postural control of articulated geometric figures. (Industrial Light and Magic)
37. PhD 1991: Catherine Pelachaud - Communication and coarticulation in facial animation. (University of Paris, France)
38. PhD 1991: Tarek Alameldin - Three-dimensional workspace visualization for redundant articulated chains. (California State College at Fresno)
39. PhD 1990: Diana Dadamo - A formalization of motion control specification. (Villanova University)
40. PhD 1990: Jugal Kalita - Classification and animation of motion verbs. (University of Colorado at Colorado Springs)
41. PhD 1990: Isaac Rudomin - Simulating cloth using a mixed geometric-physical method. (Monterrey Institute of Technology, Mexico)
42. PhD 1990: Susanna Wei - Human strength database and multidimensional data display. (St. Joseph's University)
43. PhD 1989: Pearl Pu - A methodology for automated causal reasoning about mechanisms. (EPFL, Lausanne, Switzerland)
44. PhD 1986: Tamar Granor - GUIDE: Graphical User Interface Development Environment. (Independent software developer)
45. PhD 1986: Paul Fishwick - Hierarchical reasoning: Simulating complex processes over multiple levels of abstraction. (University of Florida at Gainesville)
46. PhD 1985: Stephen Platt - A structural model of the human face. (Alterion.com)
47. PhD 1984: Gerald Radack - Local matching of surfaces using boundary-centered radial decomposition. (Concurrent Technologies Corp.)
48. PhD 1984: James Korein - A geometric investigation of reach. (Dissertation received Rubinoff Award; received ACM Doctoral Dissertation Award, 1984, and published by MIT Press) (Cyclovision.com)
49. PhD 1981: Chaim Broit - Optimal registration of deformed images. (Israel Defense Dept.)
50. PhD 1981: Dan Olsen - Procedure-based generalized interactive systems. (Brigham Young University)
51. PhD 1981: Sakunthala Gnanamgari - Information presentation through default displays. (Infovalley.com)
52. PhD 1980: Joseph O'Rourke - Image analysis of human motion. (Smith College)
53. PhD 1980: Larry Grim - Reversible image compression. (Dupont Inc.)

54. PhD 1978: Bulent Ozguc - An integrated systems approach to computer-aided architectural design and graphics communication (PhD in Architecture). (Bilkent University, Ankara, Turkey)
-

Master's Theses (Since 1980 Master's Theses have been optional)

1. MSE 2008: Patrick Cozzi – Visibility driven out-of-core HLOD rendering.
2. MSE 2008: Meng Yang - Extracting, partitioning, and stylizing feature lines on the GPU.
3. MSE 1997: Young-Jun Kim - Interactive dynamics for crawler crane simulation in virtual reality.
4. MSE 1991: Richard Rabbitz - Fast and accurate collision detection for the dynamic simulation of complex 3-D environments.
5. MSE 1989: Ernest Otani - Software tools for dynamic and kinematic modeling of human motion.
6. MSE 1987: Robin Karlin - SEAFAC: A semantic analysis system for Task Animation of Cooking Operations.
7. MSE 1987: Lisa Koelewyn - SCORE: An interactive graphic interface to the GOALTENDER language.
8. MSE 1986: Kamran Manoochehri - Articulated figure positioning by multiple constraints and 6-axis input.
9. MSE 1985: Jeffrey Gangel - A motion verb interface to a task animation system.
10. MSE 1984: Scott Steketee - Interpolation for animation incorporating positional and kinetic adjustment.
11. MSE 1984: S. David Eisenberg - An interactive sound synchronization system.
12. MSE 1984: Lynne Shapiro Brotman - A method for generating shadows with an umbra and penumbra in computer generated images.
13. MSE 1983: Douglas Bloom - A user-oriented interface control of an interactive computer graphics system.
14. MSE 1983: Luke Weinstein - A menu driven user interface.
15. MSE 1980: Gerald Radack - Jigsaw puzzle matching using a boundary-centered polar encoding.
16. MSE 1980: Stephen Platt - A system for computer simulation of the human face.
17. MSE 1980: Donna Strauss - An interactive system for the manipulation and display of quadric volumes.
18. MSE 1979: Wayne Tracton - GEL, A Graphic Editor for Labanotation.
19. MSE 1979: Pradip Madan - Interactive editing of overlapping objects on raster scan displays.
20. MSE 1979: Sharon Meltzer - A two-dimensional line drawing graphics package.

21. MSE 1979: Hasida Isaacson (Toltzis) - Spheres and planes, A body in an environment.
22. MSE 1979: Bruce Kaufman - The simulation of human locomotion.
23. MSE 1978: Kamal Raychaudhuri - Decomposing sphere sets into a planar polygon representation.
24. MSE 1978: Jim Bosco - Graphical input techniques for three-dimensional curved patch systems.
25. MSE 1977: Eric Benshetler - Three-dimensional data display using spheres and the medial axis.
26. MSE 1977: Leonard Miller - Towards a formal model for pseudo-color selection.
27. MSE 1977: Joseph O'Rourke - Spherical decomposition techniques and a human display model.
28. MSE 1977: Vicki Hirsch - Floorplans in Labanotation.

Post Doctoral and other Visitors

Monica Costa
Ambarish Goswami
Masatosi Hada
Torbjörn Hallgren
Tsukasa Noma
Begoña Martinez
Catherine Pelachaud
Yu Zhang