Robert E. Bodenheimer, Jr. Curriculum Vitae

Assistant Professor of Computer Science
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PROFESSIONAL INTERESTS

My research is in the area of computer graphics, specifically computer animation and virtual environments. My particular interests in animation and virtual environments lie in the design of algorithms that can be shaped for use in learning applications. In computer animation, I develop methods that allow the creation of visually compelling human motion. I am especially interested in formal evaluation of such methods, and how such evaluation informs the design process for the creation of animated motion. I also study how people learn and act on their perceptions in virtual environments, using this information to build virtual environments that leverage perceptual affordances.

EDUCATION

California Institute of Technology, Electrical Engineering Dept., Pasadena (CA)
Ph.D. in Electrical Engineering, June 1995
Dissertation: *The Whirling Blade and the Steaming Cauldron*
Advisor: Prof. John Doyle

University of Tennessee, Electrical Engineering Dept., Knoxville (TN)
Master of Science in Electrical Engineering, December 1987
Thesis: *Elliptical Bounds, Robustness, and Performance in Control Systems*
Advisor: Prof. Doug Birdwell

University of Tennessee, Electrical Engineering Dept., Knoxville (TN)
Bachelor of Science in Electrical Engineering, June 1986

University of Tennessee, Mathematics Dept., Knoxville (TN)
Bachelor of Arts in Mathematics, June 1986

PROFESSIONAL EXPERIENCE

Vanderbilt University, Electrical Engineering and Computer Science, Nashville (TN)
Assistant Professor, September 2000 – Present

Georgia Institute of Technology, College of Computing, Atlanta (GA)
Postdoctoral Fellow, January 1998 – May 2000

Microsoft, Microsoft Research Graphics Group, Redmond (WA)
Visiting Researcher, October 1995 – December 1997

California Institute of Technology, Pasadena (CA)
Research Assistant, September 1989 – June 1991, September 1992 – June 1995

Alysis Software, San Francisco (CA)
Software Consultant, June 1991 – June 1995

Minds and Machines, San Francisco (CA)
Software Consultant, June 1988 – August 1989

University of Tennessee, Engineering Computer Laboratory, Knoxville (TN)
System Manager, September 1983 – August 1986

AWARDS

2003-2008	NSF CAREER award
2005	Best Paper award, ACM Southeastern Regional Conference (C10)
1998-2000	Postdoctoral Research Award in Experimental Computer Science, National Science Foundation.
1987-1988	Earle C. Anthony Fellowship.
1986	John H. Barret Prize as Outstanding Senior in Mathematics, University of Tennessee, Knoxville, 1986.

HONORARY SOCIETIES

Member of Eta Kappa Nu and Tau Beta Pi

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Association for Computing Machinery (ACM)
Senior Member, Institute for Electrical and Electronics Engineers (IEEE)
ACM Special Interest Group on Graphics (SIGGRAPH)

PUBLICATIONS

Students are underlined.

Refereed Journal Articles

J1. R. A. Peters II, K. Hambuchen, and **B. Bodenheimer**, "The Sensory Ego-Sphere: A Mediating Interface Between Sensors and Cognition," *Robotics and Automation*, accepted.

This paper reports on the Sensory Ego-Sphere (SES), an interface to robotic cognition developed by Peters. My key contribution to this work is the use of the SES as a mechanism for sensor fusion. I helped obtain many of the quantitative results described in this paper. The experiments for these results were carried out by Hambuchen, a student of Peters, as part of her dissertation.

J2. A. Mohan, R. Bailey, J. Waite, J. Tumblin, C. Grimm, and **B. Bodenheimer**, "Table-top Computed Lighting for Practical Digital Photography," *IEEE Transactions on Visualization and Computer Graphics*, in press.

This article was an equal collaboration between Tumblin, Grimm, and me in the area of computational photography. This paper provides interactive methods to develop natural, studio-quality photography of objects using a single light source. Tumblin's expertise allowed the construction of computer-controlled lighting devices that could capture the 4D incident light field. Once these data are captured, however, my expertise was necessary to develop fast optimization methods that allow synthetic images of desired natural lighting to be created interactively. Grimm's expertise in art-based interaction and modeling provided details for the sketching interface that allows users to create the final image. One student from each institution was the primary implementor of his or her part of the project. Jon Waite, an undergraduate student, conducted this research under my supervision.

J3. B. Williams, G. Narasimham, C. Westerman, J. Rieser, and **B. Bodenheimer**, "Functional Similarities in Spatial Representations Between Real and Virtual Environments," *ACM Transactions on Applied Perception*, in press.

Betsy Williams, my Ph.D. student, was the primary implementor of the virtual environments, algorithms, studies, and analysis carried out in this paper, under my supervision. Rieser provided the necessary psychology expertise for the design of the experimental studies. This paper establishes relationships that inform the design of graphical virtual environments. This journal is a prestigious journal for inter-disciplinary research that crosses the boundaries between perception and computer graphics. G. Narasimham is a graduate student of John Rieser's in Psychology, and Claire Westerman was a psychology undergraduate who assisted in running the experiments.

J4. C. Campbell, R. A. Peters II, **R. E. Bodenheimer**, W. J. Bluethmann, E. Huber, and R. O. Ambrose, "Superpositioning of Behaviors Learned Through Teleoperation," *IEEE Transactions on Robotics*, **22**(1), pp. 79–91, February 2006.

Christina Campbell was the primary implementor of the work to adapt and implement techniques developed by Rose, Cohen, and me (J10) to physical robots. The original work (J10) developed methods for the synthesis of complex behaviors from motion capture data. This work showed that the same methods, with some modifications, could be applied to real robots. Peters' expertise in humanoid robotics helped to implement the methods on a physical platform. The idea for this application was mine. I supervised Christina, a student of Peters, in implementing and adapting the original animation methods, and also in running the experimental validation. Bluethmann, Huber, and Ambrose at NASA's Johnson Space Center developed the robot, Robonaut, on which this work was implemented and tested, and they provided support and advice throughout the project. This journal is the premier journal in robotics with an acceptance rate $\approx 25\%$.

J5. T. Kriete, M. House, **B. Bodenheimer**, and D. C. Noelle, "NAV: A tool for producing presentation-quality animations of graphical cognitive model dynamics." *Behavior Research Methods*, **37**(2), pp. 335–339, May 2005.

This paper addressed a need in computational neuroscience for an efficient and adaptable way to visualize complex cognitive models. Noelle's expertise in cognitive modeling provided the specifications for the project, while my expertise in the design of graphical tools and simulation provided the core on which the tool was built. Noelle and I contributed equally to the work, although I was the primary supervisor for the work done in this paper, which evolved from a CS 352 (HCI) class project by Trent Kriete and Matt House. The extension of that work into the work presented in this paper was jointly supervised by Noelle and me. This journal is the primary source for information on the methods, techniques, and research instruments in experimental psychology.

J6. A. Crecelius, D. S. Cornett, R. M. Caprioli, B. Williams, B. Dawant, and **R. E. Bodenheimer**, ""Three-Dimensional Visualization of Protein Expression in Mouse Brain Structures Using Imaging Mass Spectrometry," J. Am. Soc. Mass Spectrometry, **16**, pp. 1093–1099, June 2005.

This article describes the visualization of proteomic information in 3-D, and is the result of a collaboration between my student Betsy Williams, Benoit Dawant, me, and researchers in the Mass Spectrometry group at Vanderbilt led by Richard Caprioli. Crecelius gathered the data used in the visualization. Betsy Williams, working under my supervision, contributed 50% of the work to this paper and was responsible for all visualization and image processing tasks that contributed to the results.

J7. Z. Chen, J. F. Barnes, **B. Bodenheimer**, "Hybrid and Forward Error Correction Transmission Techniques for Unreliable Transport of 3D Geometry," *Multimedia Systems Journal*, **10**(3), pp. 230–244, March 2005.

This paper reports on results graduate student Zhihua Chen generated under Barnes and my supervision. The project investigated the best way to transfer geometry data over a lossy network. The project was an equal collaboration between Barnes and me: I provided the graphics expertise required for the work while Barnes provided the necessary networking expertise. This journal is a prime venue for interdisciplinary work involving graphics and networking.

J8. K. Kawamura, R. A. Peters II, **R. E. Bodenheimer**, N. Sarkar, J. Park, C. A. Clifton, A. Spratley, and K. A. Hambuchen, "A Multi-Agent Cognitive Robot Architecture and its Realization," *International Journal of Humanoid Robotics*, **1**(1), pp. 65–93, March 2004.

This paper describes the cognitive architecture employed by the Vanderbilt humanoid robot, ISAC. A part of that cognitive architecture involves techniques developed by me for the control and movement of ISAC that were more fully explored on Robonaut in (J4). I developed the sensory fusion capabilities of the sensory ego-sphere on ISAC, a topic more fully explored in (J1). This journal is one of the few devoted to humanoid robotics, including the science of learning for robots.

J9. P. Bendotti, and **B. Bodenheimer**, "Linear Parameter-Varying versus Linear Time-Invariant Control Design for a Pressurized Water Reactor," *International Journal of Robust and Nonlinear Control*, **9**(13), pp.969–995, November 1999.

This paper used techniques and control designs that I developed in my dissertation to synthesize and analyze a control system for the primary circuit of a pressurized water nuclear reactor. Bendotti provided expertise in the dynamics of the water reactor and performed the baseline control design against which the linear parameter-varying methods were tested. This journal is a leading forum for the dissemination of results involving control of uncertain systems, and one of the few that will accept results from black-box models, as was done in this paper, since the fundamental model of the plant discussed is classified.

J10. C. Rose, **B. Bodenheimer**, and M. Cohen, "Verbs and Adverbs: Multidimensional Motion Interpolation," *IEEE Computer Graphics and Applications*, **18**(5), pp. 32–41, September/October 1998.

This paper reports on the work that Charles Rose did for his dissertation under Cohen's supervision, and which I was involved with while at Microsoft Research. The basic system is one that creates controllable animation from example motions. Research on it continues today. My contribution to this work involved help both in the development of the underlying algorithms and in the implementation of the run-time system. This journal is a leading venue for research that bridges the theory and practice of computer graphics.

J11. **B. Bodenheimer**, P. Bendotti, and M. Kantner, "Linear Parameter-Varying Control of a Ducted Fan Engine," *Int. J. of Robust and Nonlinear Control*, **6**(9/10), pp. 1023–1044, November 1996.

This paper reports the primary results of my dissertation, on the analysis, synthesis, and application of linear parameter-varying techniques to a ducted fan engine. This journal is a leading forum for the dissemination of results involving control of uncertain systems.

J12. K. Zhou, K. Glover, **B. Bodenheimer**, and J. Doyle, "Mixed $\mathcal{H}_2$ and $\mathcal{H}_\infty$ Performance Objectives I: Robust Performance Analysis," *IEEE Trans. on Automatic Control*, **39**(8), pp. 1564–1574, August 1994.

This paper and the next one report on work done in my pre-doctoral days. I was interested in developing techniques of optimal control using a mixed optimality criterion. Several of the fundamental proofs in this work were done by me. This journal is the premier venue for publications in control systems.

J13. J. Doyle, K. Zhou, K. Glover, and **B. Bodenheimer**, "Mixed $\mathcal{H}_2$ and $\mathcal{H}_\infty$ Performance Objectives II: Optimal Control," *IEEE Trans. on Automatic Control*, **39**(8), pp. 1575–1587, August 1994.

Further results for optimal control using a mixed optimality criterion, as mentioned above. This journal is the premier venue for publications in control systems.

Papers Submitted to Journals and in Review

S1. O. C. Jenkins, **R. E. Bodenheimer**, and R. A. Peters II, "Uncovering Manifold Structure in Robot Sensorimotor Data," submitted and under review to *IEEE Transactions on Robotics*.

An equal contribution by all authors, the work applies manifold learning technology to teleoperated robots to discover structure in the data that can be used to analyze behavior. Some of the analysis can be done in real-time to provide feedback to an operator of a robot.

S2. J. Wang and **B. Bodenheimer**, "Synthesis and Evaluation of Linear Motion Transitions," revised and under review to *ACM Transactions on Graphics*.

The paper is the journal version results from Jing Wang's dissertation. Some of this work appeared in conferences and posters (C12, C16, P6), but significant new work is presented in this article on the subject of linear motion transitions. This journal is a prestigious journal in computer graphics.

S3. **B. Bodenheimer**, B. Williams, M. Kramer, K. Viswanath, R. Balachandran, K. Belynne, and G. Biswas, "Construction and Evaluation of Animated Teachable Agents," submitted and under review to *Educational Technology & Society*.

This work reflects efforts made as part of my CAREER research to implement an animated teachable agent. I developed the concepts for animating a humanoid teachable agent, led the team, and wrote the paper.

S4. B. Williams, A. Crecelius, D. S. Cornett, R. M. Caprioli, B. Dawant, and **B. Bodenheimer**, "Pre-processing of Mass Spectra for Imaging MALDI-MS," submitted and under review to *International Journal of Imaging Systems and Technology.*

This article describes technical details omitted in the mass spectrometry paper mentioned above (J6), as well as an extension of the pre-processing methods to larger data sets, involving a technique developed by us for spectral normalization of intra-slice MALDI data. This work was carried out by my Ph.D. student Betsy Williams under supervision by myself and Benoit Dawant. Betsy Williams and I generated the results and wrote most of the paper.

Papers Published in Conferences with Acceptance Based on Full Papers and Acceptance Rate Comparable to Copyrighted Journals

CF1. J. Davis, K. Leelawong, K. Belynne, **B. Bodenheimer**, G. Biswas, N. Vye, and J. Bransford, "Intelligent User Interface Design for Teachable Agent Systems," 2003 International Conference on Intelligent User Interfaces, pp. 26–34, Miami, FL, January 2003.

This paper reports on the interface design for teachable agent systems, which I helped develop. The conference is one of the top conferences in the field on interfaces to intelligent systems, and is very competitive, having a 20% acceptance rate.

CF2. C. Rose, B. Guenter, **B. Bodenheimer**, and M. Cohen, "Efficient Generation of Motion Transitions using Spacetime Constraints," *Computer Graphics '96*, pp. 147–154, Proc. SIGGRAPH '96.

This paper represents my first efforts in the field of animation after completing my dissertation. Charles Rose was a Ph.D. student under Cohen and supervised by Guenter. My contribution to this work primarily involved developing and implementing the cyclification parts of the motion transition mechanism. This conference is the top venue for presentation of results on graphics and animation, and had a 21% acceptance rate.

Conference Proceedings with Acceptance Based on Peer Review of Full Paper

C1. R. A. Peters II, **R. E. Bodenheimer**, O. C. Jenkins, "Sensory-Motor Manifold Structure Induced by Task Outcome: Experiments with Robonaut," IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS '06), Genova, Italy, December 2006, to appear.

An equal collaboration between all authors, this work was an outgrowth of work related to the journal publication (S1). Acceptance rate 62%.

C2. K. A. Fleming, R. A. Peters II, **R. E. Bodenheimer**, "Image Mapping and Visual Attention on a Sensory Ego-Sphere," IEEE/RSJ Conference on Intelligent Robotics and Systems (IROS), pp. 241–246, Beijing, China, October 2006.

This paper reports on adding imaging to the Sensory Ego-Sphere for attentional purposes. Peters provided most of the supervision and direction of his student, Katherine Fleming. I provided help in implementing the mosaicing interface. Acceptance rate 46%.

C3. O. C. Jenkins, R. A. Peters II, **R. E. Bodenheimer**, "Uncovering Success in Manipulation," RSS Workshop on Manipulation for Human Environments, Philadelphia, PA, August 2006.

An equal collaboration between all authors, this work the led to the journal publication (S1).

C4. C. N. de Juan and **B. Bodenheimer**, "Re-Using Traditional Animation: Methods for Semi-Automatic Segmentation and Inbetweening," Symposium on Computer Animation, pp. 223–232, Vienna, Austria, September 2006.

SCA is the leading forum for the dissemination of cutting-edge research in computer animation. This work reports part of Christina de Juan's dissertation, done under my direction. 29.4% acceptance rate.

C5. A. E. Seward, D. H. Ashmead, and **B. Bodenheimer**, "Discrimination and Estimation of Time-to-Contact for Approaching Traffic Using a Desktop Environment," Symposium on Applied Perception in Graphics and Visualization, pp. 29–32, Boston, MA, July 2006.

This work reports part of Elizabeth Seward's Master's thesis, done under my direction. AGPV is one of the few forums where results from perception that advance the design of methods in computer graphics and animation are easily presented. 44% acceptance rate.

C6. B. Williams, G. Narasimham, T. McNamara, T. Carr, J. Rieser, and **B. Bodenheimer**, "Updating Orientation in Large Virtual Environments Using Scaled Translational Gain," Symposium on Applied Perception in Graphics and Visualization, pp. 21–28, Boston, MA, July 2006.

This work reports part of Betsy Williams' dissertation research, done under my direction. AGPV is one of the few forums where results from perception that advance the design of methods in computer graphics and animation are easily presented. 44% acceptance rate.

C7. O. C. Jenkins, **B. Bodenheimer**, and R. A. Peters II, "Manipulation Manifolds: Explorations in Uncovering Manifolds in Sensory-Motor Spaces," Fifth International Conference on Development and Learning, Bloomington, IN, June 2006.

An equal collaboration between all authors, this work started our efforts that would result in journal article (S1).

C8. A. Mohan, J. Tumblin, **B. Bodenheimer**, C. Grimm, and R. Bailey, "Table-top Computed Lighting for Practical Digital Photography," Eurographics Symposium on Rendering, pp.165–172, Konstanz, Germany, June 2005.

The first results that led to journal article (J2). For this work, I developed and implemented the underlying optimization algorithms and wrote significant portions of the paper. Acceptance rate 33.3%.

C9. B. Williams, A. Crecelius, S. Cornett, R. Caprioli, B. Dawant, and **B. Bodenheimer**, "Baseline Correction of MALDI Mass Spectrometry Imaging," Proceedings of the 43rd ACM SE Regional Conference., v. 1, pp. 137-142, March 2005.

The first results that would develop in journal articles (S4) and (J6). Acceptance rate 60%.

C10. A. E. Seward, and **B. Bodenheimer**, "Using Nonlinear Dimensionality Reduction in 3D Figure Animation," Proceedings of the 43rd ACM SE Regional Conference, v. 2, pp. 388-392, Kennesaw, GA, March 2005.

This paper was a result of the Vanderbilt Undergraduate Summer Research Program (VUSRP) project done by Elizabeth Seward. The acceptance rate was 60%. This article was awarded best paper award at the conference.

C11. C. N. de Juan, and **B. Bodenheimer**, "Cartoon Textures," 2004 ACM SIGGRAPH / Eurographics Symposium on Computer Animation. pp. 267–276, Grenoble, France, August 2004.

SCA is the leading forum for the dissemination of cutting-edge research in computer animation. This work reports part of Christina's dissertation, done under my direction. Acceptance rate 30.8%.

C12. J. Wang, and **B. Bodenheimer**, "Computing the Duration of Motion Transitions: An Empirical Approach," 2004 ACM SIGGRAPH/Eurographics Symposium on Computer Animation, pp. 337–346, Grenoble, France, August 2004.

SCA is the leading forum for the dissemination of cutting-edge research in computer animation. This work reports part of Jing's dissertation research, done under my direction. Acceptance rate 30.8%

C13. K. Viswanath, R. Balachandran, M. R. Kramer, and **B. Bodenheimer**, "Interface Design Issues for Teachable Agent Systems," Proceedings of ED-MEDIA 2004, pp. 4197-4204, Lugano, Switzerland, June 2004.

This conference is one of the best dealing with educational multimedia. Acceptance rate 38%.

C14. M. Xie, M. Tomlinson, and **B. Bodenheimer**, "Interface Design for a Modern Software Ticketing System," Proceedings of the ACM Southeast Conference (ACMSE04), pp. 122-127, Huntsville, AL, April 2004.

Developed concepts, led team, and wrote most of the paper. Acceptance rate 54%.

C15. Z. Chen, **B. Bodenheimer**, J. F. Barnes "Extending Progressive Meshes for Use over Unreliable Networks," *2003 IEEE Conference on Multimedia and Expo*, v. 3, pp. 253–256, Baltimore, MD, July 2003.

Further results in the development of the work fully described in (J7).

C16. J. Wang, and **B. Bodenheimer**, "An Evaluation of a Cost Metric for Selecting Transitions Between Motion Segments," *2003 ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, pp. 232–238, San Diego, CA, July 2003.

This paper evaluates cost metrics for animation re-sequencing, a problem of interest and importance in the field. The symposium is one of the premier venues for computer animation research. Acceptance rate 37.6%

C17. Z. Chen, **B. Bodenheimer**, J. F. Barnes, "Robust Transmission of 3D Geometry Over Lossy Networks," *Proceedings of the 8th International Conference on 3D Web Technology*, pp. 161–173, St. Malo, France, March 2003.

First results that would lead to journal article (J7).

C18. T. Convery., B. Nuttall, **B. Bodenheimer**, "Web-based Courseware Application Usability," *Proceedings of the ACM Southeast Conference (ACMSE03)*, pp. 399-404, Savannah, GA, March 2003.

Developed concepts, led the team, and wrote most of the paper. Acceptance rate 45%.

C19. K. Viswanath, R. Balachandran, J. Davis, **B. Bodenheimer**, "Effective User Interface Design for Teachable Agent Systems," *Proceedings of the ACM Southeast Conference (ACMSE03)*, pp. 138–144, Savannah, GA, March 2003.

Developed concepts, led the team, and wrote much of the paper. Acceptance rate 45%.

C20. R. Olivares, C. Zhou, J. Adams, and **B. Bodenheimer**, "Interface Evaluation for Mobile Robot Teleoperation," *Proceedings of the ACM Southeast Conference (ACMSE03)*, pp. 112–118, Savannah, GA, March 2003.

Developed concepts and led the team. Acceptance rate 45%.

C21. J. O'Brien, **B. Bodenheimer**, B. Brostow, and J. K. Hodgins, "Automatic Joint Parameter Estimation from Magnetic Motion Capture Data," Proceedings of *Graphics Interface 2000*, pp. 53–60, Montreal, CA, May 2000.

The paper reports on the solution of a problem that has plagued motion capture results for years; that is, the development of automatic techniques for estimating the size of a skeleton. O'Brien, a student of Hodgins, developed and implemented the main algorithms. My contribution to this work involved getting the basic idea to work in practice and evaluating it. Acceptance rate 28%.

C22. **B. Bodenheimer**, A. Shleyfman, and J. K. Hodgins, "The Effect of Noise on the Perception of Animated Human Running," *Computer Animation and Simulation '99*, N. Magnenat-Thalmann and D. Thalmann (eds.), pp. 53–63, Milan, Italy, August 1999.

This paper reports the findings of a method I developed for adding variability into cyclic dynamically simulated motion.

C23. **B. Bodenheimer**, C. Rose, S. Rosenthal, and J. Pella, "The Process of Motion Capture: Dealing with the Data," *Computer Animation and Simulation '97*, D. Thalmann and M. van de Panne (eds.), pp. 3–18, Budapest, Hungary, August 1997.

This paper is still one of the fundamental references for the engineering aspects of motion capture, and arose out of my work at Microsoft.

C24. **B. Bodenheimer**, and P. Bendotti, "Optimal Linear-Parameter Varying Control of a Pressurized Water Reactor," *Proc. of 34th Conf. on Decision and Control,* pp. 182–187, New Orleans, LA, December 1995.

C25. C. Beck, **B. Bodenheimer**, and P. Bendotti, "LMI-based Model Reduction for a Vectored-Thrust Ducted Fan Experiment," *Proc. of 34th Conf. on Decision and Control,* pp. 871-875, New Orleans, LA, December 1995.

C26. M. Kantner., **B. Bodenheimer**, P. Bendotti, and R. M. Murray, "An Experimental Comparison of Controllers for a Vectored Thrust, Ducted Fan Engine," *Proc. of the American Control Conference*, v. 3, pp. 1956–1961, Seattle, WA, July 1995.

C27. P. Bendotti, and **B. Bodenheimer**, "Identification and $\mathcal{H}_\infty$ Control for a Pressurized Water Reactor," *Proc. of the 33rd Conf. on Decision and Control*, pp. 1072-1077, Orlando, FL, December 1994.

C28. C. Hrovat, and **B. Bodenheimer**, "Robust Automotive Idle Speed Control Design Based on μ-synthesis," *Proc. of the American Control Conference*, pp. 1778-1783, Seattle, WA, June 1993.

This work, done in collaboration with Davor Hrovat of Ford, was to design a better idle speed controller that would fit on the microprocessors then used by Ford in their fleet of vehicles.

C29. K. Zhou, J. C. Doyle, and **B. Bodenheimer**, "Mixed $\mathcal{H}_2$ and $\mathcal{H}_\infty$ control," *Proc. of the American Control Conference*, San Diego, CA, June 1990.

C30. J. C. Doyle, K. Zhou, and **B. Bodenheimer**, "Optimal Control with Mixed $\mathcal{H}_2$ and $\mathcal{H}_\infty$ Performance Objectives," *Proc. of the American Control Conference*, pp. 2065-2070, Pittsburgh, PA, June 1989.

C31. **R. E. Bodenheimer, Jr.**, and W. J. Toth, "Integral and Differential Linearity Errors in the Synthesis of Electronic Music," *Proc. of the 1986 IEEE Southeastcon*, pp. 260-264, Richmond, VA, March 1986.

Conference Proceedings with Acceptance Based on an Extended Abstract

CE1. S. Pallavaram, H. Yu, J. Spooner, P.-F. D'Haese, T. Koyama, **B. Bodenheimer**, P. E. Konrad, B. M. Dawant, "Automated Selection of Anterior and Posterior Commisures Based on a Deformable Atlas and Its Evaluation Base on Manual Selection by Neurosurgeons," SPIE Symposium on Medical Imaging (Visualization and Image-Guided Procedures), San Diego, CA, February 2007, to appear.

CE2. S. Shankar, L. Su, Y. Jin, J. A. Adams, and **B. Bodenheimer**, "Comparing the Usability of Enhanced RoboFlag Interfaces," *IEEE International Conference on Systems, Man, and Cybernetics*, v. 3, pp. 2815–2820, The Hague, Netherlands, October 2004.

Developed concepts and led team. Acceptance rate 58%.

CE3. S. Shankar, L. Su, Y. Jin, J. A. Adams, and **B. Bodenheimer**, "Enhancing RoboFlag Users' Situation Awareness," *Proceedings of the 48th Annual Human Factors and Ergonomics Society Meeting*, pp. 356-360, New Orleans, LA, September 2004.

Developed concepts and led team. Acceptance rate 70%.

CE4. G. Deng, Z. Ding, **B. Bodenheimer**, and S. Schach, "Understanding Software Coupling through Visualization," *2003 ACM Midsoutheast Regional Conference*, pp. 26, Gatlinburg, TN, Nov. 2003.

CE5. **R. E. Bodenheimer**, M. E. Edgerton, M. S. Ross, B. Dawant, "Registration and Alignment of Histopathological Images," *Archives of Pathology and Laboratory Medicine (proceedings of APIII '02)*, **127**(7), pp. 789–813, Pittsburgh, PA, October 2002.

Book Chapters

B1. J. K. Hodgins, J. F. O'Brien, **R. E. Bodenheimer**, "Computer Animation," In The Wiley Encyclopedia of Electrical and Electronics Engineering, John G. Webster Ed., Volume 3, pp. 686-690, 1999.

Posters and Abstracts (acceptance based on extended abstract)

P1. B. Williams, G. Narasimham, B. Rump, T. McNamara, T. Carr, J. Rieser, **B. Bodenheimer**, "Exploring Large Virtual Environments with an HMD on Foot," *Symposium on Applied Perception in Graphics and Visualization*, Boston, MA, July 2006.

P2. J. Meng, J. Rieser, and **B. Bodenheimer**, "Distance Estimation in Virtual Environments Using Bisection," *Symposium on Applied Perception in Graphics and Visualization*, Boston, MA, July 2006.

P3. S. Pallavaram, P-F. D'Haese, **B. Bodenheimer**, J. Spooner, H. Yu, P. E. Konrad, B. Dawant, "Automated selection of anterior and posterior commissures (AC-PC) based on a deformable atlas can remove variability in the current frame of reference use for stereotactic neurosurgical procedures," ASSFN, American Society of Stereotactic and Functional Neurosurgery, Boston, MA, June 2006.

P4. A. Mohan, J. Tumblin, **B. Bodenheimer**, R. Bailey, C. Grimm, "Tabletop Computed Lighting for Practical Digital Photography," *SIGGRAPH Sketch*, Los Angeles, CA, August 2005.

Acceptance rate: 25%.

P5. B. Williams, K. Belynne, and **B. Bodenheimer**, "An Evaluation of Animation in a Pedagogical Agent," SIGGRAPH 2005, Los Angeles, CA, August 2005.

P6. J. Wang and **B. Bodenheimer**, "The Just Noticeable Difference of Transition Durations," SIGGRAPH 2005, Los Angeles, CA., August 2005.

P7. A. Crecelius, B. Williams, Li Xia, B. Dawant, **B. Bodenheimer**, D. S. Cornett, R. M. Caprioli, "Creating 3D-Images of Mouse Brain Structure Using MALDI/MS," *Proceedings of 52nd ASMS Conference on Mass Spectrometry and Allied Topics.*, Nashville, TN, June 2004.

P8. A. Crecelius, D. S. Cornett, B. Williams, **B. Bodenheimer**, B. Dawant, R. M. Caprioli, "Developing 3-D Imaging Mass Spectrometry," *Proceedings of the 51st ASMS Conference on Mass Spectrometry and Allied Topics*, Montreal, Canada, June 2003.

Invited Talks

T1. "A Geometric Approach to Animation (and Robotics)," Midgraph Graphics Workshop, Nashville, TN, October 2006.

T2. "Complex Data in Computer Animation and Robotics: A Geometric Approach," Vanderbilt Kennedy Center, August 2006.

T3. "Navigating Through Large Virtual Environments when the Physical Environment is Small," Carnegie-Mellon University, April 2006

T4. "Synthesizing and Evaluating Data-Driven Motion Transitions," Carnegie-Mellon University, April 2006.

T5. "Synthesis and Evaluation of Data-Driven Motion Transitions," Electronic Arts, Vancouver, BC, Canada, April 2006.

T6. "Navigating Through Large Virtual Environments when the Physical Environment is Small," University of British Columbia, April 2006

T7. "Navigating Through Large Virtual Environments when the Physical Environment is Small," University of Minnesota, April 2006

T8. "Synthesizing and Evaluating Data-Driven Motion Transitions," University of Pennsylvania, October 2005

T9. "Synthesizing and Evaluating Data-Driven Motion Transitions," University of Iowa, October 2005

T10. "Synthesizing and Evaluating Data-Driven Motion Transitions," Brown University, September 2005.

T11. "Synthesis and Evaluation of Data-Driven Motion Transitions," Washington University at St. Louis, September 2005.

T12. "Functional Similarities in Spatial Representations Between Real and Virtual Environments," Midgraph Graphics Workshop, University of Illinois Urbana-Champaign, November 2005.

T13. "Making Them Move: Human and Robot Animation through Data Acquisition and Dynamic Simulation," Mechanical Engineering, Vanderbilt University, October 2003.

T14. "Making Them Move, Getting Stuff There, and Showing It Well: A Description of Three Applications of Computer Graphics and Animation," University of Alabama at Birmingham, November 2003.

T15. "Robust Transmission of 3D Geometry over Lossy Networks," Middle Tennessee State University, February 2003.

T16. "Registration and Alignment of Histopathological Images," Advancing Pathology Informatics, Imaging, and the Internet, Pittsburgh, PA, October 2002.

T17. "Animating Humans through Data Acquisition and Dynamic Simulation," Middle Tennessee State University, March 2002.

T18. "Animating Humans through Data Acquisition and Dynamic Simulation," University of Georgia, April 2000.

T19. "Animating Humans through Data Acquisition and Dynamic Simulation," University of Tennessee, Knoxville (CS), March 2000.

T20. "Animating Humans through Data Acquisition and Dynamic Simulation," Clemson University, March 2000.

T21. "Animating Humans through Data Acquisition and Dynamic Simulation," University of California, Irvine, March 2000.

T22. "Animating Humans through Data Acquisition and Dynamic Simulation," University of Central Florida, March 2000.

T23. "Animating Humans through Data Acquisition and Dynamic Simulation," University of New Mexico, March 2000.

T24. "Animating Humans through Data Acquisition and Dynamic Simulation," Vanderbilt University, March 2000.

T25. "Animating Humans through Data Acquisition and Dynamic Simulation," University of Tennessee, Knoxville (EE), February 2000.

T26. "The Process of Motion Capture: Dealing with the Data," Industrial Light and Magic, San Rafael, CA, November 1997.

T27. "The Process of Motion Capture: Dealing with the Data," Electronic Arts, Vancouver, BC, Canada, October 1997.

T28. "Applications of Linear Parameter Varying Control," Microsoft, August 1995

T29. "Applications of Linear Parameter Varying Control," Georgia Institute of Technology, July 1995.

Invited Articles

I1. **Bodenheimer, B.** "TEX, LATEX, etc.: questions et réponses," *Cahiers Gutenberg*, pp. 55–77, No 13, June 1992.

Other Publications

O1. **R. E. Bodenheimer**, J. D. Birdwell, A. J. Laub, *The Cascade User's Library*, 1988. Available at `http://www.netlib.org/`.

> *The software library was one of the first freely available software packages to do optimal control system design and analysis. It has been downloaded over 382,000 times since Netlib's instantiation in 1991, and ranks 138/965 of most downloaded software packages available (from* `www.netlib.org/master_counts2.html`*).*

O2. Birdwell, J. D., J. R. B. Cockett, **R. E. Bodenheimer, Jr.**, and G. Chang, *Cascade Final Report Vol. II: The Cascade Tools and Knowledge Base*, Final Report submitted to Oak Ridge National Laboratory for work performed under subcontract 41B-07685C project authorization S13, April, 1988.

O3. Birdwell, J. D., **R. E. Bodenheimer, Jr.**, and A. J. Laub, *Cascade Final Report Vol. III: The Cascade Library User's Guide*, Final Report submitted to Oak Ridge National Laboratory for work performed under subcontract 41B-07685C project authorization S13, April, 1988.

PATENTS

"Robotic Trajectories Using Behavior Superposition," **R. E. Bodenheimer, Jr.**, R. A. Peters II (pending)

"Generating Optimized Motion Transitions for Computer Animated Objects," B. Guenter, C. Rose, **R. E. Bodenheimer**, M. F. Cohen, (5,982,389).

"System for Interpolating Motions with Verbs and Adverbs," C. Rose, **R. E. Bodenheimer**, M. F. Cohen, (6,462,742).

SPONSORED RESEARCH

The total research funding that I've been involved with since September 2000 is $4,499,212. This sum can broken into two categories: Principal Investigator (PI) $535,300; Co-PI $3,963,912.

Funded External Proposals

Title: Computer-assisted Functional Neuro-Surgery
Sponsoring Agency: NIH
Date: 6/1/2006-5/31/2010
Amount: $2,039,806
PIs and Co-PIs: B. Dawant (PI), R. E. Bodenheimer, A. B. Bonds, D. P. Charles, D. Fisher, J. M. Fitzpatrick, C. Kao, P. E. Konrad (co-PIs).
Role: This proposal seeks to improve a treatment for Parkinson's disease. My role will be developing evaluation methods for the success of the surgery and new visualization methods for information stored in a deep-brain atlas that can be used by surgeons in the operating room to help place the stimulators that treat the disease. This work supports two shared graduate students.
Support from Project: 10% academic support, 2 summer weeks

Title: Blind Pedestrian's Access to Complex Intersections
Sponsoring Agency: NIH
Date: 10/01/2005-9/30/2006
Amount: $169,197
PI and Co-PIs: D. Ashmead (PI), R. E. Bodenheimer, D.W. Grantham (co-PIs).

Role: This proposal improves methods for the design of traffic intersections for use by visually impaired persons. My role is to develop desktop and immersive virtual reality technology and scenarios to investigate time-to-contact estimation and discrimination abilities in people with both normal and impaired vision. This work supports one graduate student for my part of the project.
Support from Project: 10% academic support, 2 summer weeks

Title: Center for Advanced Sensors
Sponsoring Agency: Army Research Office
Date: 1/31/2005-5/31/2006
Amount: $356,909
PI and Co-PIs: J. Davidson (PI), A. B. Bonds, B. Bodenheimer, D. Noelle (co-PIs).
Role: This work developed improved sensing technologies to assist vision. My role was to assist in the visualization of firing patterns in the visual cortex for the development of better vision sensing technologies.
Support from Project: 5% calendar year support

Title: An Approach to Authoring Content for Animated Pedagogical Agents
Sponsoring Agency: NSF
Date: 6/1/2004-8/31/2004
Amount: $6,000
PI: B. Bodenheimer
Role: This proposal is an REU supplement to my CAREER grant that funded one undergraduate over the summer.

Title: CAREER: Implementing and Assessing Human Figure Animation in Pedagogical Agents
Sponsoring Agency: NSF
Date: 3/1/2003-2/29/2008
Amount: $423,000
PI: R. Bodenheimer
Role: This proposal develops and evaluates animation methods for placing full-bodied agents in learning environments. I am the sole PI and am 100% responsible for the project. It supports one graduate student in the first four years, and two in the fifth.
Support from Project: 1 summer month

Title: 3-D Imaging Mass Spectrometry
Sponsoring Agency: NIH/NCI
Date: 1/1/2003-12/31/2005
Amount: $325,000
PI: R. M. Caprioli (PI), B. Dawant, R. Bodenheimer (co-PIs).
Role: This proposal developed methods for 3D visualization of proteomic data. I was the investigator with the role of constructing the 3-D visualization of the mass spectrometry data. The grant supports one graduate student doing this aspect of the project.
Support from Project: 10% academic support, 1 summer month

Title: Acquisition of Autonomous Behaviors by Robotics Assistants
Sponsoring Agency: DARPA
Date: 7/2002-12/2004
Amount: $1,025,000
PIs and Co-PIs: K. Kawamura (PI), R. A. Peters II, N. Sarkar, B. Bodenheimer (co-PIs).
Role: This project developed improved methods for autonomous behavior by humanoid robots. My role was to develop methods for the classification and generation of synthetic behaviors for the robots, both ISAC and Robonaut. It supports one graduate student doing this aspect of the project.
Support from Project: 1 summer month, 10-15% academic support

Funded Internal Proposals

Title: Construction of Virtual Environments for Learning and Cognition

Sponsoring Agency: Discovery Grant
Date: 5/2005-6/2007
Amount Requested: $95,000
PI: B. Bodenheimer (PI), J. Rieser, T. McNamara, D. Ashmead (co-PIs).
Role: This proposal provided money to bootstrap research on learning in virtual environments. It supports two graduate students.
Outcome: Funded.

Title: Dynamic Lighting Design with Digital Photography
Sponsoring Agency: Vanderbilt University Summer Research Program
Date: 6/2004–8/2004
Amount Requested: $4,000
PI: B. Bodenheimer
Role: This proposal funded an undergraduate, Jon Waite, for a summer on work related to computational digital photography.
Outcome: Funded.

Title: Nonlinear dimensionality reduction for 3-D animation
Sponsoring Agency: Vanderbilt University Summer Research Program
Date: 6/2004–8/2004
Amount Requested: $3,800
PI: B. Bodenheimer
Role: This proposal funded an undergraduate, Elizabeth Seward, for a summer on work related to parameterization of animation.
Outcome: Funded.

Title: Using Isomap to Animate Pedagogical Agents
Sponsoring Agency: Vanderbilt University Summer Research Program
Date: 5/2003–7/2003
Amount Requested: $3,500
PI: B. Bodenheimer
Role: This proposal funded an undergraduate, Mattie Kramer, for a summer of work on a project related to my CAREER proposal.
Outcome: Funded.

Title: Laboratory for Learning in Immersive Virtual Environments
Sponsoring Agency: Learning Sciences Institute Seed Grant
Date: 8/2002
Amount Requested: $48,000
PIs and Co-PIs: D. Ashmead, G. Biswas, B. Bodenheimer, J. Bransford, K. Frampton, M. Goldfarb, J. Lappin, T. McNamara, J. Rieser, N. Sarkar, C. Smith, P. Thompson, N. Vye
Role: The purpose of this project is to develop methods and collaborations to jump-start a research effort on learning in immersive environments. My role has been to develop, construct and evaluate the environments used for learning.
Outcome: Funded.

Pending External Proposals

Title: Blind Pedestrian's Access to Complex Intersections
Sponsoring Agency: NIH
Date Submitted: January 2006
Amount: 1,324,965
PI and Co-PIs: D. Ashmead (PI), R. E. Bodenheimer, D.W. Grantham
Role: This proposal improves methods for the design of traffic intersections for use by visually impaired persons. My role is to develop desktop and immersive virtual reality technology and scenarios to investigate time-to-contact

estimation and discrimination abilities in people with both normal and impaired vision. This grant is a full grant that was granted the seed money described above.
Outcome: Pending (Priority Score: 154; NIH has requested a revised budget but is currently operating on a continuing resolution and cannot make an award until their fiscal year budget is approved)

Title: Robot Behavior Acquisition
Sponsoring Agency: NASA
Date Submitted: August 2006
Amount: 200,000
PI and Co-PIs: R. A. Peters II (PI), R. E. Bodenheimer
Role: This proposal seeks to automatically generate complex behaviors for humanoid robots.
Outcome: Pending (We have been informed this proposal will be supported pending approval of budget for NASA)

Title: Geometric Animation: A Manifold Approach to the Analysis and Synthesis of Human Motion
Sponsoring Agency: NSF
Date Submitted: October 2006
Amount: 342,072
PI and Co-PIs: R. E. Bodenheimer (PI)
Role: This proposal is a resubmission and applies modeling machinery to the analysis and synthesis of animation data.
Outcome: Pending

Title: HCC: Design and Evaluation of Spatially Aware Interfaces into Virtual Environments
Sponsoring Agency: NSF
Date Submitted: November 2006
Amount: 877,214
PI and Co-PIs: R. E. Bodenheimer (PI), T. Carr, T. McNamara, G. Narasimham, J. Rieser (co-PIs)
Role: I am the PI on a proposal that seeks to develop and evaluate interfaces for virtual environments that provide better spatial awareness and allow reasonable skill transfer to the physical world.
Outcome: Pending

Pending Internal Proposals

Title: Motion Analysis to Assess Surgical Treatment of Movement Disorders
Sponsoring Agency: Discovery Grant
Date Submitted: November 2006
Amount: 64,471
PI and Co-PIs: R. E. Bodenheimer (PI), B. Dawant, J. Neimat (co-PIs)
Role: I am the PI on this proposal seeking preliminary results using motion analysis to quantify surgical treatment of movement disorders for use in computer-assisted surgical planning.
Outcome: Pending

Summary of Support for Myself and Graduate Students

	2002	2003		2004		2005		2006
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Offset	10%	20%	25%	15%	5%	5%	10%	15%
Students	1	3	3	2	2	2	2	3

Proposals Submitted but not Funded

Title: Geometric Animation: A Manifold Approach to the Analysis and Synthesis of Human Motion
Potential Sponsoring Agency: NSF
Date Submitted: June 2005

Amount Requested: $218,729
PIs and Co-PIs: B. Bodenheimer (PI), C. Grimm (Wash. Univ. St. Louis), R. Pless (Wash. Univ. St. Louis)
Role: PI on proposal to apply modeling machinery to the analysis and synthesis of animation data.
Outcome: Not funded, resubmitted.

Title: Blind Pedestrian's Access to Complex Intersections
Sponsoring Agency: NIH
Date Submitted: January 2005
Amount: 1,215,073
PI and Co-PIs: D. Ashmead (PI), R. E. Bodenheimer, K. Frampton, D. W. Grantham
Role: My role is to develop desktop and immersive virtual reality technology and scenarios to investigate time-to-contact estimation and discrimination abilities in people with both normal and impaired vision.
Outcome: Not funded, but extended a seed grant to develop pilot data; resubmitted and pending.

Title: Broadening the Professional Exposure of Graduate Students for Research on Learning in Virtual Environments
Potential Sponsoring Agency: Vanderbilt Enhancing Graduate Education Grant
Date Submitted: December 2004
Amount Requested: $60,000
PIs and Co-PIs: B. Bodenheimer (PI), D. Ashmead, T. McNamara, J. Rieser
Role: My role as PI was to implement the cross-disciplinary program.
Outcome: Not funded.

Title: Applications of Dexterous Manipulation for Human-Robot Interaction and Cognition
Potential Sponsoring Agency: Vanderbilt Discovery Grant
Date Submitted: November 2004
Amount Requested: $100,000
PIs and Co-PIs: B. Bodenheimer (PI), J. A. Adams, R. Hall, K. Kawamura, D. Levin, D. Noelle, R. A. Peters II, M. Saylor, N. Sarkar, M. Wilkes
Role: My role was PI and to look at interactions of virtual humans and robots.
Outcome: Not funded.

Title: Improving Human-Robot Teams through Ethnographic Analysis
Potential Sponsoring Agency: NASA
Date Submitted: September 2003
Amount Requested: $760,404
PIs and Co-PIs: B. Bodenheimer (PI), J. A. Adams, D. Noelle, R. Hall
Role: PI on proposal to improve NASA's extravehicular activity by analyzing ethnographically how astronauts train for such missions.
Outcome: Not funded.

Title: Improving Deep-Brain Stimulation for Parkinson's Disease
Potential Sponsoring Agency: NIH
Date Submitted: June 2003
Amount Requested: $1,510,000
PIs and Co-PIs: B. Dawant (PI), M. Fitzpatrick, B. Bodenheimer, P. Konrad, C. Kao, D. Charles
Role: My role is in the visualization of a medical atlas for deep-brain stimulator placement and is more fully described in the resubmitted proposal above.
Outcome: Not funded; a resubmission was successful (see above)

Title: IIS: Improving Human-Robot Teams through Ethnographic Analysis
Potential Sponsoring Agency: NSF
Date Submitted: March 2003
Amount Requested: $507,000
PIs and Co-PIs: B. Bodenheimer (PI), J. A. Adams, D. Noelle, R. Hall

Role: This project would have examined several activities in which robots and humans interact with the goal of identifying key cognitive mechanisms that could be leveraged in improved interfaces between humans and robots. We narrowed the proposal and submitted part of it to NASA.
Outcome: Not funded.

Title: SNR: Robust Networking for Reality-based Simulations
Potential Sponsoring Agency: NSF
Date Submitted: February 2002
Amount Requested: $691,000
PIs and Co-PIs: J. Fritz Barnes (PI) and B. Bodenheimer
Role: Responsible for the reality-based simulations, and assessment thereof, for this project.
Outcome: Not funded.

Title: ITR: Composable Adaptive Learning Environments(CALE): Support for Quality, Convergence, and Adaptability
Potential Sponsoring Agency: NSF
Date Submitted: April 2002
Amount Requested: $10,796,382
PIs and Co-PIs: G. Biswas, B. Bodenheimer, J. Bransford (PI), S. Brophy, J. Gordon, L. Howard, N. Vye, B. Weiner
Role: Responsible for developing meta-modeling techniques that can construct robust and compelling animated behaviors which integrate with simulation and reasoning processes developed by Dr. Biswas. Combined, these will create robust animated agents for use in the application domain of this proposal, mass casualty education.
Outcome: Not funded.

Title: CAREER: Implementing and Assessing Human Figure Animation in Educational Agents.
Potential Sponsoring Agency: NSF
Date Submitted: July 2001
Amount Requested: $352,000
PIs and Co-PIs: B. Bodenheimer
Role: Principle Investigator, responsible for the entire project
Outcome: Resubmitted successfully.

Title: ITR/PE: Visual Thinkers: Teachable Agents that Improve Communication, Learning, and Assessment.
Potential Sponsoring Agency: NSF
Date Submitted: April 2001
Amount Requested: $1,200,000
PIs and Co-PIs: G. Biswas, B. Bodenheimer, J. Bransford (PI), D. Schwartz, X. Lin, N. Vye
Role: This project was to design and assess teachable agents in a more animated, and multi-user environment. The research questions I would have addressed were how to build and evaluate compelling animated agents for use in this environment.
Outcome: Not funded.

Title: ITR/SY: Fault Diagnosis of Embedded Hybrid Systems
Potential Sponsoring Agency: NSF
Date Submitted: January 2001
Amount Requested: $400,000
PIs and Co-PIs: G. Biswas (PI), B. Bodenheimer, V. Raghavan
Role: Responsible for visualization component for the embedded hybrid systems, as an aid to performance evaluation and faster fault diagnosis.
Outcome: Not funded.

Title: ITR/SY: Hybrid Models for the Representation, Analysis, and Generation of Embedded Systems.
Potential Sponsoring Agency: NSF
Date Submitted: January 2001
Amount Requested: $400,000

PIs and Co-PIs: G. Biswas, B. Bodenheimer, G. Karsai (PI), V. Raghavan
Role: My role would have been the same as in the previous project, except that the visualization would have been used to primarily measure and analyze performance of embedded systems.
Outcome: Not funded.

NATIONAL AND INTERNATIONAL SERVICE

Program Committees

2002,'03,'04, '05	Symposium on Computer Animation
2002	International Conference on 3D Web Technology
1998	Eurographics Workshop on Computer Animation and Simulation

Journal and Conference Reviewing

ACM Transactions on Graphics
SIGGRAPH
ACM Transactions on Applied Perception
IEEE Transactions on Robotics
IEEE Transactions on Automatic Control
Perception and Psychophysics
Computer Graphics Forum
Automatica
Neural Computation
Graphical Models
American Control Conference
Eurographics
Eurographics Workshop on Computer Animation and Simulation
Interactive 3D Graphics Symposium on Computer Animation
Web 3D Symposium

Conference Organization and Responsibilities

2006	Chair, Midwest Graphics Workshop (MidGraph)
2006	Session Chair, Applied Perception in Graphics and Visualization
2003	Co-Founder and co-chair (with C. Grimm), Midwest Graphics Workshop
2002,'03	Session Chair, Symposium on Computer Animation
1995	Session Chair, Conference on Decision and Control

Review Panels

National Science Foundation (2003, 2004, 2005, 2006)
National Endowment for the Humanities (2003, 2004)

INTRAMURAL SERVICE

School

Search Committee for Electrical Engineering and Computer Science (2001-2002,2002-2003)
CAREER Preparation Workshop (2003-present)
Freshman Year Evaluation Committee (2002-2003)
School Open House participant (2001-present)
Laptop Committee (2000-present)
ABET Fulfillment Committee for Electrical Engineering and Computer Engineering (2001)

Department

Computer Science Undergraduate Curriculum Committee (2006-present)
Computer Science Graduate Program Committee (2003-2005)
Programming Languages Evaluation Committee (2001-2002)
Development of Departmental Web Page (2001-present)
Advisor for the Computer Science Class of 2005

THESES AND STUDENT SUPERVISION

Publications with students, if any, are shown in parenthesis.

Primary Advisor - Thesis

L. Elizabeth Williams	Ph.D.	2007 (ant.)	Navigating Large Virtual Environments in Small Physical Spaces (J3,J6,S3, S4,C6,C9,P1,P5,P7,P8)
Christina de Juan	Ph.D.	2006	Cartoon Textures: Re-Using Traditional Animation via Methods for Segmentation, Re-Sequencing, and Inbetweening (C4,C11). Currently at DreamWorks.
Jing Wang	Ph.D.	2005	Synthesizing and Evaluating Data-Driven Motion Transitions (S2,C12,C16,P6). Currently at the University of South Florida.
A. Elizabeth Seward	M.S.	2006 (ant.)	Time-to-Contact Estimation for Street Crossing (C10,C5)

Graduate Student Supervision

Jingjing Meng	2004-2006	Jingjing was a non-thesis M.S. student. She did research with me on distance estimation in virtual environments. (P2)
Paul Bielaczyc	2002-2004	Paul was a non-thesis M.S. student and did research with me on automatic lighting of scenes.
Zhihua Chen	2002-2004	Zhihua did research with me for two years, but then changed into bioinformatics research. (J7,C15,C17)
Chen Zhou	2003	Academic advisor, although she participated in some research with me. (C20)

Committee Member/Second Reader

Xia Li	Ph.D.	2007 (ant.)	Inter-modal Registration of Whole-Body Animal Image Data
Ramya Balachandran	Ph.D.	2007 (ant.)	Improving the Accuracy of Tracked Fiducial Systems
Yong Zhu	Ph.D.	2006	Impedance Control of a Pneumatic Actuator for Contact Tasks (Mech. Engr.)
Yuliya Babenko	Ph.D.	2006	On the Asymptotic Behavior of the Optimal Error of Spline Interpolation of Multivariate Functions (Math.)
Xiangrong Shen	Ph.D.	2006	Exploiting Natural Characteristics of Pneumatic Servo-Actuation Through Multi-Input Control (Mech. Engr.)
Navneet Gulati	Ph.D.	2005	Modeling and Observer-based Robust Control Design for Energy-Dense Monopropellant Powered Actuators (Mech. Engr.)
Zhujiang Cao	Ph.D.	2005	Segmentation of Medical Images (Bio. Engr.)
Tatyana Sorokina	Ph.D.	2005	Quintic Splines on Type-4 Tetrahedral Projections (Math.)
Krittaya Leelawong	Ph.D.	2005	A Learning-by-Teaching Environment for Learning Complex Scientific Domains: A Teachable Agent Project
Duane Yoder	Ph.D.	2003	Distortion Correction of MR Echo Planar Images
Natasha Balac	Ph.D.	2002	Learning Action Models for Navigation in Noisy Environments
Sriram Narasimhan	Ph.D.	2002	Model-based Diagnosis of Hybrid Dynamical Systems
Katherine Achim	M.S.	2005	Image Mapping and Attention on the Sensory Ego-Sphere
Trenton E. Kriete	M.S.	2005	Impaired Cognitive Flexibility and Intact Cognitive Control in Autism: A Computational Cognitive Neuroscience Approach
Christina L. Campbell	M.S.	2003	Superposition of Behaviors Learned through Teleoperation
Shuanglin Wang	M.S.	2001	A Case Study in Repeated Maintenance

Other Graduate Student Supervision

Graham Hemingway	2006	Independent study on manifold structure of human animation
Shan Xiong	2001	Independent study in advanced ray-tracing methods.

Undergraduate Student Project Supervision

Michael Andereck	2006	Independent Study (CS 240): Dynamical Simulation using the Maya Dynamics Engine
Jonathan Waite	2005	VUSRP: Dynamic Lighting Design with Digital Photography (also independent study, Fall 2005) (J2)
Timothy Rapp	2005	Independent Study (CS 240): Nonphotorealistic Rendering: Multiple Perspectives in a Single Scene
A. Elizabeth Seward	2004	VUSRP: Using Nonlinear Dimensionality Reduction for Human Figure Animation (also independent study, Fall 2004) (C10)
Jason Tan	2003	Independent Study (CS 240): Construction of Learning Tasks for Immersive Virtual Environments
Gerard Raiti	2003	Independent Study (CS 240): Can biologic motion be generalized to non-human characters?
Justin Harmon	2003	Independent Study (CS 240): Graphical design of a networked Stratego game
Mattie R. Kramer	2003	Vanderbilt Undergraduate Summer Research Program (VUSRP): Using Isomap to Animate Pedagogical Agents (also independent studies, Fall 2003 and Spring 2004) (S3,C13)
Reed Wotiz	2001	Independent study in advanced methods of computer animation: production, rendering, and sound techniques
Drew Blackard	2001	Independent study in advanced methods of computer animation: production, rendering, and sound techniques

ACADEMIC RESPONSIBILITIES

Course numbering reflects curricular changes approved by the School of Engineering faculty. Courses may have actually appeared as, for example, CS 292 instead of CS 259. Enrollment in shown in parenthesis beside the year the course was taught.

Courses Taught

Course Number	Course Title	Fall	Spring
CS 258 (291)	Introduction to Computer Graphics	2001 (18), '02 (14), '03 (11), '04 (16), '05 (16) '06 (19)	
CS 259 (292)	Introduction to Computer Animation		2001 (39), '03 (37), '04 (33), '05 (25), '06 (10)
CS 351 (396)	Advanced Animation Seminar		2002 (8), '05 (3)
CS 352 (395)	Human-Computer Interaction	2002 (10), '03 (13)	
CS 395	Seminar on Computer Graphics	2000 (19)	
CS 396	Advanced Topics in Graphics and Image Processing		2006 (18)
EECE 225/Psy 236	The Visual System (Lecturer)		2001, '02, '03, '04 (27), '05 (25), '06 (31)

Curriculum Development and Educational Innovations

CS258/CS395	I develeped both of these courses; CS395 was a graduate version, although in its current manifestation graduate students can now take CS258 by completing extra assignments. This course is an intensive programming course teaching the fundamentals of computer graphics. For several years, there was no adequate textbook that covers these topics in the detail that I go into, so I developed an extensive set of course notes. These notes now supplement a textbook. There are five projects, also of my own construction.
CS259/CS292	This course is also a new course that I developed. It is a large, group project-based course in which students are taught the fundamentals of computer animation. Since CS258 is not a prerequisite for the course, there is some duplication of material in the course, but common topics are covered in more depth in CS258. There is no adequate textbook for the material that I cover, so I developed an extensive set of course notes.
CS351/CS396	This course is an advanced seminar on computer graphics and animation, for graduate students with some maturity or background in computer graphics, and especially for those intending to do research in the area (or a related one, such as image processing). The latest developments in the field are discussed, and the students implement some of them as a project. Because of the nature of the course, there is no textbook for this course. A set of approximately 25 papers is covered, with lectures to provide an introduction to some of the underlying principles used in the papers.
CS352/CS395	This course is a new course that I developed and is a graduate level course on introductory human-computer interaction (HCI). A number of papers are presented in the course, from seminal papers in the field to latest results. The course is a combination of lecture and seminar format, and involves a semester long project involving some novel application of HCI techniques. Some of these projects have been published in peer-reviewed conferences.
CS396	I developed this graduate seminar on advanced topics in Image Processing and Graphics. We studied 24 papers covering novel and leading tools in both specialties, such as high dynamic range imaging, perception in graphics and animation, quaternions, level sets, support vector machines and manifold learning.
EECE225	This interdisciplinary course is made up of lectures given by specialists on various aspects of the visual system. I am one of several lecturers and lecture on the impact the visual system has on the theory, design, and implementation of computer graphics, and vice versa.