

CURRICULUM VITA – DOUG A. BOWMAN

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APPOINTMENTS

Associate Professor of Computer Science, Virginia Polytechnic Institute and State University
(2005-present)

Visiting Researcher in Computer Science, University of California, Santa Barbara (August 2008 –
July 2009)

Assistant Professor of Computer Science, Virginia Polytechnic Institute and State University
(1999-2005)

EDUCATION**Ph.D., Computer Science, Georgia Institute of Technology, August 1999**

- Thesis Title: “Interaction Techniques for Immersive Virtual Environments: Design, Evaluation, and Application”
- Thesis Advisor: Dr. Larry F. Hodges, Georgia Institute of Technology
- Thesis Committee: Dr. Jarek Rossignac, Dr. Albert N. Badre, Dr. Gregory Abowd, Dr. Elizabeth T. Davis

M.S., Computer Science, Georgia Institute of Technology, 1997**B.S., Mathematics and Computer Science, Emory University, 1994**

- Graduated summa cum laude
- Honors Thesis Title: “Performance Analysis of the Conch Concurrent Computing System”

HONORS AND AWARDS

- IEEE Computer Society Distinguished Service Award, for service as the General Chair of the IEEE Virtual Reality Conference, 2008
- Best Short Paper Award, ACM Symposium on Virtual Reality Software and Technology, 2007, for the paper “The Benefits of Immersion for Spatial Understanding of Complex Underground Cave Systems” (with Philip Schuchardt)
- Faculty Fellow, College of Engineering, Virginia Tech, 2005-2007
- Virginia Tech Researcher of the Week, June 16-20, 2003
- National Science Foundation CAREER award, 2003-2008
- Graduate Fellow, National Science Foundation, 1994-1997
- President’s Fellowship, Georgia Institute of Technology, 1994-1998

- Senior thesis received highest honors, Emory University, 1994
- Member, Phi Beta Kappa
- Woodruff Scholar, Emory University, 1990-1994
- Dean's List, Emory University, each semester 1990-1994

RESEARCH INTERESTS

- Three-dimensional (3D) user interfaces
- 3D interaction techniques
- Virtual environments (VEs), virtual reality (VR)
- The benefits of immersion
- Usability evaluation
- Human-computer interaction (HCI)
- Computer graphics
- Application domains: architecture, construction, structural engineering, civil engineering, mining, gerontology, psychotherapy, bioinformatics

FUNDED RESEARCH

- Evaluating the Effects of Immersion on Naval Training Applications. 8/09 – 7/12. Sole PI for Virginia Tech portion, with Tobias Höllerer (UCSB). Funded by the Office of Naval Research. \$1,160,886 (Virginia Tech portion \$509,814). Responsible for 100% of Virginia Tech portion.
- Development of Trauma Surgery Simulation Software. 1/07-12/07. Co-PI with Jeannette Capella (Carilion), Sydney Vail (Carilion), Donnelle Crouse (Carilion), Carol Gilbert (Carilion), Francis Quek (CS), and Dennis Kafura (CS). Funded by the Carilion Clinic, with matching funds from ICTAS and IBPHYS. \$60,000. Responsible for 33%.
- CRI: Interfaces for the Embodied Mind. 3/06-3/08. Co-PI with Francis Quek (PI, CS), Woodrow Winchester (ISE), Yingen Xiong (CS), and Deborah Tatar (CS). Funded by the National Science Foundation Computing Research Infrastructure Program. \$400,000. Responsible for 20%.
- CRI: Versatile 3D Imaging and Visualization System. 3/06-2/08. Co-PI with Marte Gutierrez (PI, CEE), Julio Martinez (CEE), and Conrad Heatwole (BSE). Funded by the National Science Foundation Computing Research Infrastructure Program. \$162,571. Responsible for 20%.
- 3D Interaction and Information-Rich Virtual Environments for Building Security Visualization. 1/06-12/08. Sole PI. Funded by the Robert Bosch Research and Technology Center. \$140,869. Responsible for 100%.
- Use of a Virtual Environment to Assess Real World Abilities in Older Adults Experiencing Memory Loss. 6/05-5/06. Co-PI with Karen Roberto (PI, Gerontology), Paul Diamond (UVa Medical School) and Mark Conaway (UVa Medical School). Funded by the Carilion Biomedical Institute. \$29,760. Responsible for 52%.
- Virtual Environment Applications to Improve Mining Health and Safety Training. 6/05-5/08. Co-PI with Michael Karmis (PI, VCCER), Walid Thabet (BC), and Antonio Nieto (MinE).

Funded by the National Institute of Occupational Safety and Health (NIOSH). \$640,501. Responsible for 25%.

- Towards Boundless Display: Developing a Reconfigurable Research Testbed for Large-Scale, High-Resolution Visual Displays. 9/04-8/06. Co-PI with Chris North (PI), Steve Harrison, and Roger Ehrich (CS). Funded by the National Science Foundation Research Resources Program. \$230,067. Responsible for 25%.
- VEWL Usability Evaluation. 7/04-12/04. Sole PI. Funded by OpenTech, Inc. (sub-award of NIST grant). \$6411. Responsible for 100%.
- ITR: Adaptive and Real-Time Geologic Mapping, Analysis, and Design of Underground Space (AMADEUS). 9/03-8/07. Co-PI with Marte Gutierrez (PI), Matthew Mauldon, Joe Dove (CEE), and Erik Westman (MinE). Funded by the National Science Foundation Information Technology Research (ITR) program. \$1,067,116. Responsible for 16%.
- CAREER: Domain-Specific 3D Interaction Techniques for Design and Construction tasks in Immersive Virtual Environments. 3/2003-2/2008. Sole PI. Funded by the National Science Foundation CAREER program. \$500,000. Responsible for 100%.
- Interactive Virtual Environments for Science and Engineering Education. 6/2002-5/2003. PI. Co-PIs were Mehdi Setareh (Arch.) and Srinidhi Varadarajan (CS). Funded by National Science Foundation Course Curriculum and Laboratory Improvement (CCLI) program. \$74,824. Responsible for 100%.
- Evaluating the Effectiveness of Virtual Environments for Decision Support in Construction Planning. 6/2002-5/2003. Co-PI with Walid Thabet (PI, BC). Funded by Virginia Tech ASPIRES program. \$56,500. Responsible for 50%.
- Virtual Reality Exposure to Treat Phobias in Children and Adolescents. 6/2002-5/2003. Co-PI with Thomas Ollendick (PI) and Alison Shortt (Psychology). Funded by Virginia Tech ASPIRES program. \$38,490. Responsible for 50%.
- Multi-Parametric Data Visualization on Workstation Clusters. 7/2001-12/2002. Co-PI with Srinidhi Varadarajan (PI, CS) and Ron Kriz (ESM). Funded by the Institute for Software Research. \$101,001. Not directly responsible for any funds.

PUBLICATIONS

Books and Monographs:

1. **Bowman, D.**, Kruijff, E., LaViola, J., and Poupyrev, I. *3D User Interfaces: Theory and Practice*. Addison-Wesley, Boston, 2005. (Also translated to Japanese and Chinese)

Book Chapters:

1. Thabet, W., Shiratuddin, M., and **Bowman, D.** Virtual Reality in Construction: A Review. In Topping, B. and Bittnar, Z. (Eds.), *Engineering Computational Technology*, Saxe-Coburg, Stirling, Scotland, 2002, pp. 25-52.
2. **Bowman, D.** Principles for the Design of Performance-Oriented Interaction Techniques. In Stanney, K. (Ed.). *Handbook of Virtual Environments*, Lawrence Erlbaum, Mahwah, New Jersey, 2002, pp. 277-300.
3. **Bowman, D.** Conceptual Design Space: Beyond Walk-through to Immersive Design. In Bertol, D. *Designing Digital Space: An Architect's Guide to Virtual Reality*. John Wiley & Sons, New York, 1996, pp. 225-236.

Edited Books and Proceedings:

1. Fröhlich, B., **Bowman, D.**, and Iwata, H. (eds.). Proceedings of the IEEE Virtual Reality Conference, 2006.
2. Kitamura, Y., **Bowman, D.**, Fröhlich, B., and Stürzlinger, W. (eds.). Proceedings of the IEEE Symposium on 3D User Interfaces, 2006.
3. **Bowman, D.**, Fröhlich, B., Kitamura, Y., and Stürzlinger, W. (eds.). New Directions in 3D User Interfaces. Shaker-Verlag, 2005.
4. Thabet, W. and **Bowman, D.** (eds.). Proceedings of the Conference on Construction Applications of Virtual Reality, 2003.

Guest-Edited Special Issues:

1. Fröhlich, B. and **Bowman, D.** Guest Editors' Introduction: 3D User Interfaces. *IEEE Computer Graphics & Applications*, vol. 29, no. 6, November/December 2009, pp. 24-25.
2. **Bowman, D.**, Fröhlich, B., Kitamura, Y., and Stürzlinger, W. Current Trends in 3D User Interface Research. Introduction to Special Section on 3D User Interfaces. *International Journal of Human-Computer Studies*, vol. 67, no. 3, 2009, pp. 223-224.
3. Fröhlich, B., **Bowman, D.**, and Iwata, H. Guest Editors' Introduction: Special Section on Virtual Reality. *IEEE Transactions on Visualization and Computer Graphics*, vol. 13, no. 3, 2007, pp. 420-421.
4. **Bowman, D.** and Billinghamurst, M. Special Issue on 3D Interaction in Virtual and Mixed Realities: Guest Editors' Introduction. *Virtual Reality*, vol. 6, no. 3, 2002, pp. 105-106.

Dissertation and Thesis:

1. **Bowman, D.** Interaction Techniques for Common Tasks in Immersive Virtual Environments: Design, Evaluation, and Application. Ph.D. dissertation, Georgia Institute of Technology, 1999.
2. **Bowman, D.** Performance Analysis of the Conch Concurrent Computing System. Undergraduate honors thesis, Emory University Department of Mathematics and Computer Science, 1994.

Refereed Journals:

1. Pinho, M., **Bowman, D.**, and Freitas, C. Cooperative Object Manipulation in Collaborative Virtual Environments. To appear in *Journal of the Brazilian Computer Society*, 2009.
2. **Bowman, D.**, Coquillart, S., Fröhlich, B., Hirose, M., Kitamura, Y., Kiyokawa, K., and Stürzlinger, W. 3D User Interfaces: New Directions and Perspectives. *IEEE Computer Graphics & Applications*, vol. 28, no. 6, Nov/Dec 2008, pp. 20-36.
3. Wang, Y., **Bowman, D.**, Krum, D., Coelho, E., Smith-Jackson, T., Bailey, D., Peck, S., Anand, S., Kennedy, T., and Abdrzakov, Y. Effects of Video Placement and Spatial Context Presentation on Path Reconstruction Tasks with Contextualized Videos. *IEEE Transactions on Visualization and Computer Graphics* (Proceedings of IEEE Visualization), vol. 14, no. 6, Nov/Dec 2008, pp. 1755-1762.
4. Wang, Y., Krum, D., Coelho, E., and **Bowman, D.** Contextualized Videos: Combining Videos with Environment Models to Support Situational Understanding. *IEEE Transactions on Visualization and Computer Graphics* (Proceedings of IEEE Visualization), vol. 13, no. 6, Nov/Dec 2007, pp. 1568-1575.

5. **Bowman, D.** and McMahan, R. Virtual Reality: How Much Immersion is Enough? *IEEE Computer*, vol. 40, no. 7, 2007, pp. 36-43.
6. Wang, Y, Otitoju, K., Liu, T., Kim, S., and **Bowman, D.** The Effect of Gaps Between Displays on Spatial Perception and Cognition Tasks in Virtual Environments. *International Journal of Virtual Reality*, vol. 6, no. 2, 2007, pp. 33-41. (Extended version of VRST 2006 paper)
7. Polys, N., Kim, S., and **Bowman, D.** Effects of Information Layout, Screen Size, and Field of View on User Performance in Information-Rich Virtual Environments. *Computer Animation and Virtual Worlds*, vol. 18, no. 1, 2007, pp. 19-38. (Extended version of VRST 2005 paper)
8. **Bowman, D.**, Chen, J., Wingrave, C., Lucas, J., Ray, A., Polys, N., Li, Q., Haciahmetoglu, Y., Kim, J., Kim, S., Boehringer, R., and Ni, T. New Directions in 3D User Interfaces. *International Journal of Virtual Reality*, vol. 5, no. 2, 2006, pp. 3-14.
9. Schafer, W. and **Bowman, D.** Supporting Distributed Spatial Collaboration: An Investigation of Navigation and Radar View Techniques. *Geoinformatica*, vol. 10, no. 2, 2006, pp. 123-158.
10. Setareh, M., **Bowman, D.**, and Kalita, A. Development of a Virtual Reality Structural Analysis System. *Journal of Architectural Engineering*, vol. 11, no. 4, 2005, pp. 156-164.
11. Setareh, M., **Bowman, D.**, Kalita, A., Gracey, M., and Lucas, J. Application of a Virtual Environment System in Building Sciences Education. *Journal of Architectural Engineering*, vol. 11, no. 4, 2005, pp. 165-172.
12. Polys, N. and **Bowman, D.** Design and Display of Enhancing Information in Desktop Information-Rich Virtual Environments: Challenges and Techniques. *Virtual Reality*, vol. 8, no. 1, 2004, pp. 41-54.
13. Schafer, W. and **Bowman, D.** Evaluating the Effects of Frames of Reference on Spatial Collaboration in Desktop Virtual Environments. *Virtual Reality*, vol. 7, nos. 3-4, 2004, pp. 164-174.
14. **Bowman, D.**, Wingrave, C., Campbell, J., Ly, V., and Rhoton, C. Novel Uses of Pinch Gloves™ for Virtual Environment Interaction Techniques. *Virtual Reality*, vol. 6, no. 3 2002, pp. 122-129.
15. Setareh, M. and **Bowman, D.** Application of Virtual Environments for the Study of Building Structures Subjected to Earthquake Excitations. *International Journal of Design Computing*, vol. 5, 2002.
16. **Bowman, D.**, Gabbard, J., and Hix, D. A Survey of Usability Evaluation in Virtual Environments: Classification and Comparison of Methods. *Presence: Teleoperators and Virtual Environments*, vol. 11, no. 4, 2002, pp. 404-424.
17. Terriberry, T., Cox, D., and **Bowman, D.** A Tool for the Interactive 3D Visualization of Electronic Structure in Molecules and Solids. *Computers and Chemistry*, vol. 26, no. 4, pp. 313-319, 2002.
18. Broll, W., Schaefer, L., Hoellerer, T., and **Bowman, D.** Interface with Angels: The Future of VR and AR Interfaces. *IEEE Computer Graphics & Applications*, vol. 21, no. 6, pp. 14-17, 2001.
19. **Bowman, D.**, Johnson, D., and Hodges, L. Testbed Evaluation of Immersive Virtual Environments. *Presence: Teleoperators and Virtual Environments*, vol. 10, no. 1, 2001, pp. 75-95.
20. **Bowman, D.**, Kruijff, E., LaViola, J., and Poupyrev, I. An Introduction to 3D User Interface Design. *Presence: Teleoperators and Virtual Environments*, vol. 10, no. 1, 2001, pp. 96-108.

21. Kessler, G., **Bowman, D.**, and Hodges, L. The Simple Virtual Environment Library: An Extensible Framework for Building VE Applications. *Presence: Teleoperators and Virtual Environments*, vol. 9, no. 2, 2000, pp. 187-208.
22. **Bowman, D.**, Davis, E., Badre, A., and Hodges, L. Maintaining Spatial Orientation during Travel in an Immersive Virtual Environment. *Presence: Teleoperators and Virtual Environments*, vol. 8, no.6, 1999, pp. 618-631.
23. **Bowman, D.** Wineman, J., Hodges, L., and Allison, D. The Educational Value of an Information-Rich Virtual Environment. *Presence: Teleoperators and Virtual Environments*, vol. 8, no. 3, June 1999, pp. 317-331.
24. **Bowman, D.** and Hodges, L. Formalizing the Design, Evaluation, and Application of Interaction Techniques for Immersive Virtual Environments. *Journal of Visual Languages and Computing*, vol. 10, no. 1, February 1999, pp. 37-53.
25. **Bowman, D.**, Wineman, J., Hodges, L., and Allison, D. Designing Animal Habitats Within an Immersive VE. *IEEE Computer Graphics and Applications*, vol. 18, no. 5, September/October 1998, pp. 9-13.
26. **Bowman, D.**, Hodges, L., and Bolter, J. The Virtual Venue: User-Computer Interaction in Information-Rich Virtual Environments. *Presence: Teleoperators and Virtual Environments*, vol. 7, no. 5, 1998, pp. 478-493.
27. **Bowman, D.**, Koller, D., and Hodges, L. A Methodology for the Evaluation of Travel Techniques for Immersive Virtual Environments. *Virtual Reality: Research, Development, and Applications*, vol. 3, no. 2, 1998, pp. 120-131.
28. **Bowman, D.** and Hodges, L. Toolsets for the Development of Highly Interactive and Information-Rich Virtual Environments. *The International Journal of Virtual Reality*, vol. 3, no. 2, 1997, pp. 12-20.
29. Allison, D., Wills, B., **Bowman, D.**, Wineman, J., and Hodges, L. The Virtual Reality Gorilla Exhibit. *IEEE Computer Graphics and Applications*, vol. 17, no. 6, November/December 1997, pp. 30-38.

Refereed Conference Proceedings:

1. **Bowman, D.**, Sowndararajan, A., Ragan, E., and Kopper, R. Higher Levels of Immersion Improve Procedure Memorization Performance. To appear in *Proceedings of the Joint Virtual Reality Conference*, 2009.
2. Ventura, J., Jang, M., Crain, T., **Bowman, D.**, and Höllerer, T. Evaluating the Effects of Tracker Reliability and Field of View on a Target Following Task in Augmented Reality. To appear in *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2009.
3. Bacim, F., **Bowman, D.**, and Pinho, M. Wayfinding Techniques for MultiScale Virtual Environments. *Proceedings of the IEEE Symposium on 3D User Interfaces*, 2009, pp. 67-74.
4. Peck, S., North, C., and **Bowman, D.** A Multiscale Interaction Technique for Large, High-Resolution Displays. *Proceedings of the IEEE Symposium on 3D User Interfaces*, 2009, pp. 31-38.
5. McMahan, R., **Bowman, D.**, Schafrik, S., and Karmis, M. Virtual Environment Training for Preshift Inspection of Haul Trucks to Improve Mining Safety. *Proceedings of the First International Future Mining Conference*, 2008, pp. 167-173.
6. Lucas, J., McMahan, R., Engle, R., **Bowman, D.**, Thabet, W., Schafrik, S., and Karmis, M. Improving Mining Health and Safety Through Conveyor System Training in a Virtual

- Environment. *Proceedings of the First International Future Mining Conference*, 2008, pp. 161-166.
7. Wilkes, C. and **Bowman, D.** Advantages of Velocity-Based Scaling for Distant 3D Manipulation. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2008, pp. 23-29.
 8. Sowndararajan, A., Wang, R., and **Bowman, D.** Quantifying the Benefits of Immersion for Procedural Training. *Proceedings of the ACM SIGGRAPH Workshop on Emerging Display Technologies and Immersive Projection Technologies*, 2008, 4 pages.
 9. Ni, T., McMahan, R., and **Bowman, D.** Tech-note: rapMenu: Remote Menu Selection using Freehand Gestural Input. *Proceedings of the IEEE Symposium on 3D User Interfaces*, 2008, pp. 55-58.
 10. Wingrave, C. and **Bowman, D.** Tiered Developer-Centric Representations for 3D Interfaces: Concept-Oriented Design in Chasm. *Proceedings of IEEE Virtual Reality*, 2008, pp. 193-200.
 11. **Bowman, D.** and Schuchardt, P. The Benefits of Immersion for Spatial Understanding of Complex Underground Cave Systems. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2007, pp. 121-124. (Winner of Best Short Paper Award)
 12. Ray, A. and **Bowman, D.** Towards a System for Reusable 3D Interaction Techniques. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2007, pp. 187-190.
 13. **Bowman, D.**, Badillo, B., and Manek, D. Evaluating the Need for Display-Specific and Device-Specific 3D Interaction Techniques. *Proceedings of Virtual Reality International Conference (in Lecture Notes in Computer Science, vol. 4563)*, 2007, pp. 195-204.
 14. Ball, R., North, C., and **Bowman, D.** Move to Improve: Promoting Physical Navigation to Increase User Performance with Large Displays. In *CHI 2007 (Proceedings of the SIGCHI conference on Human Factors in computing systems)*, 2007, pp. 191-200.
 15. McMahan, R. and **Bowman, D.** An Empirical Comparison of Task Sequences for Immersive Virtual Environments. *Proceedings of the IEEE Symposium on 3D User Interfaces*, 2007, pp. 25-32.
 16. Wang, Y., Otitoju, K., Liu, T., Kim, S., and **Bowman, D.** Evaluating the Effect of Real World Distraction on User Performance in Virtual Environments. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2006, pp. 19-26.
 17. McMahan, R., Gorton, D., Gresock, J., McConnell, W., and **Bowman, D.** Separating the Effects of Level of Immersion and 3D Interaction Techniques. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2006, pp. 108-111.
 18. Ray, A., Decker, J., Vardakos, S., Murphy, M., **Bowman, D.**, Gutierrez, M., Mauldon, M., Dove, J. and Westman, E., A Virtual Environment for Visualizing Fractures During Tunneling. *Proceedings of the 41st U.S. Symposium on Rock Mechanics*, 2006, Paper No. 1104, 12 pages (CD-ROM proceedings).
 19. Ni, T., **Bowman, D.**, and Chen, J. Increased Display Size and Resolution Improve Task Performance in Information-Rich Virtual Environments. *Proceedings of Graphics Interface*, 2006, pp. 139-146.
 20. Wingrave, C., Haciahmetoglu, Y., and **Bowman, D.** Overcoming World in Miniature Limitations by a Scaled and Scrolling WIM. *Proceedings of the IEEE Symposium on 3D User Interfaces*, 2006, pp. 11-16.
 21. Chen, J. and **Bowman, D.** Effectiveness of Cloning Techniques for Architectural Virtual Environments. *Proceedings of IEEE Virtual Reality*, 2006, pp. 103-110.

22. Kopper, R., Ni, T., **Bowman, D.**, and Pinho, M. Design and Evaluation of Navigation Techniques for Multiscale Virtual Environments. *Proceedings of IEEE Virtual Reality*, 2006, pp. 175-182.
23. **Bowman, D.**, Ray, A., Gutierrez, M., Mauldon, M., Dove, J., Westman, E., and Setareh, M. Engineering in Three Dimensions: Immersive Virtual Environments, Interactivity, and 3D User Interfaces for Engineering Applications. Invited paper in the *Proceedings of ASCE GeoCongress*, 2006, 17 pages (CD-ROM proceedings).
24. Gutierrez, M., **Bowman, D.**, Dove, J., Mauldon, M., and Westman, E. Adaptive and Real-Time Geologic Mapping, Analysis, and Design of Underground Space (AMADEUS). *Proceedings of ASCE GeoCongress*, 2006, 6 pages (CD-ROM proceedings).
25. Decker, J., Antony, A., Ray, A., Vardakos, S., Murphy, M., Mauldon, M., Dove, J., Gutierrez, M., **Bowman, D.**, and Westman, E. An Integrated Relational Database for Tracking Rock Mass Data During Tunneling. *Safety in the Underground Space - Proceedings of the ITA-AITES 2006 World Tunnel Congress and 32nd ITA General Assembly*, 2006, 6 pages (CD-ROM proceedings). (Abstract available in *Tunneling and Underground Space Technology*, vol. 21, no. 3-4, May-July 2006, p. 429)
26. Schafer, W. and **Bowman, D.** Integrating 2D and 3D Views for Spatial Collaboration. *Proceedings of GROUP 2005*, 2005, pp. 41-50.
27. Polys, N., Kim, S., and **Bowman, D.** Effects of Information Layout, Screen Size, and Field of View on User Performance in Information-Rich Virtual Environments. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2005, pp. 46-55.
28. Narayan, M., Waugh, L., Zhang, X., Bafna, P., and **Bowman, D.** Quantifying the Benefits of Immersion for Collaboration in Virtual Environments. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2005, pp. 78-81.
29. **Bowman, D.**, Raja, D., Lucas, J., and Datey, A. Exploring the Benefits of Immersion for Information Visualization. *Proceedings of HCI International*, 2005, 10 pages (CD-ROM proceedings).
30. Wingrave, C. and **Bowman, D.** Baseline Factors for Raycasting Selection. *Proceedings of Virtual Reality International*, 2005, 10 pages (CD-ROM proceedings).
31. Lucas, J., Kim, J., and **Bowman, D.** Resizing Beyond Widgets: Object Resizing Techniques for Immersive Virtual Environments. *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)*, 2005, pp. 1601-1604.
32. Wingrave, C., Tintner, R., Walker, B., **Bowman, D.**, and Hodges, L. Exploring Individual Differences in Raybased Selection: Strategies and Traits. *Proceedings of IEEE Virtual Reality*, 2005, pp. 163-170.
33. Mackie, C., Cowden, J., **Bowman, D.**, and Thabet, W. Desktop and Immersive Tools for Residential Home Design. *Proceedings of CONVR Conference on Construction Applications of Virtual Reality*, 2004, pp. 63-70.
34. Shiratuddin, M., Thabet, W., and **Bowman, D.** Evaluating the Effectiveness of Virtual Environment Displays for Reviewing Construction 3D Models. *Proceedings of CONVR Conference on Construction Applications of Virtual Reality*, 2004, pp. 87-98.
35. Chen, J., **Bowman, D.**, Lucas, J., and Wingrave, C. Interfaces for Cloning in Immersive Virtual Environments. *Proceedings of the Eurographics Symposium on Virtual Environments*, 2004, pp. 91-98.

36. Raja, D., **Bowman, D.**, Lucas, J., and North, C. Exploring the Benefits of Immersion in Abstract Information Visualization. *Proceedings of the Immersive Projection Technology Workshop*, 2004, 7 pages (CD-ROM proceedings).
37. Polys, N., **Bowman, D.**, North, C., Laubenbacher, R., and Duca, K. PathSim Visualizer: an Information-Rich Virtual Environment Framework for Systems Biology. *Proceedings of ACM Web3D Symposium*, 2004, pp. 7-14.
38. Chen, J., Pyla, P., and **Bowman, D.** Testbed Evaluation of Navigation and Text Display Techniques in Information-Rich Virtual Environments. *Proceedings of IEEE Virtual Reality*, 2004, pp. 181-188.
39. Polys, N., North, C., **Bowman, D.**, Ray, A., Moldenhauer, M., and Dandekar, C. Snap2Diverse: Coordinating Information Visualizations and Virtual Environments. *Proceedings of SPIE Visualization and Data Analysis*, 2004.
40. Schafer, W. and **Bowman, D.** A Comparison of Traditional and Fisheye Radar View Techniques for Spatial Collaboration. *Proceedings of Graphics Interface*, 2003, pp. 39-46.
41. **Bowman, D.**, North, C., Chen, J., Polys, N., Pyla, P., and Yilmaz, U. Information-Rich Virtual Environments: Theory, Tools, and Research Agenda. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 2003, pp. 81-90.
42. Cowden, J., **Bowman, D.**, and Thabet, W. Home Design in an Immersive Virtual Environment. *Proceedings of CONVR Conference on Construction Applications of Virtual Reality*, 2003, pp. 1-7.
43. Larimer, D. and **Bowman, D.** VEWL: A Framework for Building a Windowing Interface in a Virtual Environment. *Proceedings of INTERACT: IFIP TC13 International Conference on Human-Computer Interaction*, 2003, pp. 809-812.
44. **Bowman, D.**, Setareh, M., Pinho, M., Ali, N., Kalita, A., Lee, Y., Lucas, J., Gracey, M., Kothapalli, M., Zhu, Q., Datey, A., and Tumati, P. Virtual-SAP: An Immersive Tool for Visualizing the Response of Building Structures to Environmental Conditions. *Proceedings of IEEE Virtual Reality*, 2003, pp. 243-250.
45. Pinho, M., **Bowman, D.**, and Freitas, C. Cooperative Object Manipulation in Immersive Virtual Environments: Framework and Techniques. *Proceedings of ACM Virtual Reality Software and Technology*, 2002, pp. 171-178.
46. **Bowman, D.**, Datey, A., Ryu, Y., Farooq, U., and Vasnaik, O. Empirical Comparison of Human Behavior and Performance with Different Display Devices for Virtual Environments. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 2002, pp. 2134-2138.
47. **Bowman, D.**, Rhoton, C., and Pinho, M. Text Input Techniques for Immersive Virtual Environments: an Empirical Comparison. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 2002, pp. 2154-2158.
48. Wingrave, C., **Bowman, D.**, and Ramakrishnan, N. Towards Preferences in Virtual Environment Interfaces. *Proceedings of the Eurographics Workshop on Virtual Environments*, 2002, pp. 63-72.
49. **Bowman, D.**, Wingrave, C., Ly, V., and Campbell, J. Using Pinch Gloves for Both Natural and Abstract Interaction Techniques in Virtual Environments. *Proceedings of the HCI International Conference*, 2001, pp. 629-633.
50. Wingrave, C., **Bowman, D.**, and Ramakrishnan, N. A First Step Towards Nuance-Oriented Interfaces for Virtual Environments. *Proceedings of the Virtual Reality International Conference*, 2001, pp. 181-188.

51. Setareh, M., **Bowman, D.**, and Tumati, P. Development of a Collaborative Design Tool for Structural Analysis in an Immersive Virtual Environment. *Proceedings of the International Building Performance Simulation Association Conference*, 2001, 6 pages.
52. **Bowman, D.** and Wingrave, C. Design and Evaluation of Menu Systems for Immersive Virtual Environments. *Proceedings of IEEE Virtual Reality*, 2001, pp. 149-156.
53. **Bowman, D.**, Johnson, D., and Hodges, L. Testbed Evaluation of VE Interaction Techniques. *Proceedings of the ACM Symposium on Virtual Reality Software and Technology*, 1999, pp. 26-33.
54. **Bowman, D.** and Hodges, L. An Evaluation of Techniques for Grabbing and Manipulating Remote Objects in Immersive Virtual Environments. *Proceedings of the ACM Symposium on Interactive 3D Graphics*, 1997, pp. 35-38.
55. **Bowman, D.**, Koller, D., and Hodges, L. Travel in Immersive Virtual Environments: An Evaluation of Viewpoint Motion Control Techniques. *Proceedings of the IEEE Virtual Reality Annual International Symposium*, 1997, pp. 45-52.

Other Refereed Publications:

1. Lee, C., Bonebrake, S., Höllerer, T., and **Bowman, D.** A Replication Study Testing the Validity of AR Simulation in VR for Controlled Experiments. Poster presented at the IEEE/ACM International Symposium on Augmented and Mixed Reality, 2009.
2. Ragan, E., Wilkes, C, **Bowman, D.**, and Höllerer, T. Simulation of Augmented Reality Systems in Purely Virtual Environments. Poster presented at IEEE Virtual Reality, 2009.
3. Chen, J., **Bowman, D.**, and Laidlaw, D. A Hybrid Direct Visual Editing Method for Architectural Massing Study in Virtual Environments. Poster presented at IEEE Symposium on 3D User Interfaces, 2009.
4. Wingrave, C. and **Bowman, D.** CHASM: Bridging Description and Implementation of 3D Interfaces. *Proceedings of the Workshop on New Directions in 3D User Interfaces*, 2005, pp. 85-88.
5. **Bowman, D.** and Raja, D. A Method for Quantifying the Benefits of Immersion Using the CAVE. *Presence-Connect* (online journal), vol. 4, no. 2, 2004. Available at: www.presence-connect.com
6. Polys, N., **Bowman, D.**, and North, C. Information-Rich Virtual Environments: Challenges and Outlook. NASA Virtual Iron Bird Workshop, NASA Ames, 2004.
7. **Bowman, D.**, Gracey, M., and Lucas, J. Efficient, Intuitive User Interfaces for Classroom-Based Immersive Virtual Environments. Poster abstract in *Proceedings of IEEE Virtual Reality*, 2004, pp. 219-220.
8. Parrott, M., **Bowman, D.**, and Ollendick, T. A Methodology for Designing Specific Animal Phobia Stimuli for Virtual Reality Exposure Therapy. *Proceedings of Cybertherapy*, 2004. (abstract)
9. Parrott, M., **Bowman, D.**, and Ollendick, T. An Immersive Virtual Environment for the Treatment of Ophidiophobia. *Proceedings of Cybertherapy*, 2004. (abstract)
10. Polys, N., **Bowman, D.**, Duca, K., Laubenbacher, R., and North, C. Interactive Visualization of Biological Databases Using Information-Rich Virtual Environments. Poster presented at Digital Biology: The Emerging Paradigm Symposium, National Institutes of Health, 2003.
11. Carroll, J., **Bowman, D.**, McCrickard, S., North, C., Pérez-Quñones, M., and Rosson, M. Center for Human-Computer Interaction at Virginia Tech. *Proceedings of INTERACT: IFIP TC13 International Conference on Human-Computer Interaction*, 2003, pp. 1061-1062.

12. Pinho, M., **Bowman, D.**, and Freitas, C. Cooperative Object Manipulation in Immersive Virtual Environments. Paper presented at the Brazilian Thesis and Dissertations Forum in Computer Science, 2003.
13. Schafer, W., **Bowman, D.**, and Carroll, J. Map-Based Navigation in a Graphical MOO. *ACM Crossroads*, vol. 9, no. 1, 2002, pp. 8-15.
14. Wheeler, K., **Bowman, D.** Evaluating an Educational Virtual Environment Application. Poster presented at the Annual Biomedical Research Conference for Minority Students, 2002.
15. **Bowman, D.** Immersive Design Tools for Virtual Environments. Technical sketch, ACM SIGGRAPH, 1995 (refereed abstract).

Non-refereed Publications:

1. Kopper, R., **Bowman, D.**, and Silva, M. A Human Motor Behavior Model for Distant Pointing Tasks. Technical Report TR-08-26, Computer Science, Virginia Tech, 2008.
2. Kopper, R., Silva, M., McMahan, R., and **Bowman, D.** Increasing the Precision of Distant Pointing for Large High-Resolution Displays. Technical Report TR-08-17, Computer Science, Virginia Tech, 2008.
3. Badillo, B., **Bowman, D.**, McConell, W., Ni, T., and Silva, M. Literature Survey on Interaction Techniques for Large Displays. Technical Report TR-06-21, Computer Science, Virginia Tech, 2006.
4. Chen, J., **Bowman, D.**, Wingrave, C., and Lucas, J. Designing Explicit Numeric Input Interfaces for Immersive Virtual Environments. Technical Report TR-04-13, Computer Science, Virginia Tech, 2004.
5. **Bowman, D.**, Chennupati, B., Gracey, M., Pinho, M., and Wheeler, K. Using Virtual Environments in the Teaching of Computer Graphics. Technical Report TR-03-19, Computer Science, Virginia Tech, 2003.
6. **Bowman, D.**, Gracey, M., Lucas, J., Setareh, M., and Varadarajan, S. Immersive Virtual Environments for University Education: Views from the Classroom. Technical Report TR-03-18, Computer Science, Virginia Tech, 2003.
7. Melanson, B., Kelso, J., and **Bowman, D.** Effects of Active Exploration and Passive Observation on Spatial Learning in a CAVE. Technical Report TR-02-15, Computer Science, Virginia Tech, 2002.
8. Wingrave, C., **Bowman, D.**, and Ramakrishnan, N. Personalized Nuance-Oriented Interaction in Virtual Environments. Technical Report TR-01-24b, Computer Science, Virginia Tech, 2001.
9. Wingrave, C., **Bowman, D.**, and Ramakrishnan, N. Affordances and Feedback in Nuance-Oriented Interfaces. Technical Report TR-01-22, Computer Science, Virginia Tech, 2001.
10. **Bowman, D.**, Ly, V., and Campbell, J. Pinch Keyboard: Natural Text Input for Immersive Virtual Environments. Technical Report TR-01-15, Computer Science, Virginia Tech, 2001.
11. **Bowman, D.** Interaction Techniques for Immersive Virtual Environments: Design, Evaluation, and Application. Presented at the Human-Computer Interaction Consortium (HCIC) Conference, 1998.
12. **Bowman, D.**, Wineman, J., and Hodges, L. Exploratory Design of Animal Habitats Within an Immersive Virtual Environment. Graphics, Visualization, and Usability Center Technical Report GIT-GVU-98-06, 1998.

13. **Bowman, D.** and Hodges, L. User Interface Constraints for Immersive Virtual Environments Applications. Graphics, Visualization, and Usability Center Technical Report GIT-GVU-95-26, 1995.
14. **Bowman, D.** and Hodges, L. WiMP (Widgets, Menus, and Pointing) Design Tools for Virtual Environments. Graphics, Visualization, and Usability Center Technical Report GIT-GVU-94-37, 1994.
15. Sunderam, V., Schmidt, B., Schmidt, M., Topol, B., Ferrari, A., and **Bowman, D.** The Conch User Interface. Emory University Department of Mathematics and Computer Science Technical Report CSTR-940301, 1994.

ADDITIONAL SCHOLARLY OUTPUT

Presentations and Talks:

1. Exploring the Effects of Immersion in Virtual Reality. Invited seminar at the National Institute of Aerospace, Hampton, Virginia, September 2009.
2. Using Spatial Mappings in Immersive Virtual Reality to Memorize Abstract Sequences of Information. Invited presentation for the UCSB "SCRAM" series on spatial cognition research, Santa Barbara, California, April 2009.
3. Exploring the Effects of Immersion in Virtual Reality. UCSB Computer Science Seminar, Santa Barbara, California, December 2008.
4. VR and beyond: Increasing the Impact of VR and 3D Interaction Research in the Real World. **Invited keynote address** at the X Symposium on Virtual and Augmented Reality (SVR), João Pessoa, Brazil, May 2008.
5. VR and beyond: Increasing the Impact of VR Research in the Real World. **Invited keynote address** at the INTUITION international conference and workshop, Athens, Greece, October 2007.
6. VEs at Virginia Tech: Immersive Virtual Environments for Mining and Engineering Applications. Invited presentation at the NIOSH Workshop on Virtual Reality in Mine Training, Pittsburgh, Pennsylvania, July 2006.
7. Engineering in Three Dimensions: Immersive Virtual Environments, Interactivity, and 3D User Interfaces for Engineering Applications. **Invited keynote address** at ASCE GeoCongress, Atlanta, Georgia, March 2006.
8. Usable 3D: User Interface Design for Virtual Environments. Invited talk at the Robert Bosch Research and Technology Center, Palo Alto, California, November 2005.
9. The NSF CAREER Program: Experiences and Lessons Learned. Virginia Tech CAREER Workshop, April 2004.
10. Research in Human-Computer Interaction and Visualization/Virtual Environments. Virginia Tech College of Engineering Northern Virginia Showcase, March 2004.
11. Virtual Environments for Architecture and Construction: Research Challenges in 3D User Interface Design. Invited talk at the Department of Computer Science, University of Iowa, November 2003.
12. Immersive VEs for University Education: Views from the Classroom. Virginia Tech Instructional Design Program, October 2003.
13. Virtual Environments Research at Virginia Tech. College of Engineering Discovery Seminar, September 2003.

14. Immersive VEs for University Education: Views from the Classroom. Virginia Tech Virtual Environments Research Group, February 2003.
15. Virtual Environments Research in Virginia Tech Computer Science. Presentation to Computer Science Department Advisory Board, October 2002.
16. Research Methods in the Design and Evaluation of 3D User Interfaces. Department of Computer Science Research Methods Class, October 2001.
17. Current and Recent Research in the 3DI Group. Virginia Tech Virtual Environments Research Group, September 2001.
18. 3D User Interface Design: Enabling Highly Interactive Virtual Environments. Invited talk at the Virtual Reality International Conference, June 2001.
19. The Design and Evaluation of Three-Dimensional Interaction Techniques. Virginia Tech Department of Computer Science, November 2000.
20. Environmental Design Education in an Immersive Virtual Environment. Graphics, Visualization, and Usability Center, January 1998.
21. Interaction Techniques for Immersive Virtual Environments: Design, Evaluation, and Application. Invited talk at the Human Interface Technology (HIT) laboratory, University of Washington, June 1997.
22. Immersive Design Tools for Virtual Environments. Graphics, Visualization, and Usability Center, March 1995.

Short Courses:

1. LaViola, J., Kruijff, E., Poupyrev, I., and **Bowman, D.** 3D User Interfaces: Design, Implementation, Usability. Full-day course presented at ACM CHI, Boston, April 2009.
2. Kruijff, E., **Bowman, D.**, LaViola, J., and Poupyrev, I. 3D User Interfaces: From Lab to Living Room. Full-day course presented at ACM CHI, Florence, Italy, April 2008.
3. Kriz, R. and **Bowman, D.** Visualization and Virtual Environments. Presented within “Tools for Research and Presentation” workshop, Faculty Development Institute (FDI), Virginia Tech, July 2003.
4. Lockhart, J., Kriz, R., Kelso, J., Arsenault, L., **Bowman, D.**, and Sforza, P. Visualization and Virtual Environments. Three-day workshop, Faculty Development Institute (FDI), Virginia Tech, May 2002.
5. **Bowman, D.**, Kruijff, E., LaViola, J., Mine, M., and Poupyrev, I. Advanced Topics in 3D User Interface Design. Full-day course presented at ACM SIGGRAPH, Los Angeles, California, August 2001.
6. **Bowman, D.**, Kruijff, E., LaViola, J., Mine, M., and Poupyrev, I. 3D User Interface Design: Fundamental Techniques, Theory, and Practice. Full-day course presented at ACM SIGGRAPH, New Orleans, Louisiana, July 2000.
7. **Bowman, D.**, Kruijff, E., LaViola, J., and Poupyrev, I. The Art and Science of 3D Interaction. Full-day tutorial presented at the IEEE Virtual Reality Conference, New Brunswick, New Jersey, March 2000.
8. **Bowman, D.**, Kruijff, E., LaViola, J., and Poupyrev, I. The Art and Science of 3D Interaction. Full-day tutorial presented at the ACM Symposium on User Interface Software and Technology, London, UK, December 1999.

9. **Bowman, D.**, Kruijff, E., LaViola, J., and Poupyrev, I. The Art and Science of 3D Interaction. Full-day tutorial presented at the IEEE Virtual Reality Conference, Houston, Texas, March 1999.

Workshops co-organized:

1. **Bowman, D.**, Fröhlich, B., Kitamura, Y., and Stürzlinger, W. New Directions in 3D User Interfaces. Workshop co-organized at IEEE Virtual Reality, Bonn, Germany, 2005.
2. Fröhlich, B., Kitamura, Y., and **Bowman, D.** Beyond Wand and Glove Based Interaction. Workshop co-organized at IEEE Virtual Reality, Chicago, 2004.
3. Broll, W., Schaefer, L., Höllerer, T., and **Bowman, D.** The Future of VR and AR Interfaces. Workshop co-organized at IEEE Virtual Reality, Yokohama, Japan, 2001.
4. Loftin, R., **Bowman, D.**, Cohen, P., Hix, D., Metaxas, D., and Rosenblum, L. Perceptual and Multi-Modal Interfaces. Workshop co-organized at IEEE Virtual Reality, New Brunswick, New Jersey, 2000.

Panels:

1. LaViola, J., **Bowman, D.**, Lok, B., Swan, E., Interrante, V., and Ellis, S. User Studies in VR: What Can We Learn From Them and What Are They Good For? Panel presented at IEEE Virtual Reality, Reno, 2008 (refereed).
2. Hirose, M., **Bowman, D.**, Stuerzlinger, W., and Kitamura, Y. 3D User Interfaces: Present and Future. Panel presented at IEEE Symposium on 3D User Interfaces, Reno, 2008 (invited).
3. May, R., Arya, P., **Bowman, D.**, Schmidt, G., and Sullivan, A. Challenges to Applying Virtual Reality Technology and Techniques to Visual Analytics. Panel presented at IEEE Virtual Reality, Alexandria, 2006 (refereed).
4. Wingrave, C., **Bowman, D.**, Schmalsteig, D., Mine, M., Feiner, S., and Swan, E. Mixed Reality Interaction: The Continuum from Virtual to Augmented Reality. Panel presented at IEEE Virtual Reality, Los Angeles, 2003 (refereed).

Demonstrations:

1. **Bowman, D.**, Gracanin, D., Wingrave, C., Chen, J., Polys, N., Ni, T., Kopper, R., and Kim, J. 3D Interaction Group Research. Lab exhibit at IEEE Virtual Reality, 2006 (refereed).
2. Kopper, R., Watson, B., Hodges, L., Newton, G., Kessler, D., **Bowman, D.**, and Rothbaum, B. Overcoming Phobias Using Virtual Reality. Digital Bayou at ACM SIGGRAPH, 1996 (refereed).

Videos:

1. **Bowman, D.** and Hodges, L. WiMP Design Tools for Virtual Environments. Video proceedings of the IEEE Virtual Reality Annual International Symposium, 1995 (refereed).

STUDENTS ADVISED

Ph.D. students:

1. Chadwick Wingrave, Ph.D. 2008. Dissertation title: Concept-Oriented Design in Chasm: Conversational Domain Language Inspired 3D User Interface Design and Development.
2. Andrew Ray, Ph.D. 2008. Dissertation title: The Interaction Framework for Innovation: A Method to Create Reusable Three-Dimensional Interaction Techniques.

3. Jian Chen, Ph.D. 2006. Dissertation title: Design and Evaluation of Domain-Specific Interaction Techniques in the AEC Domain for Immersive Virtual Environments.
4. Nicholas Polys, Ph.D. 2006. Dissertation title: Display Techniques in Information-Rich Virtual Environments. (Won CS Department Outstanding PhD Dissertation Award)
5. Wendy Schafer, Ph.D. 2004. Dissertation title: Enhancing Distributed, Spatial Collaboration: An Investigation of Representation Techniques. (Won CS Department Outstanding PhD Dissertation Award)
6. Marcio Pinho, Ph.D. 2002 (from Federal University of Rio Grande do Sul, Brazil; served as official co-advisor). Dissertation title: Cooperative Object Manipulation in Immersive Virtual Environments.

M.S. students:

1. Ajith Sowndararajan, M.S. 2008. Thesis title: Quantifying the Benefits of Immersion for Procedural Training.
2. Ryan McMahan, M.S. 2007. Thesis title: Exploring and Evaluating Task Sequences for System Control Interfaces in Immersive Virtual Environments. (Won CS Department Outstanding Masters Thesis Award).
3. Brian Badillo, M.S. 2007. Thesis title: Migrating Three Dimensional Interaction Techniques.
4. Dheva Raja, M.S. 2006. Thesis title: The Effects of Immersion on 3D Information Visualization.
5. John Lucas, M.S. 2005. Thesis title: Techniques for Selecting Multiple Objects in Virtual Environments. (Won CS Department Outstanding Masters Thesis Award)
6. Dhruv Manek, M.S. 2004. Thesis title: Effects of Visual Displays on 3D Interaction in Virtual Environments.
7. Ameya Datey, M.S., 2002. Thesis title: Experiments in the Use of Immersion for Information Visualization.
8. Chad Wingrave, M.S., 2001. Thesis title: Nuance-Oriented Interfaces in Virtual Environments.

Thesis and dissertation committees:

1. Cha Lee (co-advisor; University of California, Santa Barbara)
2. Xiaoyu Zhang
3. Ji-Sun Kim
4. Jianghui Ying (Ph.D. Computer Science, expected 2009)
5. Mithilesh Kumar (M.S. Computer Science, expected 2008)
6. Tovi Grossman (Ph.D., Computer Science, University of Toronto, 2008)
7. Mehmet Dasiyici (M.S. Computer Science, 2008)
8. Brian Sciacchitano (M.S. Computer Science, expected 2008)
9. Sarah Peck (M.S. Computer Science, 2008)
10. Joseph Gabbard (Ph.D. Computer Science, 2008)
11. Niklas Elmqvist (Ph.D., Computer Science, Chalmers University of Technology, 2007; I served as the "opponent")
12. Beth Yost (Ph.D. Computer Science, 2007)

13. Robert Ball (Ph.D. Computer Science, 2006)
14. Lauren Shupp (M.S. Computer Science, 2006)
15. Régis Kopper (M.S., Computer Science, Pontifical Catholic University of Rio Grande do Sul, 2006).
16. Christa Chewar (Ph.D. Computer Science, 2004)
17. Jacob Somervell (Ph.D. Computer Science, 2004)
18. Christopher Collins (M.S. Mechanical Engineering, 2004)
19. Ali Ndiwalana (M.S. Computer Science, 2003)
20. Mohammed Fairuz Shiratuddin (M.S. Building Construction, 2003)
21. Vineet Kamat (Ph.D. Civil Engineering, 2002)
22. Ravikiran Vatrappu (M.S. Computer Science, 2002)
23. Wes Lloyd (M.S. Computer Science, 2001)

Graduate independent study students:

1. Alex Kalita (Spring 2003)
2. Ali Ndiwalana (Spring 2003)
3. Brian Melanson (Summer 2002)
4. Matthew Gracey (Summer 2002)
5. Balaprasuna Chennupati (Fall 2001)

Undergraduate research students:

1. Philip Schuchardt (Spring 2007 – Spring 2008)
2. Brandon Linton (Spring 2005 – Fall 2005; won best poster award at College of Engineering Undergraduate Research Symposium)
3. Cris Kania (Spring 2005)
4. Curtis Wilkes (2004-2007)
5. Ryan McMahan (Spring 2004)
6. Craig Mackie (Fall 2003 – Spring 2004)
7. Ryan Schlesinger (Fall 2003)
8. Daniel Larimer (Fall 2003)
9. Robert Hoffman (Spring 2003)
10. Peter Camponola (Spring 2003)
11. Jason Cowden (Spring 2003 – Spring 2004)
12. Saqib Sheikh (Spring 2002)
13. Jonathan Berkowitz (Fall 2002)
14. Matthew Parrott (Spring 2002)
15. Christopher Rhoton (Fall 2001)
16. Joshua Campbell (Spring 2001)
17. Vinh Ly (Spring 2001)
18. Matthew Campbell (Spring 2000)

19. Manu Sporny (Spring 2000)

Summer Interns:

1. Farid Sultani (CHCI Research Experiences for Undergraduates (REU) Program, Summer 2006)
2. Latasa Anderson (Virginia Tech Minority Academic Opportunities Program (MAOP), Summer 2003)
3. Kristin Wheeler (Virginia Tech Minority Academic Opportunities Program (MAOP), Summer 2002)

TEACHING

- Department of Computer Science, University of California, Santa Barbara
 - CS 290I (Immersion in Virtual and Augmented Reality): I developed this new graduate course to supplement my sabbatical research at UCSB. Students discussed the theory of immersion as a framework for understanding VR, AR, and other technologies on the MR continuum. The class included a major literature review project and a research project in which students designed and ran experiments on the effects of immersion.
- Department of Computer Science, Virginia Tech
 - CS 2204 (Unix): I was responsible for revamping this course (formerly CS 1206) in Fall 2001. I developed all new lectures, laboratory assignments, quizzes, and programming assignments.
 - CS 3724 (Human-Computer Interaction): In this project-based course, teams of students gain both theoretical and practical experience with a complete usability engineering process including requirements analysis, design, prototyping, and evaluation.
 - CS 4204 (Computer Graphics): This senior-level class is focused on the basic theory of computer graphics, providing students with the details of the process of 3D rendering. Students also complete 3-4 practical programming assignments using OpenGL.
 - CS 4634 (Design of Information): This course, a senior elective, teaches students about effective design of information-oriented interfaces such as websites. Topics include information architecture, user interface design, and visual design. Teams of students complete a semester project involving a significant website design and implementation.
 - CS 5754 (Virtual Environments): I developed this course as a special topics course in Spring 2000, and have taught it each year since. Both graduate and undergraduate students take this course, which is an overview of the technology, design issues, applications, and research challenges for VEs. Students help to lead discussions of important research papers, and also complete a semester project of their own choosing.
 - CS 6724 (3D Interaction): I developed this graduate seminar in Fall 2004. The class focuses on 3D user interfaces as a special subtopic of human-computer interaction. We discuss the distinctive characteristics of 3D UI technology, design, and evaluation, using the latest research results. Students also gain practical design and implementation experience in the 3DI laboratory.
- Instructor, College of Computing, Georgia Institute of Technology
 - CS 4753 (Human-Computer Interaction, Winter 1999): As a graduate student at Georgia Tech, I was solely responsible for this upper-level undergraduate course. I also developed new lecture materials and assignments for this class.

- CS 4390 (Computer Graphics, Summer 1998): As a graduate student at Georgia Tech, I was solely responsible for teaching, administering, and grading this upper-level undergraduate course.
- Teaching Assistant, College of Computing, Georgia Institute of Technology, Fall 1997 and 1998. I served as a TA for Computer Graphics, Virtual Environments, and User Interface Software classes.
- Guest Lecturer, College of Computing, Georgia Institute of Technology, 1996-1998.
- Recitation instructor, Department of Mathematics and Computer Science, Emory University. I taught recitation sections to freshman and sophomore non-majors in CS 150 (Introduction to Computers and Programming, 1994).

SELECTED SERVICE ACTIVITIES

Selected Professional Service:

- Associate Editor, International Journal of Human-Computer Studies, 2005-present
- Associate Editor, International Journal of Virtual Reality, 2006-present
- Steering Committee member, IEEE Virtual Reality Conference, 2009-present
- Steering Committee member, IEEE Symposium on 3D User Interfaces, 2006-present
- General chair, IEEE Virtual Reality Conference, 2007 and 2008
- Program Chair, IEEE Virtual Reality Conference, 2006
- Co-chair, IEEE Symposium on 3D User Interfaces, 2006
- Co-Organizer, Workshop on New Directions in 3D User Interfaces, IEEE Virtual Reality Conference, 2005
- Co-Organizer, Workshop on Beyond Wand and Glove Based Interaction, IEEE Virtual Reality Conference, 2004
- Co-Organizer, Workshop on The Future of VR and AR Interfaces, IEEE Virtual Reality Conference, 2001
- Co-Organizer, Workshop on Perceptual and Multi-Modal Interfaces, IEEE Virtual Reality Conference, 2000
- Panels Chair, IEEE Virtual Reality Conference, 2004
- Program Chair, Conference on Construction Applications of Virtual Reality, 2003
- Video Chair, IEEE Virtual Reality Conference, 2002 and 2003
- Exhibits Chair, IEEE Virtual Reality Conference, 2000 and 2001
- Member, ACM SIGGRAPH and SIGCHI
- Member, IEEE Computer Society
- Co-founder, 3D User Interface Mailing List (www.3dui.org)
- Numerous Program Committees and reviewing assignments

University Service:

- Director, 3D Interaction Research Group, Virginia Tech
- Member, Virginia Tech Center for Human-Computer Interaction
- Member, Virginia Tech University Visualization and Animation Group

- Appointed chair, CS Dept. Admissions Committee, 2009-present
- Member, CS Department Head search committee, 2007-2008
- Elected member, CS Dept. Personnel Committee, 2005-2008
- Elected member, CS Dept. Computing Resources Committee, 2000-2004
- Member, Animation/Graphics faculty search committee, 2005-2006
- Chair, CS Department ad-hoc committee on assessment, 2005
- Co-founder, Virginia Tech Virtual Environments Research Group
- Georgia Institute of Technology delegate to the Human-Computer Interaction Consortium (HCIC) conference, 1998

PERSONAL INFORMATION

- Married to Dawn Bowman, three children
- Born 1971
- Active in the ministries of Grace Covenant Presbyterian Church, Blacksburg