Morgan McGuire
Curriculum Vitae

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Education

Ph.D. Computer Science, Brown University, May 2006.
Thesis: Computational Videography with a Single-Axis, Multi-Parameter Lens Camera
Advisor: John F. Hughes

Sc. M. Computer Science, Brown University, May 2003.
Thesis: Fast Shadow Volumes on Graphics Hardware
Advisor: John F. Hughes

M.Eng. Computer Science and Electrical Engineering, MIT, May 2000.
Thesis: The Curl 2D Immediate Mode Graphics API
Advisor: Stephen S. Ward

B.S. Electrical Engineering and Computer Science, MIT, May 2000.

Teaching Experience

Advising

I assisted Hanspeter Pfister in advising George Stathis' Masters Thesis on Aspect Oriented Shading Trees at the Harvard Extension School, which won the best thesis award for all departments at that institution in 2005. I have advised several undergraduates through research publications at Brown University as part of our Games Research Group: Andrea Fein, Pawel Wrotek, Colin Hartnett, Kevin Egan, Ethan Bromberg, and Alex Rice.

2006 **Course Advisor to Games Course** (CS196) Brown
I'm currently developing course material for a new class on video games with Chad Jenkins. Prof. Jenkins will lecture; I'm writing the textbook.

2005 **Consultant to Introduction to Computer Graphics and GPU Programming** (CSCI E-234) Harvard Extension School
I advised Prof. Hanspeter Pfister and the TAs on the syllabus, support code, and GPU programming.

2004 **Advisor to Group Independent Study on Games** Brown
I lectured, advised, and graded a group of five undergraduates during their independent study. The students created animated 3D models, a graphics engine, and an interactive environment for a computer game; and reports on job roles within the game industry.

2004 **Course Instructor for Interactive Computer Graphics** (CS224) Brown
While my advisor was on sabbatical, I worked with two other graduate students to create an entirely new syllabus for the advanced graduate course in computer graphics, presented half of the lectures, and graded students. Topics covered: Rigid body physics, non-photorealistic rendering, user interaction, optimization in graphics, texture synthesis, and light transport.

2002 **Teaching Assistant for Interactive Computer Graphics** (CS224) Brown

1998-Present **Tutoring**
I've tutored advanced high school students in computer science and math as a community service since I was an undergraduate.

1998-2000 **Instructor for Beginner Sailing** MIT
I gave on-the-dock lectures to beginning sailors, taught groups of students on the water (occasionally performing rescues), and administered MIT's official sailing examinations. I helped maintain a fleet of Tech Dinghies, Rhodes 19's, and 420s, and FJ's, and assisted during varsity race events.

1998 **Course Instructor for Computer Science** (HSSP:CSBC) MIT
Created and taught an aggressive, one semester computer science course for high school students as part of the MIT HSSP program. Topics covered: Scheme and Lambda calculus, orders of growth, how a compiler works, garbage collection, data structures, and computer graphics.

1998 **Teaching Assistant for Advanced Math** (HSSP:CSBC) MIT
Assisted with an aggressive, one-semester mathematics course for high school students.

1996 **Laboratory Assistant for Computational Structures** (6.004) MIT

Professional Appointments

1996-Present **Independent Consulting**
I evaluate new algorithms and technology, prototype tools and demos, write whitepapers and grant proposals, and architect graphics-intensive software. Previous clients include Iron Lore Entertainment, ROBLOX, Shakti Systems, Mitsubishi Electric Research Laboratory, LightSpace Technologies, BAE Systems, Oculus, Curl, Valora Wireless, E Ink, and Pfizer.

2002-Present **Open Source projects**
I am the project manager for two Open Source projects. The **G3D Engine** (http://g3d-cpp.sf.net) is a C++ library for high-performance 3D graphics on Windows, Linux, and OS X used by professional game developers, students, and researchers at several universities. G3D is in the 99.9th percentile of active SourceForge projects and has been downloaded over 50,000 times in the last three years.

***i*Compile** (http://ice.sf.net) is a build system for Linux and OS X. It is an expert system that can compile most projects without per-project configuration (i.e., no Makefiles) and is intended to help students who are new to programming on Linux.

2000-2002 **Senior Architect at Oculus Technology Corporation**, Boston, MA
I designed and implemented client-side and plug-in APIs in Java for peer-to-peer connectivity software for major 3D engineering tools like AutoCAD, SolidWorks, ProEngineer, and PTC. I created a web browser-like interface and visual programming environment.

1998-2000 **Senior Graphics Architect at Curl Corporation**, Cambridge, MA
I designed the graphics systems and parts of the compiler for Curl, a web-based language for interactive content. I helped grow the company from 13 to over 100 employees and $500M valuation by hiring engineers, performing sales support, designing and implementing major APIs, and managing groups of up to 15 engineers.

Internships

2004 **Intern with Dr. Hanspeter Pfister**
MERL, Cambridge, MA.
I designed and built a "single-axis, multi-parameter" lens camera and the CPU/GPU software to drive it. I applied this camera to solving problems in natural video matting and compositing, high dynamic range, high speed, and multi-modal imaging and filed three patent applications.

1995-1998 **Research Assistant to Dr. Harold Stone**
NEC Research Institute, Princeton, NJ.
I implemented a large research tool in Matlab and performed independent research on image registration in Fourier and wavelet domains. I patented a new registration method and coauthored several papers.

1995 **Undergraduate Research with the Epistemology and Learning Group**
MIT Media Laboratory, Cambridge, MA

1993-1995 **Intern with Dr. Stephen Lavenberg and Dr. Miriam Masullo**
IBM T.J. Watson Research Center, Yorktown, NY

Journal Papers

1. P. Wrotek, A. Rice, and M. McGuire. **Real-Time Bump Map Deformations using Graphics Hardware**. Journal of Graphics Tools, 10(4), 2005
2. M. McGuire, W. Matusik, H. Pfister, J. F. Hughes, and F. Durand. **Defocus Video Matting**. ACM Transactions on Graphics (SIGGRAPH '05), 2005
3. **Observations on Silhouette Sizes**. Journal of Graphics Tools, Aug 2004
4. H. S. Stone, B. Tao, and M. McGuire, **Analysis of Image Registration Noise Due to Rotationally Dependent Aliasing**. Journal of Visual Communication and Image Representation 14: 114-135, 2003
5. M. McGuire and H.S. Stone, **Techniques for Multiresolution Image Registration in the Presence of Occlusions**. IEEE Transactions on Geoscience and Remote Sensing, 38(3):1476-1479, May 2000
6. H. S. Stone, J. Le Moigne and M. McGuire, **The Translation Sensitivity of Wavelet-Based Registration**. IEEE Trans. on Pattern Analysis and Machine Intelligence, 21(10):1074-1081, 1999

Peer-Reviewed Conference Papers and SIGGRAPH Sketches

7. M.McGuire and A. Fein, **Real-Time Cartoon Smoke Animation**, NPAR, June 4, 2006. Annecy, Fr.
8. M. McGuire, G. Stathis, H. Pfister, and S. Krishnamurthi, **Abstract Shade Trees**. I3D, March 14-17, 2006. Redwood City, CA.
9. M. McGuire and W. Matusik, **Defocus Difference Matting**, SIGGRAPH 2005 Sketch. Los Angeles, CA. Aug 2005
10. S. Becker, S. Greenlee, D. Lemmerman, M. McGuire, N. Musurca, and N. Wardrip-Fruin, **Cave Writing: Toward a Platform for Literary Immersive VR**. SIGGRAPH 2005 Sketch. Los Angeles, CA. Aug 2005
11. M. McGuire and P. Sibley, **A Heightfield on an Isometric Grid**. SIGGRAPH 2004 Sketch. Los Angeles, CA. August 2004*
12. M. McGuire and J. F. Hughes, **Hardware Contour Rendering**. NPAR '04. Annecy, France. June 2004

13. M. McGuire, S. Krishnamurthi, and J. F. Hughes, **Programming Languages for Image Compression**. ESOP 2002. Grenoble, France. June 2002

14. H. S. Stone, J. Le Moigne, and M. McGuire, **Image Registration Using Wavelet Techniques**. Proc. of the 26th AIPR Workshop, Proc. of the SPIE, Exploiting New Image Sources and Sensors 3240:116-125, 1997*

15. M. McGuire and H.S. Stone, **Techniques for Multi-Resolution Image Registration in the Presence of Occlusions**, Proc. of Image Registration Workshop pp.101-122, 1997*

Posters

16. M. McGuire, J. F. Hughes, W. Matusik, H. Pfister, F. Durand, and S. Nayar. **A Configurable Single-Axis, Multi-Parameter Lens Camera**, poster at the Symposium on Computational Photography and Video, MIT, May 24, 2005

17. M. McGuire and M. McGuire, **Steep Parallax Mapping**, I3D 2005 Poster, Washington D.C, 2005

18. M. McGuire, A. Fein, and C. Hartnett, **Real-Time Cartoon Smoke Rendering**. SIGGRAPH 2004 Poster Abstract and Talk, Los Angeles, CA. 2004. **1st place 2004 ACM SIGGRAPH Student Research Competition***

19. P. Wrotek, A. Rice, and M. McGuire. **Real-Time Bump Map Deformations using Graphics Hardware**, SIGGRAPH 2004 Poster Abstract and Talk. Los Angeles, CA, 2004* **2nd place 2004 ACM SIGGRAPH Student Research Competition**

20. E. Bromberg-Martin, A. Jonsson, G. E. Marai, and M. McGuire, **Hybrid Billboard Clouds for Model Simplification**. SIGGRAPH 2004 Poster Abstract, Los Angeles, CA. 2004

* *significantly expanded versions of these presentations later appeared as publications*

Book Chapters

21. *Theory and Application of Computer Graphics Techniques*. Textbook *to be published 2007 by* Prentice-Hall, Upper Saddle River, NJ.

22. *Game Development: Design and Process*. Textbook *to be published 2007 by* A K Peters, Newton, MA.

23. **The SuperShader**. *in ShaderX4,* W. Engel ed. Delmar Thomson Learning, 2006.

24. **Effective Shadow Volume Rendering**. *in GPU Gems: Programming Techniques, Tips and Tricks for Real-Time Graphics*, R. Fernando ed. Addison Wesley, 2004, ISBN: 0-321-22832-4. **Won the 2004 Game Developer Magazine Front Line Award for Books.**

Other Publications

25. M. McGuire and P. Sibley, **A Heightfield on an Isometric Grid**, Tech Report CS-05-14, Brown University, Providence, RI. Oct 2005

26. **The G3D 3D Engine**, Software 2.0, Sept. 2005

27. **A Game Developer's Review of SIGGRAPH 2005/Technical Event Wrap-Up**. gamasutra, August 2005, http://www.gamasutra.com/features/200508111/mcguire_01.shtml

28. A. Vetro, M. McGuire, W. Matusik, A. Behrens, J. Lee, and H. Pfister, **Test sequence for the MPEG multi-view working group**, ISO/IEC JTC1/SC29/WG11 Document m12077, Busan, Korea, Apr. 2005
29. **The G3D Graphics Engine: Advanced language features for simplicity and safety in a graphics API**. C/C++ Users Journal, Dec. 2004
30. **A Game Developer's Review of SIGGRAPH 2004/Event Wrap-Up**. gamasutra, August 2004, http://www.gamasutra.com/features/20040830/mcguire_01.shtml. *Reprinted by* ACM SIGGRAPH Vancouver, October 2004, http://vancouver.siggraph.org/12_archive_2004-08.html.
31. **A Game Developer's Review of SIGGRAPH 2003**. flipcode, July 2003, http://www.flipcode.com/misc/siggraph2003.shtml
32. M. McGuire, J. F. Hughes, K. Egan, M. J. Kilgard, C. Everitt, **Fast, Practical and Robust Shadows**. Tech Report. NVIDIA Corporation, Austin, TX. Nov. 2003.
33. **A Game Developer's Review of SIGGRAPH 2002: San Antonio**. flipcode, July 2002, http://www.flipcode.com/misc/siggraph2002.shtml
34. **A Game Developer's Perspective of SIGGRAPH 2001**. flipcode, July 2001, http://www.flipcode.com/misc/siggraph2001.shtml
35. **A Game Developer's Review of SIGGRAPH 2000: New Orleans**. flipcode, July 2000, http://www.flipcode.com/misc/siggraph2000.shtml
36. **The Curl 2D Immediate Mode Graphics API**. Masters Thesis, MIT, May 21, 2000

Patents

- **System and method for compile-time checking of units**. United States Patent 6,598,186 issued July 22, 2003
- **Image Registration Method**. United States Patent 6,266,452 issued July 24, 2001 (also NEC Tech Report) also available as **An image registration technique for recovering rotation, scale and translation parameters**, NEC Tech Report, Feb. 1998

4 additional patents pending on virtual reality and matting technologies.

Games

- Software design consulting credit on **Titan Quest**, Iron Lore Entertainment, *published by* THQ, to be released in 2006
- Graphics and level design credit on **ROBLOX**, by ROBLOX Corporation, released 2005

Images

- *Shadow Volume Visualization*, *in* Giles Simon, *3D Integration*, 2006
- *Matting Collage*, on the back cover of *Proceedings of SIGGRAPH 2005.*
- *Anime Robot*, Front cover of the *C/C++ Users Journal*, Dec 2004
- *Isometric Terrain*, Front cover of *Brown CS: The Undergraduate Experience*, Sept. 2004
- *Teapot and Robot*, on the back cover of *Proceedings of NPAR 2004*.

Invited Talks

- **New Results in Video Game Research**. UMass Dartmouth, North Dartmouth, MA, Sept 24, 2004
- **Contours and Constants: Bounding NPR Rendering Time and Making it Fast on Graphics Hardware**. MIT, Cambridge, MA, Aug 2004
- **NPR and Terrain Rendering**. Harvard Extension School, Cambridge, MA, May 2004
- **MacVicar Panel on Education**. MIT, Cambridge, MA, Feb 10, 1998
- **The LASER Computer Graphics Language**. NEC USA, Princeton, NJ, Aug 1996
- **Principles of User Interface Design**. NEC USA, Princeton, NJ, Aug 1995

Grants

While working for BAE Systems in 2004, I helped write the successful $750,000 "OAV Repositioning Resource-Allocating Tracker" grant sponsored by DOD/DARPA under contract number DAAH01-03-C-R268 and was a key researcher on the project.

Honors and Service

Awards and Fellowships

2004	1st place ACM SIGGRAPH Student Research Competition
2004	NVIDIA International Ph.D. Fellowship
2003	NVIDIA International Ph.D. Fellowship
2002	Andy van Dam Fellowship
1994	Hitachi America Scholarship
1994	U.S. Department of the Navy Science Award

Service to the Profession

I3D 2006 Program Committee Local Arrangements Chair

I3D 2005 Poster Session Co-chair

Reviewer for: *ACM Transactions on Graphics*/SIGGRAPH (since 2003), I3D 2006, *IEEE Transactions on Image Processing* (since 2000), *IEEE Transactions on Visualization and Computer Graphics* (since 2003), ICIG 2004, *Eurographics 2005.*

Service to the University (at Brown)

2002-2004	Sheridan Teaching Center CS Liaison
2003	Computer Science Graduate Recruiting Czar

Professional Societies

Member of ACM (since 2000), IEEE (1995-2000), IEEE Computer Society (1997-2000), Sigma Xi (1998), Order of Omega (1996)