

Education

University of California, Davis, Davis, CA
Ph.D. in Computer Science, September 2006
Title: Glift: Generic Data Structures for Graphics Hardware
Advisor: John Owens

University of Utah, Salt Lake City, UT
Master of Science in Computer Science, December 2003
Research: Computer graphics and scientific visualization
Advisor: Ross Whitaker

University of Utah, Salt Lake City, UT
Master of Science in Physical Chemistry, May 2001
Research: Theoretical chemistry
Advisor: Greg Voth

Whitman College, Walla Walla, WA
Bachelor of Arts in Chemistry, May 1997
Research: Experimental and theoretical physical chemistry
Advisors: Steve Schvaneveldt and Ellen Fisher

Honors and Awards

Best Doctoral Dissertation Award, Computer Science Department, UC Davis, 2006
National Science Foundation Graduate Fellowship, 2003
Pixar Animation Studios internship, 2003 and 2004
Invited to IBM Watson Research Graphics and Visualization Student Symposium, 2003
Nomination for Best Paper award, MICCAI, 2003
Nomination for Best Paper award, IEEE Visualization, 2003
Proceedings cover image, IEEE Visualization, 2003
Invited paper, Medical Image Analysis, 2003
Invited paper, IEEE Transactions on Visualization and Computer Graphics, 2003
Fellowship for outstanding new graduate student in chemistry, 1998–1999

Journal Articles

A. Lefohn, S. Sengupta, J. Owens, “Resolution-Matched Shadow Maps,” *ACM Transactions on Graphics*, 26 (4), pp. 20:1-20:17, Oct. 2007, presented at ACM SIGGRAPH 2008 TOG session.

J. D. Owens, D. Leubke, N. Govindaraju, M. Harris, J. Kruger, A. Lefohn, T. Purcell, “A Survey of General-Purpose Computation on Graphics Hardware,” *Eurographics Computer Graphics Forum*, 26 (1), pp. 80-113, 2007.

A. Lefohn, J. Kniss, R. Strzodka, S. Sengupta, J. Owens, “Glift : Generic, Efficient, Random-Access GPU Data Structures,” *ACM Transactions on Graphics*, 25 (1), pp. 60-99, Jan. 2006 (referred by SIGGRAPH 2005 papers committee).

F. Pellacini, K. Vidimce, A. Lefohn, A. Mohr, M. Leone, J. Warren, “Lpics: A Hardware-Accelerated Relighting Engine for Computer Cinematography,” *ACM Transactions on Graphics*, Proceedings of ACM SIGGRAPH, pp. 464-470, 2005.

J. E. Cates, A. E. Lefohn, R. T. Whitaker, “GIST: An Interactive, GPU-Based Level-Set Segmentation Tool for 3D Medical Images,” *Medical Image Analysis*, Invited paper, 8 (3), Sep., pp. 217-231, 2004.

A. E. Lefohn, J. M. Kniss, C. D. Hansen, R. T. Whitaker, “A Streaming Narrow-Band Al-

gorithm: Interactive Deformation and Visualization of Level Sets,” IEEE Transactions on Visualization and Computer Graphics, Invited paper, 10 (4), Jul./Aug., pp. 422-433, 2004.

A. E. Lefohn, R. T. Caruso, E. Reinhard, B. Budge, and Peter Shirley, “An Ocularist’s Approach to Human Iris Synthesis,” IEEE Computer Graphics and Applications, 23 (6), Nov./Dec., pp. 70-75, 2003.

J. Jeon, A. E. Lefohn, G. A. Voth, “An Improved Polarflex Water Model,” The Journal of Chemical Physics, 118 (16), pp. 7504-7518, 2003.

A. E. Lefohn, M. Ovchinnikov, and G. A. Voth, “A Multistate Empirical Valence Bond Approach to a Polarizable and Flexible Water Model,” The Journal of Physical Chemistry B, 105 (28), pp. 6628-6637, 2001.

A. E. Lefohn, N. M. Mackie, and E. R. Fisher, “Comparison of Pulsed and Continuous Wave Deposition of Thin Films from Acetonitrile and Acrylonitrile Inductively Coupled Plasmas,” Plasma Polymers, 3, pp. 197-209, 1998.

Conference Papers

L. Bavoil, S. P. Callahan, A. Lefohn, J. L. D. Comba, C. T. Silva, “Multi-Fragment Effects on the GPU using the k -Buffer,” ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (I3D), pp. 97-104, 2007.

J. D. Owens, D. Leubke, N. Govindaraju, M. Harris, J. Kruger, A. Lefohn, T. Purcell, “A Survey of General-Purpose Computation on Graphics Hardware,” State of the Art Report, Eurographics, 2005.

N. Fout, H. Akiba, K. Ma, A. E. Lefohn, J. Kniss, “High Quality Rendering of Compressed Volume Data Formats,” EuroVis (Eurographics/IEEE-VGTC Symposium on Visualization), 2005.

A. Riffel, A. E. Lefohn, K. Vidimce, M. Leone, J. D. Owens, “Mio: Fast Multipass Partitioning via Priority-Based Instruction Scheduling,” Graphics Hardware, pp. 35-44, 2004.

A. E. Lefohn, J. E. Cates, R. T. Whitaker, “Interactive, GPU-Based Level Sets for 3D Segmentation,” Medical Image Computing and Computer Assisted Intervention (MICCAI), pp. 564-572, 2003.

J. M. Kniss, S. Premoze, M. Ikits, A. E. Lefohn, C. D. Hansen, E. Praun, “Gaussian Transfer Functions for Multi-field Volume Visualization,” IEEE Visualization, pp. 497-504, 2003.

A. E. Lefohn, J. M. Kniss, C. D. Hansen, R. T. Whitaker, “Interactive Deformation and Visualization of Level Set Surfaces Using Graphics Hardware,” IEEE Visualization, pp. 75-82, 2003.

S. Premoze, T. Tasdizen, J. Bigler, A. E. Lefohn, R. T. Whitaker, “Particle-Based Simulation of Fluids,” Eurographics Computer Graphics Forum, pp. 401-410, 2003.

SIGGRAPH Sketches

A. Lefohn, S. Sengupta, J. Kniss, R. Strzodka, J. Owens, “Dynamic Adaptive Shadow Maps on Graphics Hardware,” ACM SIGGRAPH Conference Abstracts and Applications, 2005.

J. Kniss, A. Lefohn, R. Strzodka, S. Sengupta, J. Owens, “Octree Textures on Graphics Hardware,” ACM SIGGRAPH Conference Abstracts and Applications, 2005.

Book Chapters

A. E. Lefohn, J. Kniss, J. Owens, “Implementing Efficient Parallel Data Structures on GPUs,” in Matt Pharr, editor, *GPU Gems II: Programming Techniques for High-Performance Graphics and General-Purpose Computation*, Addison Wesley, Ch. 33, pp. 521-545, 2005.

J. Kniss, A. E. Lefohn, N. Fout, “Deferred Filtering: Rendering From Difficult Data Formats,” in Matt Pharr, editor, *GPU Gems II: Programming Techniques for High-Performance Graphics and General-Purpose Computation*, Addison Wesley, Ch. 41, pp. 669–677, 2005.

M. Ikits, J. Kniss, A. E. Lefohn, C. Hansen, “Volume Rendering Techniques,” in Randima Fernando, editor, *GPU Gems: Programming Techniques, Tips and Tricks for Real-Time Graphics*, Addison Wesley, Ch. 39, pp. 667–692, 2004.

Technical Reports

M. Pharr, A. Lefohn, C. Kolb, P. Lalonde, T. Foley, G. Berry, “Programmable Graphics—The Future of Interactive Rendering,” Neoptica Technical Report, March 2007.

L. Bavoil, S. P. Callahan, A. Lefohn, J. L. D. Comba, C. T. Silva, “Multi-Fragment Effects on the GPU using the k -buffer,” Scientific Computing and Imaging Institute Technical Report, UUSCI-2006-032, University of Utah, 2006.

M. Kass, A. Lefohn, J. Owens, “Interactive Depth of Field Using Simulated Diffusion on a GPU,” Pixar Animation Studios Technical Report, 06-01, 2006

J. E. Cates, A. E. Lefohn, R. T. Whitaker, “GIST: An Interactive GPU-Based Level Set Segmentation Tool For 3D Medical Images,” University of Utah School of Computing Technical Report, UUCS-04-007, 2004.

J. Kniss, S. Premoze, M. Ikits, A. Lefohn, C. Hansen, “Closed Form Solution to the Volume Rendering Integral with Gaussian Transfer Functions,” University of Utah School of Computing Technical Report, UUCS-03-013, 2003.

A. E. Lefohn, J. M. Kniss, C. D. Hansen, R. T. Whitaker, “Interactive Deformation and Visualization of Level Set Surfaces Using Graphics Hardware,” University of Utah School of Computing Technical Report, UUCS-03-005, 2003.

A. E. Lefohn, J. E. Cates, R. T. Whitaker, “Interactive, GPU-Based Level Sets for 3D Brain Tumor Segmentation,” University of Utah School of Computing Technical Report, UUCS-03-004, 2003.

A. E. Lefohn, R. T. Whitaker, “A GPU-Based, Three-Dimensional Level Set Solver with Curvature Flow,” University of Utah School of Computing Technical Report, UUCS-02-017, 2002.

Conference Tutorials

A. Lefohn, M. Houston, C. Boyd, K. Fatahalian, T. Forsyth, D. Luebke, A. Munshi, J. Owens, “Beyond Programmable Shading: Fundamentals,” ACM SIGGRAPH, 2008.

A. Lefohn, M. Houston, D. Luebke, J. Olick, F. Pellacini, M. Pharr, J. Shopf, “Beyond Programmable Shading: In Action,” ACM SIGGRAPH, 2008.

M. Houston, I. Buck, N. Govindaraju, M. Harris, J. Hensley, J. Kruger, A. Lefohn, J. Owens, “GPGPU: General-Purpose Computation on Graphics Hardware,” ACM SIGGRAPH, Course 24, 2007.

K. Museth, A. Lefohn, “Introduction to Level Set Methods, Data Structures, and Efficient Algorithms,” IEEE Visualization, Tutorial, 2007.

D. Breen, A. Lefohn, K. Museth, M. Rousson, “Level Set Applications for Visualization,” IEEE Visualization, Tutorial, 2007.

M. Harris, D. Leubke, I. Buck, N. Govindaraju, M. Houston, A. Lefohn, J. Owens, M. Pappakipos, M. Segal, “GPGPU: General-Purpose Computation on Graphics Hardware,” ACM/IEEE Supercomputing, Tutorial, 2006.

M. Harris, D. Luebke, I. Buck, N. Govindaraju, J. Kruger, A. E. Lefohn, T. Purcell, and C. Woolley, "GPGPU: General-Purpose Computation on Graphics Hardware," ACM SIGGRAPH, Course, 2005.

A. E. Lefohn (organizer), I. Buck, P. McCormick, J. D. Owens, T. Purcell, R. Strzodka, "GPGPU: General-Purpose Computation on Graphics Processors," IEEE Visualization, Tutorial, 2005.

D. Breen, M. Kirby, A. E. Lefohn, K. Museth, T. Preusser, G. Sapiro, R. Whitaker, "Level Set and PDE Methods for Visualization," IEEE Visualization, Tutorial, 2005.

M. Harris, D. Luebke, I. Buck, N. Govindaraju, J. Kruger, A. E. Lefohn, T. Purcell, and C. Woolley, "GPGPU: General-Purpose Computation on Graphics Hardware," ACM SIGGRAPH, Course 32, 2004.

A. E. Lefohn (organizer), I. Buck, J. D. Owens, R. Strzodka, "GPGPU: General-Purpose Computation on Graphics Processors," IEEE Visualization, Tutorial #3, 2004.

K. Engel, M. Hadwiger, J. Kniss, A. E. Lefohn, C. Rezk-Salama, D. Weiskopf, "Real-Time Volume Graphics," ACM SIGGRAPH, Course 28, 2004.

K. Engel, M. Hadwiger, J. Kniss, A. E. Lefohn, D. Weiskopf, "Interactive Visualization of Volumetric Data on Consumer PC Hardware," IEEE Visualization, Tutorial #1, 2003.

Poster Presentations

S. Sengupta, A. E. Lefohn, J. D. Owens, "A Work-Efficient Step-Efficient Prefix Sum Algorithm," Proceedings of the 2006 Workshop on Edge Computing Using New Commodity Architectures, pp. D-26-27, 2006

A. E. Lefohn, S. Sengupta, J. Kniss, R. Strzodka, J. D. Owens, "Glift: Generic Data Structures for the GPU," in Proceedings of the 2006 Workshop on Edge Computing Using New Commodity Architectures, pp. D-15-16, 2006

A. E. Lefohn, A. Riffel, K. Vidimce, M. Leone, J. D. Owens, "Mio: An Instruction Scheduling Approach to Fast Multipass Partitioning," ACM Workshop on General-Purpose Computing on Graphics Processors, Los Angeles, CA, August, 2004.

A. E. Lefohn, M. Ovchinnikov, G. Voth, "Polarflex: An MS-EVB Approach to a Polarizable and Flexible Water Model," West Coast Theoretical Chemistry Conference, Salt Lake City, UT, June, 2000.

A. E. Lefohn, M. A. Leich, S. J. Schvaneveldt, "A Comparison of the Molecular Dynamics and the Instantaneous Normal Modes of a Solvated Diatomic Molecule," Book of Abstracts, 213th American Chemical Society National Meeting, San Francisco, April 13-17, 1997.

Software

Programming system for GPU-accelerated shading in Pixar's Photorealistic RenderMan renderer. Created programming model, implemented compiler and runtime system, and integrated into existing film shading pipeline. Announced at ACM SIGGRAPH 2005 RenderMan User's Group Meeting and to be released with RenderMan version 13.

OpenGL Framebuffer Object class. Released on SourceForge at <http://gpgpu.sourceforge.net>. Over 10,000 downloads in two years. Released July 2005.

Software developer, "Star-Ray Interactive Ray Tracing Demo", Demo at SGI booth, ACM SIGGRAPH 2002.

Invited Talks

School of Computing, University of Utah, Salt Lake City, UT. Jan. 2007
NVIDIA-U / Midgraph, Urbana-Champaign, IL, Nov. 2005

NVIDIA Corporation, Santa Clara, CA, Sep. 2005, May 2004
Pixar Animation Studios, Emeryville, CA, May 2005, Feb. 2003
Intel Corporation, Santa Clara, CA, Apr. 2005
Stanford University, Stanford, CA, Apr. 2005
Los Alamos National Lab, Los Alamos, NM, Mar. 2005
ATI Research Silicon Valley, Inc., Santa Clara, CA, Oct. 2004, Mar. 2003
IBM T. J. Watson Research Center, Hawthorne, NY, Nov. 2003
Center of Advanced European Studies and Research (Caesar), Bonn, Germany, May 2003

Professional Experience

Intel *Senior Graphics Architect*
Bellevue, WA **Oct. 2007 – Present**
Designing rendering algorithms and programming models for next-generation interactive rendering.

Neoptica *Principle Engineer*
San Francisco, CA **May 2006 – Oct. 2007**
Developing technology to leverage heterogeneous parallel architectures for interactive computer graphics. Redefining interactive rendering programming in a world far beyond the constraints of OpenGL and DirectX. Neoptica was acquired by Intel in October of 2007.

Computer Science Dept., Univ. of Calif. *Graduate Research Assistant*
Davis, CA **Sept. 2003 – Sept. 2006**
Develop parallel data structure models for graphics processors and create novel rendering applications that demonstrate the effectiveness of the abstractions. The resulting GPU template library, Glift, has made it possible to implement real-time versions of octree textures, adaptive shadow maps, heat-diffusion depth-of-field, and various numerical solvers. Abstract GPU computation as parallel iteration over data structures.

Pixar Animation Studios *Researcher, Part-Time*
Emeryville, CA **Oct. 2005 – Mar. 2006**
Worked with Michael Kass to develop a new algorithm for interactive depth-of-field preview. The algorithm uses a heat diffusion model to perform variable-width blurs using recursive, infinite impulse response (IIR) filters. The GPU implementation uses an Alternating Direction Implicit (ADI) solver to achieve highly interactive frame rates while solving hundreds of tridiagonal, linear systems in parallel.

Pixar Animation Studios *Graphics Software Engineer, Part-Time*
Emeryville, CA **Jun. 2004 – Oct. 2005**
Research the viability of a GPU-accelerated shading engine in Pixar's Photorealistic RenderMan offline renderer. Led the design and implementation of a plugin compiler and runtime system for GPU shading in Renderman. Announced at the ACM SIGGRAPH 2005 as an optional extension to RenderMan 13.

Pixar Animation Studios *Graphics Software Engineer, Part-Time*
Emeryville, CA **Jun. 2003 – Jun. 2004**
Interactive rendering research and development in Pixar's Studio Tools division. Helped design, develop and debug *Lpics*, the first interactive, GPU relighting engine at Pixar. Worked with lighting artists to assess needs and fix problems.

School of Computing, University of Utah *Graduate Research Assistant*
Salt Lake City, UT **Jan. 2002 – Sept. 2003**
Accelerated the level-set method of computing deformable surfaces by a factor of 10x - 15x by mapping the sparse partial differential equation (PDE) solver to a graphics processor (GPU). Developed techniques for the simultaneous computation, visualization, and steering of level-set computations. Evaluated the new technique with a brain tumor segmentation study.

School of Computing, University of Utah

Salt Lake City, UT

Created a computer graphics technique to easily create human iris patterns. Method is applicable to both ocular prosthetics and computer graphics.

*Independent Research***Nov. 2001 – Mar. 2002****Chemistry Dept., University of Utah**

Salt Lake City, UT

Developed an electronically polarizable and geometrically flexible water model for molecular dynamics simulations, "Polarflex." Also advised the implementation of and helped design a remote visualization system for molecular dynamics simulations, "TclMd".

*Graduate Research Assistant***Jun. 1998 – May 2001****Chemistry Dept., Whitman College**

Walla Walla, WA

Wrote a Metropolis Monte Carlo simulation of a diatomic solute in an atomic solvent. Taught myself C++.

*Undergraduate Research***Jun. 1996 – May 1997****Teaching Experience****Computer Science Dept., Univ. of Calif.**

Davis, CA

Mentor new graduate students, Shubhbrata Sengupta and Adam Moerschell, in our research group. Help define research directions, involve them in my research, and guide their technical knowledge development.

*Graduate Mentor***Sep. 2004 – Present****School of Computing, University of Utah**

Salt Lake City, UT

Teaching assistant for Computer Science 6610, "Advanced Computer Graphics I." Designed homework assignments with Associate Professor Charles Hansen. Also presented several course lectures, graded assignments, and provided individual assistance to students.

*Teaching Assistant***Aug. 2001 – Dec. 2001****School of Computing, University of Utah**

Salt Lake City, UT

Teaching assistant for Computer Science 1020, "Introduction to Programming with C++" taught by Professor Dave Hanscom. Prepared and led discussion sections, graded homework and exams, and provided individual help to students.

*Teaching Assistant***Aug. 2000 – Dec. 2000****Chemistry Dept., University of Utah**

Salt Lake City, UT

Advised Nathan Lovell in scientific visualization research.
Advised David Small in theoretical chemistry research.

*Supervisor for Undergraduate Researchers***May 1999 – Aug. 2000****Chemistry Dept., University of Utah**

Salt Lake City, UT

Teaching assistant for Chemistry 1210, "General Chemistry I" taught by Professor Greg Voth. Helped write exams and coordinated three other teaching assistants. Led three discussion sections and graded exams.

*Head Teaching Assistant***Aug. 1998 – Dec. 1998****Professional Activities**

Reviewer for ACM SIGGRAPH Asia, 2008

Papers committee for Graphics Hardware, 2008

Reviewer for Eurographics Symposium on Rendering (EGSR), 2006–2008

Reviewer for Graphics Interface, 2008

Reviewer for IEEE Transactions on Visualization and Computer Graphics, 2005, 2008

Reviewer for ACM SIGGRAPH papers, 2003–2004, 2006–2007

Reviewer for ACM SIGGRAPH courses, 2006–2007

Reviewer for ACM Transactions on Graphics (TOG) 2006

Reviewer for IEEE Visualization, 2003–2006

Reviewer for Eurographics 2002, 2007 - 2008

Reviewer for Eurographics Workshop on Natural Phenomena, 2006

Reviewer for Eurographics Short Papers 2006

Sketches reviewer for ACM SIGGRAPH, 2005
Reviewer for Journal of Graphics Tools, 2005
Reviewer for Simulation Practice and Theory Journal (SIMPRA) special issue on GPUs, 2005
Reviewer for “GPU Gems 2” book by Matt Pharr, NVIDIA Corporation, 2004
Reviewer for “GPU Gems” book by Randy Fernando, NVIDIA Corporation, 2003
Reviewer for Eurographics-IEEE Symposium on Visualization (VisSym), 2003

Attended ACM SIGGRAPH annual conference, 2001–2007

Attended IEEE Visualization, 2003–2005

Attended Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2003

Organized GPGPU tutorial, IEEE Visualization 2004, 2005

Co-organized “Realistic Image Synthesis” graduate course, University of California Davis, 2004

Organized and led weekly physically-based animation seminar, Univ. of Utah, 2002

Other Activities Professional Ski Instructors of America, Level 3 certified alpine ski instructor, 1991–Present
Head of rock climbing instruction program, Whitman College, 1996–1997
Leader of student rock climbing and backpacking trips, Whitman College, 1992–1997