

## 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

M. Salvi, K. Vidimce, A. Lauritzen, A. Lefohn, "Adaptive Volumetric Shadow Maps," Computer Graphics Forum (Proceedings of Eurographics Symposium on Rendering), 29(4), pp. 1289-1296, June 2010.

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 Algorithm: 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 (organizer), M. Houston (organizer), K. Fatahalian, C. Boyd, J. Andersson, D. Luebke, J. Ragan-Kelley, K. Akeley, L. Fascione, J. Pantaleoni, A. Lauritzen, D. Blythe, S. Molnar, “Beyond Programmable Shading,” ACM SIGGRAPH, 2010.

A. Lefohn (organizer), M. Houston (organizer), K. Fatahalian, T. Foley, J. Andersson, J.M.P. van Waveren, U. Assarsson, J. Hensley, P. Lalonde, D. Luebke, K. Akeley, J. Ragan-Kelley, C. Everitt, “Beyond Programmable Shading,” ACM SIGGRAPH, 2009.

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

A. Lefohn (organizer), 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. Papanikolaou, 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.

#### **Invited Talks**

"High Performance Graphics in 7 Years," Panel at High Performance Graphics, Aug. 2009

"Interactive Rendering Programming in 2009," CS Dept., Univ. of Washington, Feb. 2009

"Beyond Programmable Shading," School of Computing, Univ. of Utah, Jan. 2007

"Glift: Generic, Efficient GPU Data Structures", NVIDIA-U / Midgraph, Nov. 2005

"Glift: Generic, Efficient GPU Data Structures", NVIDIA Corp., Sep. 2005

"Glift: An Abstraction for Generic, Efficient GPU Data Structures", Pixar, May 2005

"Glift: An Abstraction for Generic, Efficient GPU Data Structures", Intel Corp., Apr. 2005

"An Abstraction for Generic, Random-Access GPU Data Structures", Stanford, Apr. 2005

"Glift: Generic, Efficient GPU Data Structures", Los Alamos Natl. Lab, Mar. 2005

"Mio: Fast Multipass Partitioning", ATI Research, Santa Clara, CA, Oct. 2004

"Interactive Level-Set Surface Deformation on the GPU", NVIDIA Corp., May 2004

"Interactive Level-Set Surface Deformation on the GPU", ATI Research, Mar. 2003

“Interactive Level-Set Surface Deformation on the GPU”, Pixar Animation Studios, Feb. 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** *Graphics Researcher and Architect*  
Seattle, WA **Oct. 2007 – Present**  
Designing rendering algorithms, pipelines, and programming models for next-generation interactive rendering. Led team of five researchers to create new shadow rendering algorithms for upcoming graphics architectures. I also led Intel’s engagement in OpenCL and designed a major portion of the heterogeneous parallelism aspects of the API.

**Stanford University** *Lecturer*  
Stanford, CA **Mar. 2010 – Jun. 2010**  
Proposed, co-created, and co-taught new computer graphics graduate course, “Beyond Programmable Shading,” with Mike Houston from AMD. The course introduces students to the parallel graphics architectures and parallel programming models used to create advanced real-time rendering algorithms and alternate rendering pipelines. The course also introduces students to many of the unsolved rendering and programming model research topics in the field.

**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 map-

ping 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., Stanford Univ.**

Stanford, CA

Co-design and co-teach a new graduate graphics course at Stanford called "Beyond Programmable Shading" with Mike Houston that is an expanded version of the ACM SIGGRAPH course we have led since 2008.

*Lecturer*

**Mar. 2010 – Jun. 2010**

**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 – Mar. 2006**

**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**

Papers committee for High Performance Graphics, 2009–2010

Posters co-chair for High Performance Graphics, 2010

Reviewer for ACM SIGGRAPH papers, 2003–2004, 2006–2007, 2009–2010  
Reviewer for Eurographics 2010  
Reviewer for Computer Graphics & Applications, 2010  
Reviewer for EuroVis 2009  
Reviewer for ACM SIGGRAPH Asia, 2008-2009  
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 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, 2001–2009  
Attended IEEE Visualization, 2003–2005, 2007  
Attended Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2003

Organized Beyond Programmable Shading tutorial, ACM SIGGRAPH 2008–2010  
Organized GPGPU tutorial, IEEE Visualization 2004, 2005  
Co-organized “Realistic Image Synthesis” graduate course, University of California Davis, 2004

**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  
Mountain and road biking, backcountry and alpine skiing, rock climbing, mountaineering