David P. Luebke
Curriculum Vitae

Vice President of Research
NVIDIA Corporation
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Charlottesville, VA 22911
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INTERESTS Computer graphics, virtual/augmented reality, GPU computing, and related fields

EDUCATION

University of North Carolina at Chapel Hill (Chapel Hill, NC)
M.S. in Computer Science, 1997
Ph.D. in Computer Science, 1998, Dr. Frederick P. Brooks, Advisor:
View-Dependent Simplification of Arbitrary Polygonal Environments

The Colorado College (Colorado Springs, CO)
B.A. *magna cum laude* in Chemistry, 1993;
Barnes Chemistry Scholar

EXPERIENCE

NVIDIA Corporation: Vice President of Research (March 2016-Present)

NVIDIA Corporation: Senior Director of Research (March 2012-Present)

NVIDIA Corporation: Director of Research (Dec 2009-Mar 2012)

NVIDIA Corporation: Manager, NVIDIA Research (Aug 2008-Dec 2009)

NVIDIA Corporation: Senior Research Scientist (July 2006-Aug 2008)

University of Virginia: Assistant Professor (Aug 1998-May 2006)

The Colorado College: Visiting Instructor (Spring 1997)

International Business Machines: Research Intern (Summer 1994, 1996-97)

Silicon Graphics, Inc.: Research Intern, Nintendo64 Project (Summer 1995)

SELECTED HONORS

IEEE VR Technical Achievement Award (2021)

Fellow of the IEEE for "GPU computing & computer graphics" (2016)

NVIDIA Distinguished Inventor (2008)

SIGGRAPH 2010 OptiX paper chosen for **CACM Research Highlights** (2012)

Best Paper Award, SIGGRAPH Symposium on Interactive 3D Graphics (2010)

Test of Time Award, SIGGRAPH Symposium on Interactive 3D Graphics (2005)

NSF **CAREER Award** (2001-2006); DOE **Early Career PI Award** (2002-05)

BOOKS

Level of Detail for 3D Graphics. Luebke, D., Reddy, M., Cohen, J., Varshney, A., Watson, B., and Huebner, R. Morgan-Kaufmann Publishers, San Francisco (July 2002). 2nd Printing.

JOURNAL ARTICLES

Josef Spjut, Ben Boudaoud, Jonghyun Kim, Trey Greer, Rachel Albert, Michael Stengel, Kaan Aksit, and David Luebke. "Towards Standardized Classification of Foveated Displays." *IEEE Transactions on Visualization and Computer Graphics*, Vol. 26 No 5, May 2020 (Presented at IEEE VR, journal track, Atlanta).

Qi Sun, Fu-Chung Huang, Li-Yi Wei, David Luebke, Arie Kaufman, and Joohwan Kim. "Eccentricity effects on blur and depth perception", *Optics Express*, Vol. 28 No. 5, January 2020.

Jonghyun Kim, Youngmo Jeong, Michael Stengel, Kaan Akşit, Rachel Albert, Ben Boudaoud, Trey Greer, Joohwan Kim, Ward Lopes, Zander Majercik, Peter Shirley, Josef Spjut, Morgan McGuire, and David Luebke. "Foveated AR: dynamically-foveated augmented reality display," *ACM Transactions on Graphics*, Vol. 38 No. 4, July 2019 (Proceedings SIGGRAPH 2019, Los Angeles).

Kaan Akşit, Praneeth Chakravarthula, Kishore Rathinavel, Youngmo Jeong, Rachel Albert, Henry Fuchs, and David Luebke. "Manufacturing Application-Driven Foveated Near-Eye Displays," *IEEE Transactions on Visualization and Computer Graphics*, Vol. 25 No. 5, May 2019.

Jose Barreiros, Houston Claure, Bryan Peele, Omer Shapira, Josef Spjut, David Luebke, Malte Jung, Robert Shepherd. "Fluidic Elastomer Actuators for Haptic Interactions in Virtual Reality," *IEEE Robotics and Automation Letters*, Vol. 4 No. 2, December 2018.

Qi Sun, Anjul Patney, Li-Yi Wei, Omer Shapira, Jingwan Lu, Paul Asente, Suwen Zhu, Morgan Mcguire, David Luebke, and Arie Kaufman. "Towards virtual reality infinite walking: dynamic saccadic redirection," *ACM Transactions on Graphics*, Vol. 37 No. 4, July 2018 (Proceedings of SIGGRAPH 2018, Vancouver, Canada).

Kaan Aksit, Ward Lopes, Jonghyun Kim, Peter Shirley, and David Luebke. "Near-Eye Varifocal Augmented Reality Display using See-Through Screens," *ACM Transactions on Graphics*, Vol. 36 No. 7, November 2017 (Proceedings of SIGGRAPH Asia 2017, Bangkok, Thailand).

Liang Shi, Fu-Chung Huang, Ward Lopes, Wojciech Matusik, and David Luebke. "Near-eye Light Field Holographic Rendering with Spherical Waves for Wide Field of View Interactive 3D Computer Graphics," *ACM Transactions on Graphics*, Vol. 36 No. 7, November 2017 (Proceedings of SIGGRAPH Asia 2017, Bangkok, Thailand).

Qi Sun, Fu-Chung Huang, Joohwan Kim, Li-Yi Wei, David Luebke, and Arie Kaufman. "Perceptually-Guided Foveation for Light Field Displays." *ACM Transactions on Graphics*, Vol. 36 No. 7, November 2017 (Proceedings of SIGGRAPH Asia 2017, Bangkok, Thailand).

Rachel Albert, Joohwan Kim, Anjul Patney, and David Luebke. "Latency Requirements for Foveated Rendering in Virtual Reality," *ACM Transactions on Applied Perception* (Special Issue SAP 2017), Vol. 14 No. 4 (September 2017).

Fu-Chung Huang, Dawid Pajak, Jonghyun Kim, Jan Kautz, and David Luebke. "Mixed-primary Factorization for Dual-frame Computational Displays.", *ACM Transactions on Graphics*, Vol. 36 No. 4, July 2017 (Proceedings of SIGGRAPH 2017, Los Angeles, CA).

David Dunn, Cary Tippets, Kent Torell, Petr Kellnhofer, Kaan Akşit, Piotr Didyk, Karol Myszkowski, David Luebke, and Henry Fuchs. "Wide field of view varifocal near-eye display using see-through deformable membrane mirrors*.", IEEE Transactions on Visualization and Computer Graphics* (Selected Proceedings, IEEE Virtual Reality 2017), Los Angeles, CA (2017). **IEEE VR 2017 Best Paper Award.**

Anjul Patney, Marco Salvi, Joohwan Kim, Anton Kaplanyan, Chris Wyman, Nir Benty, David Luebke, and Aaron Lefohn. "Towards foveated rendering for gaze-tracked virtual reality.", *ACM Transactions on Graphics*, Vol. 35 No. 6, December 2016 (Proceedings of SIGGRAPH Asia 2016, Macao, China).

Cyril Crassin, David Luebke, Michael Mara, Morgan McGuire, Brent Oster, Peter Shirley, Peter-Pike Sloan, and Chris Wyman. "CloudLight: A System for Amortizing Indirect Lighting in Real-Time Rendering." *Journal of Computer Graphics Techniques* 4:4 (September-December 2015).

Akşit, K., Kautz, J., and Luebke, D. "Slim Near-Eye Display Using Pinhole Aperture Arrays." *Applied Optics*, Vol. 54 No. 11, April 10, 2015.

Maimone, A., Lanman, D., Rathinavel, K., Keller, K., Luebke, D., and Fuchs, H. "Pinlight Displays: Wide Field of View Augmented-Reality Eyeglasses using Defocused Point Light Sources." *ACM Transactions on Graphics*, Vol. 33 No. 4, August 2014 (Proceedings of ACM SIGGRAPH 2014, Vancouver, Canada).

Heide, F., Lanman, D., Reddy, D., Kautz, J., Pulli, K., and Luebke, D. "Cascaded Displays: Spatiotemporal Superresolution Using Offset Pixel Layers." *ACM Transactions on Graphics*, Vol. 33 No. 4, August 2014 (Proceedings of ACM SIGGRAPH 2014, Vancouver, Canada).

Lanman, D. and Luebke, D. "Near-Eye Light Field Displays." *ACM Transactions on Graphics*, Vol. 32 No. 6, November 2013 (Proceedings of ACM SIGGRAPH Asia 2013, Hong Kong).

Parker, S.G., Friedrich, H., Luebke, D., Morley, K., Bigler, J., Hoberock, J., McAllister, D., Robison, A., Dietrich, A., Humphreys, G., McGuire, M., Stich, M. "GPU Ray Tracing." *Communications of the ACM*, Vol. 56 No. 5, May 2013. **CACM Research Highlights:** *Communications of the ACM* chose our SIGGRAPH 2010 OptiX paper as one of "the most important research results published in CS in recent years." This revised version of the paper appears with an accompanying Technical Perspective by Matt Pharr.

Wetzstein, G., Heidrich, W., and Luebke, D. "Optical Image Processing Using Light Modulation Displays." *Computer Graphics Forum*, Vol. 29 No. 6, 2010. (Presented at Eurographics 2011)

Parker, S.G., Bigler, J., Dietrich, A., Friedrich, H. Hoberock, J., Luebke, D.,

McAllister, D., McGuire, M., Morley, M., Robison, A., and Stich, M. "OptiX: A General Purpose Ray Tracing Engine." *ACM Transactions on Graphics*, Vol. 29 No. 4, July 2010 (Proceedings of ACM SIGGRAPH 2010, Los Angeles, CA).

Wang, R., Cheslack-Postava, E., Wang, R., Luebke, D., Chen, Q., Hua, W., Peng, Q., and Bao, H."Real-time Editing and Relighting of Homogeneous Translucent Materials." *The Visual Computer*, Vol. 24 No. 7-9, pp. 565-575. Presented at Computer Graphics International 2008.

Owens, J., Houston, M., Luebke, D., Green, S., Stone, J., and Phillips, J. "GPU Computing." *Proceedings of the IEEE,* March 2008.

Luebke, D., and Humphreys, G. "How GPUs Work." Invited article, *IEEE Computer*, Vol. 40 No. 2, pp 96-100, February 2007.

John D. Owens, David Luebke, Naga Govindaraju, Mark Harris, Jens Krüger, Aaron E. Lefohn, and Tim Purcell. "A Survey of General-Purpose Computation on Graphics Hardware," *Computer Graphics Forum*, Vol. 26 No. 1, March 2007.

Dale, K., Sheaffer, J.,Kumar, V., Luebke, D., Humphreys, G., and Skadron, K. "Small-Scale Reconfigurability for Improved Performance and Double Precision in Graphics Hardware," *Int'l Journal of Electronics*, Vol. 94 No. 5, May 2007.

Wang, R., Tran, J., and Luebke, D. "All-Frequency Relighting of Glossy Objects." *ACM Transactions on Graphics*, Vol. 25 No. 2, April 2006.

Wang, R., Tran, J., and Luebke, D. "All-Frequency Interactive Relighting of Translucent Objects with Single and Multiple Scattering", *ACM Transactions on Graphics*, Vol. 24 No. 3, August 2005 (Proceedings of ACM SIGGRAPH 2005, Los Angeles, CA).

Luebke, D. and Watson, B. "The Ultimate Display: Where Will All The Pixels Come From?". Invited article, *IEEE Computer*, Vol. 38 No. 8, August 2005.

Watson, B., Dayal, A., Luebke, D., and Woolley, C. "Improving adaptive display with temporally adaptive rendering", *CyberPsychology & Behavior*, Vol. 7 No. 6 (December 2004).

Luebke, D. "A Developer's Survey of Polygonal Simplification Algorithms", *IEEE Computer Graphics & Applications* (May 2001).

Luebke, D., and Erikson, C. "View-Dependent Simplification of Arbitrary Polygonal Environments," *Computer Graphics*, Vol. 31 (July 1997). First presented at ACM SIGGRAPH 97 (acceptance rate: 18%).

CONFERENCE PAPERS (REFEREED)

Richard Li, Eric Whitmire, Michael Stengel, Ben Boudaoud, Jan Kautz, David Luebke, Shwetak Patel, Kaan Akşit. "Optical Gaze Tracking with Spatially-Sparse Single-Pixel Detectors", IEEE International Symposium on Mixed and Augmented Reality, November 2020 (ISMAR 2020, Virtual).

Rachel Albert, Angelica Godinez, and David Luebke. "Reading Speed Decreases for Fast Readers Under Gaze-Contingent Rendering," *2019 Symposium on Applied Perception*, September 2019 (SAP 2019, Barcelona, Spain).

Joohwan Kim, Michael Stengel, Alexander Majercik, Shalini De Mello, David Dunn, Samuli Laine, Morgan McGuire, and David Luebke. "NVGaze: An anatomically-informed dataset for low-latency, near-eye gaze estimation," *Proceedings of the 2019 ACM CHI Conference on Human Factors in Computing Systems*, April 2019 (CHI 2019, Glasgow, Scotland).

Benjamin C Mac Murray, Bryan N Peele, Patricia Xu, Josef Spjut, Omer Shapira, David Luebke, Robert F Shepherd. "A variable shape and variable stiffness controller for haptic virtual interactions," *2018 IEEE International Conference on Soft Robotics*, April 2018 (RoboSoft 2018, Livorno, Italy).

Morgan McGuire, Michael Mara, Derek Nowrouzezahrai, and David Luebke. "Real-time global illumination using precomputed light field probes." *ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games* (I3D 2017), San Francisco, CA.

Alexander Reshetov and David Luebke. "Phantom Ray-Hair Intersector," *Proceedings of the 2013 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, (March 2013), Orlando, FL.

Michael Mara, Morgan McGuire, Derek Nowrouzezahrai, and David Luebke. "Deep G-Buffers for Stable Global Illumination Approximation." *High Performance Graphics 2016*, Dublin, Ireland (June 2016).

Alexander Reshetov and David Luebke. "Infinite Resolution Textures." *High Performance Graphics 2016*, Dublin, Ireland (June 2016).

Kautz, J., Widmer, S., Pajak, D., Schulz, A., Pulli, K., Goesele, M., and Luebke, D. "An Adaptive Acceleration Structure for Screen-Space Ray Tracing." *High Performance Graphics 2015* (August 2015), Los Angeles, CA.

Ip, C.Y., Yalçi, M.A., Luebke, D., and Varshney, A. "PixelPie: Maximal Poisson-disk Sampling with Rasterization", *High Performance Graphics 2013* (July 2013), Anaheim, CA.

Mara, M., McGuire, M., and Luebke, D. "Toward Practical Real-Time Photon Mapping: Efficient GPU Density Estimation", *Proceedings of the 2013 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, (March 2013), Orlando, FL.

McGuire, M., Mara, M., and Luebke, D. "Scalable Ambient Obscurance", *High Performance Graphics 2012* (June 2012), Paris, France.

Chajdas, M., McGuire, M., and Luebke, D. "Subpixel Reconstruction Antialiasing", *Proceedings of the 2011 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, (February 2011), San Francisco, CA.

Shirley, P., Aila, T., Cohen, J., Enderton, E., Laine, S. and Luebke, D. "A Local Image Reconstruction Algorithm for Stochastic Rendering", *Proceedings of the 2011 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, (February 2011), San Francisco, CA.

McGuire, M., Enderton, E., Shirley, P., and Luebke, D. “Real-Time Stochastic Rasterization on Conventional GPU Architectures”, *High Performance Graphics 2010* (June 2010), Saarbrücken, Germany.
Pantaleoni, J., and Luebke, D. “HLBVH: Hierarchical LBVH Construction for Real-Time Ray Tracing”, *High Performance Graphics 2010* (June 2010), Saarbrücken, Germany.

Enderton, E., Sintorn, E., Shirley, P., and Luebke, D. “Stochastic Transparency”, *Proceedings of the 2010 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, (February 2010), Washington, DC. **Best Paper Award, I3D 2010**.

McGuire, M., and Luebke, D. “Hardware-accelerated global illumination by image space photon mapping”, *High Performance Graphics 2009* (August 2009), New Orleans, LA.

Lauterbach, C., Garland, M., Sengupta, S., Luebke, D., and Manocha, D. “Fast BVH construction on GPUs”, *Eurographics 2009* (March 2009), Munich, Germany.

Luebke, D. “CUDA: Scalable Parallel Programming for High-Performance Scientific Computing”. *2008 IEEE Int’l Symposium on Biomedical Imaging* (May 2008), Paris, France.

Sheaffer, J., Luebke, D., and Skadron, K. “A Hardware Redundancy and Recovery Mechanism for Reliable Scientific Computation on Graphics Processors”, *Graphics Hardware 2007* (August 2007; acceptance rate 40%), San Diego, CA.

D’Eon, E., Luebke, D., and Enderton, E. “Efficient Rendering of Human Skin,” *Proceedings of 2007 Eurographics Symposium on Rendering* (June 2007; acceptance rate 35%), Grenoble, France. Also appears as *Rendering Techniques 2007*, Ed. Jan Kautz and Sumanta Pattanaik, Springer-Verlag, Austria (June 2007).

Sheaffer, J., Luebke, D., and Skadron, K. “The Visual Vulnerability Spectrum: Characterizing Architectural Vulnerability for Graphics Hardware.”, *Graphics Hardware 2006* (September 2006; acceptance rate 31%).

Wang, R., Ng, R., Luebke, D., Humphreys, G. “Effiicent Wavelet Rotation for Environment Map Rendering,” *Proceedings of the 2006 Eurographics Symposium on Rendering*, Nicosia, Cyprus (June 2006; acceptance rate 35.7%). Also appears as *Rendering Techniques 2006*, Ed. Wolfgang Heidrich and Tomas Akenine-Moller, Springer-Verlag, Vienna).

Dale, K., Sheaffer, J., Kumar, V., Luebke, D., Humphreys, G., and Skadron, K. “Applications of Small-Scale Reconfigurability to Graphics Processors,” *International Workshop on Applied Reconfigurable Computing (ARC2006)* (March 2006; acceptance rate 22%). **Selected as one of 10 best workshop papers to be extended for a special edition of the International Journal of Electronics.** Published as book chapter in *Reconfigurable Computing: Architectures and Applications* (Series: *Lecture Notes in Computer Science*), Volume 3985/2006, pp. 99-108.

Stoleru, R., He, T., Stankovic, J., and Luebke, D. "A High-Accuracy, Low-Cost Localization System for Wireless Sensor Networks," *ACM SenSys 2005* (November 2005; acceptance rate 16.8%), San Diego, CA.

Zhu, T., Wang, R., and Luebke, D. "A GPU-Accelerated Render Cache," *Pacific Graphics 2005*, Macao, China (October 2005).

Dayal, A., Woolley, C., Watson, B., and Luebke, D. "Adaptive Frameless Rendering," *Proceedings of 2005 Eurographics Symposium on Rendering* (June 2005; acceptance rate 33%), Konstanz, Germany. Also appears as *Rendering Techniques*, Ed. Kavita Bala, Philip Dutre, Springer-Verlag, Austria (June 2005).

Owens, J.D., Luebke, D., Govindaraju, N., Harris, M., Krüger, J., Lefohn, A. E., and Purcell, T. "A Survey of General-Purpose Computation on Graphics Hardware". State of the Art Report (STAR), *Eurographics 2005*, Dublin, Ireland (August 2005).

Sheaffer, J., Skadron, K., and Luebke, D. "Studying Thermal Management for Graphics-Processor Architectures." *Proceedings of the 2005 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2005)*, Austin, TX (March 2005). Acceptance rate: 29%

Sheaffer, J., Luebke, D., and Skadron, K. "A Flexible Simulation Framework for Graphics Architectures". *Proceedings of Graphics Hardware 2004*, Grenoble, France (August 2004). Acceptance rate: 32%

Wang, R., Tran, J., and Luebke, D. "All-Frequency Relighting of Non-Diffuse Objects using Separable BRDF Approximation", *Proceedings of 2004 Eurographics Symposium on Rendering*, Norrköping, Sweden (acceptance rate: 40%). Also appears as *Rendering Techniques*, pp. 345-354, Ed. Henrik Wann Jensen and Alex Keller, Springer-Verlag, Austria (June 2004).

Williams, N., Hantak, C., Low, K., Thomas, J., Keller, K., Nyland, L., Luebke, D., and Lastra, A. "Monticello Through the Window". *Proceedings of the 4th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage (VAST 2003)*, Brighton, UK (November 2003).

Wang, R., and Luebke, D. "Efficient Reconstruction and Texture Mapping of Indoor Scenes," *Proceedings of the 4th International Conference on 3-D Digital Imaging and Modeling (3DIM 2003)* (October 2003). Acceptance rate: 40%

Goodnight, N., Woolley, C., Lewin, G., Luebke, D., and Humphreys, G. "A Multigrid Solver for Boundary Value Problems Using Programmable Graphics Hardware," *Proceedings of Graphics Hardware 2003*, San Diego, CA (July 2003). Acceptance rate: 33%

Williams, N., Luebke, D., Cohen, J., Kelley, M., and Schubert, B. "Perceptually Guided Simplification of Lit, Textured Meshes," *2003 Symposium on Interactive 3D Graphics*, Monterey, CA (April 2003). Acceptance rate: 26%

Woolley, J. C., Dayal, A., Watson, B., and Luebke, D. "Interruptible Rendering," *2003 Symposium on Interactive 3D Graphics*, Monterey, CA (April 2003). Acceptance rate: 26%

Luebke, D. and Hallen, B. "Perceptually Driven Simplification for Interactive Rendering", *Proceedings of the 2001 Eurographics Workshop on Rendering*, London, United Kingdom (acceptance rate: 39%). Also appears as *Rendering Techniques*, Ed. Steven Gortler and Karol Myszkowski, Springer-Verlag, Austria (June 2001).

Cornish, D., Rowan, A., and Luebke, D. "View-Dependent Particles for Interactive Non-Photorealistic Rendering", *Proceedings of Graphics Interface 2001* (June 2001). Acceptance rate: 48%

Luebke, D., and Georges, C. "Portals and Mirrors: Simple, Fast Evaluation of Potentially Visible Sets," *ACM Symposium on Interactive 3D Graphics* (April 1995). Acceptance rate: 34%. **Winner, 2005 Test of Time Award (for paper with the most impact from the first five years of the Symposium)**.

BOOK CHAPTERS

"Advanced Techniques for Realistic Real-Time Skin Rendering." Eugene d'Eon and David Luebke. *GPU Gems 3*, Editor Hubert Nguyen. Addison-Wesley (August 2007).

PROCEEDINGS EDITED

Proceedings of the 2005 ACM SIGGRAPH Symposium on Interactive 3D Graphics & Games., Ed. David Luebke and Hanspeter Pfister, ACM Press, New York, NY.

Proceedings of ACM SIGGRAPH High Performance Graphics 2011, Ed. Aaron Lefohn and David Luebke, ACM Press, New York, NY.

JURIED ANIMATIONS

"NVIDIA Real-Time Graphics Research: The GeForce 8 Demo Suite." NVIDIA Demo Team. Video animation, ACM SIGGRAPH Computer Animation Festival, *SIGGRAPH 2007 Electronic Theater*, San Diego, CA (August 6-8, 2007).

POSTERS (REFEREED)

Tran, J., Jordan, D., Luebke, D. "New Challenges for Cellular Automata Simulation on the GPU," ACM Workshop on General Purpose Computing on Graphics Processors (August 2004).

Sheaffer, J., Skadron, K., Luebke, D. "Temperature-Aware GPU Design," **Finalist, ACM Student Research Competition** (5 finalists chosen from 118 entries), presented at a special session of ACM SIGGRAPH 2004 (August 2004).

Cohen, J., Duca, N., Luebke, D., Schubert, B. "GLOD: A Geometric Level of Detail System at the OpenGL API Level", **Best Poster Award**, *IEEE Visualization 2003* (July 2003).

PRESENTATIONS (REFEREED)

Lanman, D., and Luebke, D. "Near-Eye Light Field Displays", *SIGGRAPH 2013 Talks* (July 2013).

Crassin, C., Luebke, D., Mara, M., McGuire, M., Oster, B., Shirley, P., Sloan, P-P., Wyman, C. "Interactive Indirect Lighting Computed in the Cloud", *SIGGRAPH 2013 Talks* (July 2013).

Cohen, J., Luebke, D., Duca, N., Schubert, B. "GLOD: A Driver-Level Interface for Geometric Level of Detail", *SIGGRAPH 2003 Technical Sketch* (July 2003).

Woolley, J., Luebke, D., and Watson, B. "Interruptible Rendering," *SIGGRAPH 2002 Technical Sketch* (July 2002).

Dayal, A., Watson, B., and Luebke, D. "Improving Frameless Rendering by Focusing on Change." *SIGGRAPH 2002 Technical Sketch* (July 2002).

Luebke, D. "Perceptually Guided Level of Detail", *Perceptually Adaptive Graphics,* ACM SIGGRAPH/Eurographics Campfire, Snowbird Utah (May 2001). See *http://isg.cs.tcd.ie/campfire/davidluebke.html*.

MUSEUM EXHIBITS

The Virtual Monticello museum exhibit, produced in collaboration with researchers at the University of North Carolina, showcased computer graphics at the major exhibition Jefferson's America & Napoleon's France: Commemorating the Bicentennial of the Louisiana Purchase at the New Orleans Museum of Art. Visitors to the Museum peeked through virtual windows into Thomas Jefferson's library, an extremely detailed computer model produced from the real-world library with a laser-based 3D scanner. The computer model was brought to life using polarized projection (similar to a 3D movie) and a magnetic tracker that adjusted the image as the viewer moved, depicting what they would see through a real window. The exhibition was visited by over 110,000 people from April 12-August 31, 2003.

HONORS AND AWARDS

IEEE VR Technical Achievement Award (2021)
Fellow of the IEEE (2016)
CACM Research Highlights (2012) for SIGGRAPH 2010 OptiX paper
NVIDIA Distinguished Inventor (2008).
Test of Time Award, ACM SIGGRAPH Symposium on Interactive 3D Graphics (2005).
National Science Foundation **CAREER Award** (2001-2006)
Department of Energy **Early Career PI Award** (2002-05)
UVA **Teaching + Technology Initiative Fellowship** (2001)
UVA **University Teaching Fellowship** (2000-01)
UVA Faculty Senate Teaching Initiative Award (1999)
UVA ACM **Undergraduate Teaching Award** (1998-99)
IBM Graduate Fellowship (1995-1997; twice renewed)

The 2021 **IEEE VR Technical Achievement Award** was given for "research and leadership at the intersection of rendering algorithms, display technology, and human perception." The IEEE site states, "With an interdisciplinary orientation, Dr. Luebke and his team have advanced the state of virtual reality across topics as diverse as real-time rendering, low-latency display, foveated resolution, redirected walking, haptics, and focus-supporting displays."

The citation for my elevation to **IEEE Fellow** reads, "…for contributions to GPU computing and computer graphics."

The ***Communications of the ACM*** **Research Highlights** featured our SIGGRAPH 2010 OptiX paper as one of "the most important research results published in CS in recent years," with a Technical Perspective by Matt Pharr.

The **NVIDIA Distinguished Inventor** award recognizes individuals who have made outstanding contributions to NVIDIA's intellectual property portfolio. Only 10 such awards have been made at this time (among over 3400 R&D employees).

The **Interactive 3D Graphics Test of Time Award** was chosen to honor the single paper from the first five years of the conference judged to have had the most important, lasting impact on the field of interactive 3D computer graphics. Papers were nominated by the I3D 2005 international program committee and voted on by the program committee, conference attendees, and the ACM SIGGRAPH 2005 program committee. The award was given to me and my co-author Chris Georges (both graduate students at the time) for our 1995 paper *Portals and Mirrors: Simple, Fast Evaluation of Potentially Visible Sets*. The nomination, made by Stephen Chenney at the University of Wisconsin, read in part, "…There are few papers ever in graphics that present such a useful, simple idea so important to real time environments. Possible to teach in an undergraduate graphics class, yet a fundamental enabling technology for the most important commercial applications of what we do."

The **University Teaching Fellowship** and the **Teaching + Technology Fellowship** were year-long fellowships at UVA. These provided equipment, software, buyout, and summer salary to support the design and offering of an interdisciplinary course "3D Animation and Special Effects", taken by students from over a dozen majors scattered across the entire University, and combining 3-D graphics, art, film, music, and digital media.

EXHIBITS (REFEREED)

Towards AR for Humans: Matching Prescription & Visual Acuity, *SIGGRAPH 2019 Emerging Technologies* (July 2019). Inspired by human visual perception, we demonstrate two novel wearable augmented reality displays. The first "Prescription AR" integrates prescription correction in a 5mm-thick image combiner. The static prototype is 50g and has an eyeglasses form factor. The second "Foveated AR" display combines a microOLED and a holographic Maxwellian-view display to adapt to user gaze by moving a high-resolution inset and adjust focal depth. **Won Best of Show at SIGGRAPH 2019 Emerging Technologies.**

Manufacturing Application-Driven Foveated Near-Eye Displays, *SIGGRAPH 2018 Emerging Technologies* (July 2018). We present a novel optical design for augmented reality near-eye displays exploiting 3D stereolithography printing techniques to achieve similar characteristics to progressive prescription binoculars. We show how to manufacture inter-changeable optical components using 3D printing, leading to arbitrary shaped static projection screen surfaces that are adaptive to the targeted applications. We presented an augmented reality prototype with a moderate form-factor, large field of view, and demonstrated a prototype foveation technique using a moving lens in front of a projection system. We argue that these techniques provide a gateway to application-adaptive, easily replicable, customizable, and cost-effective near-eye display designs. **Won Best of Show at SIGGRAPH 2018 Emerging Technologies**. The corresponding IEEE VR paper can be found at https://ieeexplore.ieee.org/document/8642529.

Near-Eye Varifocal Augmented Reality Display using See-Through Screens, *SIGGRAPH 2017 Emerging Technologies* (July 2017). We demonstrated a novel optical layout for near-eye display that uses a curved combiner magnifying a see-through holographic diffuser, to create an on-axis optical imaging system from an off-axis projector. This design has several advantages including simplicity and wide field of view. Most importantly, the design supports optical see-through augmented reality (using a partially reflective combiner) and variable focal length (by moving the combiner). The corresponding SIGGRAPH paper can be found at https://research.nvidia.com/publication/2017-11_Near-Eye-Varifocal-Augmented.

Foveated Rendering, *SIGGRAPH 2016 Emerging Technologies* (July 2016). We demonstrate foveated rendering in virtual reality with an HMD-integrated eye tracker, rendering less detail in the periphery than the fovea (center of gaze). We show that naive approaches, such as simply dropping peripheral resolution or texture LOD, lead to flickering or lowered contrast. Our temporally-stable, contrast-enhancing rendering approaches address these visible artifacts, allowing more aggressive reduction in rendering effort. The corresponding SIGGRAPH paper can be found at https://dl.acm.org/doi/10.1145/2980179.2980246.

The Light Field Stereoscope, *SIGGRAPH 2015 Emerging Technologies* (August 2015). This exhibit, in collaboration with Stanford University, demonstrates a compressive approach to near-eye light field display that uses simple hardware and maintains spatial resolution better than previous approaches. The single screen in typical HMDs is replaced by two screens separated by a spacer, the first screen attenuating the second screen multiplicatively. The corresponding SIGGRAPH paper, written at Stanford, can be found at http://www.computationalimaging.org/publications/the-light-field-stereoscope.

Pinlight Displays, *SIGGRAPH 2014 Emerging Technologies* (August 2014). We demonstrate a simple new approach for optical see-through display in augmented reality (AR). The new approach allows for a very wide field of view while remaining thin and light, and can be manufactured using standard techniques. The corresponding SIGGRAPH paper can be found at http://pinlights.info.

Cascaded Displays, *SIGGRAPH 2014 Emerging Technologies* (August 2014). We demonstrate that layered spatial light modulators (SLMs), subject to fixed lateral displacements and refreshed at staggered intervals, can synthesize images with greater spatiotemporal resolution than that afforded by any single SLM used in their construction. Dubbed *cascaded displays*, such architectures enable superresolution flat panel displays (e.g., using thin stacks of liquid crystal displays (LCDs)) and digital projectors (e.g., relaying the image of one SLM onto another). The corresponding SIGGRAPH paper can be found at http://www.nvidia.com/cascaded-displays.

Near-Eye Light Field Displays, *SIGGRAPH 2013 Emerging Technologies* (July 2013). We demonstrate dramatically thinner and lighter head-mounted displays capable of depicting accurate accommodation, convergence, and binocular-disparity depth cues. Our approach replaces bulky conventional optics with a microlens array and computationally synthesized light field display.

Our exhibit was written up in many popular press outlets. The corresponding SIGGRAPH paper, videos, and a sample writeup from Engadget can be found at https://research.nvidia.com/publication/near-eye-light-field-displays.

PATENTS ISSUED

Approximately 100 US patent applications filed since July 2006; the 41 patents below have issued as of April 2021. Some of these have also been chosen for international filing, which is not reflected here.

10,948,985	*Retina space display stabilization and a foveated display for augmented reality*
10,922,876	*Saccadic redirection for virtual reality locomotion*
10,838,492	*Gaze tracking system for use in head mounted displays*
10,838,459	*Hybrid optics for near-eye displays*
10,713,838	*Image illumination rendering system and method*
10,699,383	*Computational blur for varifocal displays*
10,664,049	*Systems and methods for gaze tracking*
RE47,984	*Near-eye optical deconvolution displays*
10,642,311	*Hybrid optics for near-eye displays*
10,636,336	*Mixed primary display with spatially modulated backlight*
10,573,071	*Path planning for virtual reality locomotion*
10,573,061	*Saccadic redirection for virtual reality locomotion*
10,573,058	*Stable ray tracing*
10,438,400	*Perceptually-based foveated rendering using a contrast-enhancing filter*
10,401,623	*Holographic reflective slim virtual/augmented reality display system and method*
10,395,624	*Adjusting an angular sampling rate during rendering utilizing gaze information*
10,395,432	*Near-eye parallax barrier displays*
10,388,059	*Stable ray tracing*
10,317,678	*Catadioptric on-axis virtual/augmented reality glasses system and method*
10,151,924	*Holographic reflective slim virtual/augmented reality display system and method*
10,121,276	*Infinite resolution textures*
10,008,043	*Near-eye parallax barrier displays*
10,008,034	*System, method, and computer program product for computing indirect lighting in a cloud network*
9,940,901	*See-through optical image processing*
9,934,714	*Superresolution display using cascaded panels*
9,892,669	*Superresolution display using cascaded panels*
9,880,325	*Hybrid optics for near-eye displays*
9,841,537	*Near-eye microlens array displays*
9,594,247	*System, method, and computer program product for a pinlight see-through near-eye display*
9,582,922	*System, method, and computer program product to produce images for a near-eye light field display*
9,582,075	*Gaze-tracking eye illumination from display*
9,576,340	*Render-assisted compression for remote graphics*
9,557,565	*Near-eye optical deconvolution displays*
9,547,931	*System, method, and computer program product for pre-filtered anti-aliasing with deferred shading*
9,519,144	*System, method, and computer program product to produce images for a near-eye light field display having a defect*
9,494,797	*Near-eye parallax barrier displays*
9,437,039	*Method and system for graphics rendering employing gradient domain metropolis light transport*
9,305,392	*Fine-grained parallel traversal for ray tracing*
9,305,324	*System, method, and computer program product for tiled deferred shading*
9,111,393	*System, method, and computer program product for sampling a hierarchical depth map*
8,947,432	*Accelerated rendering with temporally interleaved details Accelerated*
6,574,360	*Occlusion Culling Using Directional Discretized Occluders and System Therefor.*

SELECTED KEYNOTES

Since 2013 I have stopped tracking keynotes and invited talks.

"Democratizing Parallelism, Democratizing Education: Teaching a MOOC about GPU Computing", **EduPar 2013**, Cambridge, MA (May 2013).

"The Democratization of Parallel Computing", **The Future of Computation in Science 2012**, Harvard University Institute for Applied Computational Science, Cambridge, MA (January 2012).

"GPU Computing: Past, Present, and Future", **ACM SIGGRAPH Symposium on Interactive 3D Graphics & Games**, San Francisco, CA (February 2011).

"Democratizing Supercomputing: The Surprising Story of GPU Computing", **Applied Imagery Pattern Recognition (AIPR) Workshop 2011**, Cosmos Club, Washington, D.C. (October 2010)

"Graphics Hardware & GPU Computing", **Graphics Interface 2009**, Kelowna, Canada. (May 2009)

"GPU Computing 3.0: The Past, Present, and Future of GPU Computing", **ASPLOS XIV GPGPU Workshop**, Washington, D.C. (March 2009)

"The Future of Graphics Hardware", **Visual Computing Trends 2009**, Vienna, Austria (January 2008).

"The Present and Future of Web3D?", **Web3d Symposium 2008**, Los Angeles, CA (August 2008).

INVITED TALKS & PANELS

Various invited talks on GPU computing & architecture:

Adobe Research (Jan 2012)
Northeastern University (October 2011)
NASA Goddard IS&T Seminar (March 2011)
University of Maryland Baltimore County (February 2011),
Virginia Tech (January 2011),
Massachusetts Institute of Technology (November 2010),
Williams College (November 2010),
Georgia Institute of Technology CCOE (August 2010),
University of Illinois Urbana-Champaign (September 2010),
Princeton University (January 2010),
Boston University (November 2009),
University of Texas (October 2009),
University of California Los Angeles (July 2009),
Pennsylvania State University (May 2009),
University of Maryland CSCAMM (April 2009),
Johns Hopkins University (April 2009),
Center for Disease Control (March 2009),
University of Maryland (February 2009),
Massachusetts Institute of Technology, IAP 2009/6.963 (January 2009),
Warsaw University (December 2008),
Colorado State University (November 2008),
Oak Ridge National Laboratory (May 2008),
University of Pennsylvania (April 2009, April 2008),
Georgia Institute of Technology (May 2009, April 2008),
University of California Davis (March 2008, Feburary 2007),
College of William & Mary (February 2008),
University of Virginia (Nov 2010, Nov 2009, Nov 2007, Dec 2006).

"CUDA and GPU Computing", Panel participant on *Industrial Perspectives*, **HPCA 2009**, Raleigh, NC (February 2009).

"GPU Architectures: Goals, Implications, and Emerging Directions", Invited Talk, **2009 Workshop on Emerging Applications and Manycore Architecture**, at HPCA 2009, Raleigh, NC (February 2009).

"Accelerating Science with Massively Parallel Computing", Initiative in Innovative Computing Colloquium, **Harvard University**, Boston, MA (November 2008).

"The Democratization of GPU Computing", Various invited talks:

Sharp Laboratories of America (July 2008),
US Patent & Trademark Office (June 2008),
Southwest Research Institute (February 2008),
In-Q-Tel (February 2008)
Fraunhofer Institute for Computer Graphics (September 2007).

"The Democratization of GPU Computing", **AstroGPU 2007**, Institute for Advanced Studies, Princeton NJ (November 2007).

"The Democratization of GPU Computing", **GPGPU 2007**, Northeastern University, Boston MA (October 2007).

"GPU Computing with CUDA", Invited talk, **2007 ACM SIGGRAPH Symposium on Interactive 3D Graphics & Games**, Seattle, WA (May 2007).

"G80 and CUDA: The GPU Parallel Computing Revolution", **SCI Institute Seminar**, Scientific Computing & Imaging Institute, University of Utah (April 2007).

"Adaptive Frameless Rendering", Invited talk, **Vienna Technical University**, Austria (September 2005).

"Real-time Illumination Models & Adaptive Frameless Rendering", Invited talk
NVIDIA Corporation (March 2006)
Electronic Arts (Winter 2005)
University of California Santa Cruz (Spring 2006)
Virginia Tech (Spring 2006)
University of Victoria (Spring 2006)

Invited participant, **Summit on Digital Tools for the Humanities**, University of Virginia (September 2005).

"The Future Is Not Framed", Panel participant on *The Ultimate Display*, **SIGGRAPH 2005**, Los Angeles, CA (August 2005).

"Rethinking Rendering For Gigapixel Imagery", Panel participant on *3D Graphics Hardware: Revolution or Evolution?*, **Graphics Hardware 2005**, Los Angeles, CA (August 2005).

"The Ultimate Display: Adaptive Frameless Rendering for Ultra High-Resolution Displays", **Microsoft Research** (May 2005).

"Adaptive Frameless Rendering", **Intel Architecture Research Laboratory** (May 2005).

"Breaking the Frame: Novel Sampling and Reconstruction Strategies for Interactive Ray Tracing", **University of Utah** (May 2005).

"Breaking the Frame: Novel Sampling and Reconstruction Strategies for Interactive Ray Tracing", Colloquium for **Max-Planck-Institut für Informatik**, Saarbrücken, Germany (April 2005).

"Frameless Rendering for Perceptually Adaptive Graphics",
Trinity College Dublin, Dublin, Ireland (April 2005),
University of Bristol, Bristol, England (April 2005).

"Breaking the Frame: Adaptive Frameless Rendering":
University of Maryland (March 2005),
University of Texas (March 2005),
Texas A&M University (March 2005).

"All-Frequency Relighting of Non-Diffuse Objects for Interactive Rendering", **Northwestern University** (July 2004).

"Breaking the Frame: Novel Strategies for Interactive Computer Graphics":
Mitsubishi Electric Research Laboratories (July 2004),
Purdue University (July 2004),
Microsoft Research (July 2004),
Massachusetts Institute of Technology (July 2004).

"Breaking the Frame: Novel Sampling and Reconstruction Strategies for Interactive Rendering", **University of Texas** (May 2004).

"Interruptible Rendering", **Northwestern University** (November 2003).

"Sampling and Reconstruction Strategies for Frameless Rendering", **University of North Carolina at Chapel Hill** (October 2003).

"Scanning Monticello: Lasers, Museums, and Other Topics in Computer Graphics", **Colorado College** (October 2003).

"Interruptible Rendering", *Dagstuhl Seminar: Hierarchical Methods in Computer Graphics,* **Dagstuhl, Germany** (July 2003).

"Perceptually Guided Interactive Rendering", **Microsoft Research** (July 2001).

"Perceptually Guided Interactive Rendering", **University of Southern California Institute for Creative Technology** (April 2001).

"Perceptually Guided Level of Detail", **University of North Carolina at Chapel Hill** (February 2000).

TECHNICAL REPORTS

Since 2015 I release preprints via arXiv.org; these are not listed here.

Mara, M., McGuire, M., and Luebke, D. *Lighting Deep G-Buffers: Single-Pass, Layered Depth Images with Minimum Separation Applied to Indirect Illumination.* NVIDIA Research Technical Report NVR-2013-04 (December 2013).

Crassin, C., Luebke, D., Mara, M., McGuire, M., Oster, B., Shirley, P., Sloan, P., and Wyman, C. *CloudLight: A system for amortizing indirect lighting in real-time rendering*. NVIDIA Research Technical Report NVR-2013-001 (July 2013).

Dale, K., Sheaffer, J., Vijay Kumar, V., Luebke, D., Humphreys, G., and Skadron, K. *Applications of Small Scale Reconfigurability to Graphics Processors*. University of Virginia Technical Report CS-2005-11 (June 2005).

Dayal, A., Woolley, C., Watson, B., and Luebke, D. *Adaptive Frameless Rendering*. University of Virginia Technical Report CS-2005-07 (April 2005). Also appears as Northwestern University Technical Report NWU-CS-05-07.

Goodnight, N., Lewin, G., Luebke, D., and Skadron, K. *A Multigrid Solver for Boundary Value Problems Using Graphics Hardware*. University of Virginia Technical Report CS-2003-03 (January 2003).

Hallen, B., Luebke, D. *Perceptually-Driven Interactive Rendering*. University of Virginia Technical Report CS-2001-01.

Clarke, Brian, and D. Luebke. *Design and Implementation of a Prototype Memory Management System for Geometric Data in Out-of-Core Simplification*, University of Virginia Technical Report CS-2000-18, 2000.

Cornish, D., and Luebke, D. *View-Dependent Particles for Non-Photorealistic Rendering*. University of Virginia Technical Report CS-2000-11.

Luebke, D. *Robust View-Dependent Simplification for Very Large-Scale CAD Visualization*. University of Virginia Technical Report CS-99-33 (Submitted to *Computer-Aided Design*).

ACADEMIC SOFTWARE

None of the below packages are still maintained, including for documentation only

Qsilver: a flexible simulation framework for graphics architectures. We used Qsilver to model power and thermal behavior in GPUs, and to experiment with dynamic management strategies for both. Qsilver was released in October 2004. Other groups at UC-Davis and U. Texas acknowledged Qsilver as an enabling tool for their own research. Described in [Sheaffer 2004][Sheaffer 2005].

GLOD: a novel minimalist API for simple, powerful integration of level of detail techniques into OpenGL applications (*http://www.cs.jhu.edu/~graphics/GLOD*). GLOD has been downloaded extensively and has recently been incorporated into the commercial product *SceneVision* by 3rdTech, Inc.

VDSlib: a public-domain view-dependent simplification and rendering library for interactive rendering of very complex scenes. Available at *http://vdslibs.virginia.edu*; includes a sample program integrated with the OpenGL® rendering library. VDSlib has been downloaded and used both in industry (e.g., Boeing, SRI International) as well as at universities (e.g., Northwestern, Johns Hopkins, British Columbia).

pfPortals: a public-domain visibility library compatible with SGI's IRIS Performer® toolkit. Based on the "Portals and Mirrors" paper [Luebke 95] and available at *http://pfportals.cs.virginia.edu*. Was used and extended by researchers and developers at SGI, MIT, Disney, and others.

COURSES TAUGHT

University of Virginia: Assistant Professor (Fall 1998-May 2006)

Spring 2006:	CS 446: Real-Time Rendering & Game Technology
Fall 2005:	CS 101E: Introduction to Computer Science
Spring 2005:	CS 445: Introduction to Computer Graphics
Fall 2004:	CS 440/MDST375: Computer Graphics for Film
Spring 2004:	CS 446: Real-Time Rendering
Spring 2003:	CS 445/645: Introduction to Computer Graphics
Fall 2002:	CS 551: Real-Time Rendering
Spring 2002:	CS 432: Algorithms
	CS 493: Independent Study: 3D Animation
Fall 2001:	CS 446/MDST 375: 3-D Animation & Special FX
Spring 2001:	CS 493: Independent Study: Virtual CS Building
	CS 551/651: Advanced Computer Graphics
	CS 651: Modern Research in Computer Graphics
Fall 2000:	CS 332: Algorithms
Spring 2000:	CS 493: Independent Study: Digital Earth
	CS 551/645: Introduction to Computer Graphics
Fall 99:	CS 551/645: Introduction to Computer Graphics
Spring 99:	CS 551/651: Advanced Computer Graphics
Fall 98:	CS 651: Modern Research in Computer Graphics

The Colorado College: Visiting Instructor (Spring 1997)

Spring 97:	MA 235: Computer Graphics

RESEARCH TUTORIALS

I stopped tracking these in 2009, but occasionally speak in courses & tutorials.

SIGGRAPH 2008, 2009: *Beyond Programmable Shading*.
ASPLOS 2008: *GPU Computing* (Course organizer).
AstroGPU 2007: *High-Performance Computing on GPUs with CUDA*. Co-taught.
Supercomputing 2007, 2009: *High-Performance Computing on GPUs with CUDA*. Co-organized with Massimiliano Fatica.
Supercomputing 2006: *GPGPU: General-Purpose Computing on Graphics Hardware*. Co-organized with Mark Harris.
ACM SIGGRAPH 2004, 2005: *GPGPU: General-Purpose Computing on Graphics Hardware*. Co-organized with Mark Harris.
Game Developers Conference 2003*: Level of Detail Management for 3D Games* (Course organizer).
ACM SIGGRAPH 2000-2002: *Advanced Issues in Level of Detail* (Organizer).
ACM SIGGRAPH 2000: *Interactive Walkthroughs of Large Geometric Datasets.*
IEEE VR 2000: *Advanced LOD for Dynamic Fidelity Control.*
IEEE VR 99: *Dynamic Level of Detail* (Course organizer).

SPONSORED RESEARCH FUNDING

NSF Digital Libraries and Archives: *Establishing the SAVE Center: Studying Secure Dissemination and Archiving of 3D Cultural Heritage Projects*. Amount: $340,000. Award IIS-0535118. Award begins November 1, 2005 for a duration of 3 years. PI: David Luebke. Co-PIs: Greg Humphreys (Computer Science), Bernard Frischer (Institute for Advanced Technology in the Humanities).

NSF CAREER Award: *Techniques for Very Large-Scale Interactive Rendering*. Award CCF-0092973. Amount: $347,000. Began June 1, 2001 for a duration of 5 years. Includes two Research Experience for Undergraduates (REU) supplements for $22,000. Sole PI.

DOE Early Career Principal Investigator Program: *View-Dependent Strategies for Very Large Scale Visualization*. Amount: $298,783. Began September 1, 2002 for a duration of 3 years, later extended to 4 years. Sole PI.

NSF Information Technology Research: *ITR Collaborative Research: Image-Based Rendering in Forensic Reconstruction and Historical Preservation*. Award CCF-0205324. Sole PI (UVA proposal): David Luebke. Collaborative with proposal with Anselmo Lastra, Gary Bishop, Frederick P. Brooks, Jr, Henry Fuchs, and Lars Nyland (University of North Carolina at Chapel Hill). Amount: $260,736. Began Oct 1, 2002 for a duration of 4 years, later extended to 4 years. Includes two REU supplements for $22,000.

NSF CISE Research Resources: *A High-Performance Shared-Purpose Cluster for Computer Architectural Simulation and Perceptual Interactive Ray Tracing* (March 2002). Award CNS-0224434. PI: David Luebke. Co-PIs: Kevin Skadron (Computer Science) and Mircea Stan (Electrical and Computer Engineering), UVA. Amount: $82,802. Began Sept 1, 2002, for a duration of 2 years. Includes an REU supplement for $10,000.

NSF Small Grant for Exploratory Research: *Beyond the Frame: Novel Algorithms for Perceptually Based Interactive Rendering*. Award CCF-0135943. Sole PI: David Luebke. Amount: $52,670. Ran May 15, 2002 to May 14, 2004.

NSF CISE Research Resources: *A State-of-the-Art Immersive Display for*

Research in Rendering, Animation and Simulation, and Cognitive Human-Computer Interface Design. Award CNS-0130800. PI: David Luebke. Co-PIs: David Brogan (Computer Science) and Dennis Proffitt (Psychology), UVA. Amount: $67,864. Ran August 15, 2001 to August 31, 2003. An REU supplement added $12,000.

PROPOSALS AWARDED

NSF Foundations of Computer Processes and Artifacts: *Change-Focused Gigapixel Imagery* (June 2005). PI: David Luebke. Co-PIs: Ben Watson (North Carolina State University), Jack Tumblin (Northwestern University). Chosen for funding Dec 15, 2005. I declined since I was leaving academia; co-PIs Tumblin and Watson received exploratory SGER grants.

INDUSTRIAL FUNDING

ATI Technologies Inc, NVIDIA Corporation: *Hardware support for Interruptible Rendering & GPU Ray Tracing Research*. Two separate equipment donations (Radeon and GeForce/Quadro cards, respectively), approximate combined retail value $6000. PI: David Luebke. Donated December 2003.

INTERNAL FUNDING

UVA Teaching + Technology Initiative Fellowship (2001: $19,700)
UVA University Teaching Fellowship (2000-01: $7,000)
UVA Faculty Senate Teaching Initiative Award (1999: $3000)

DOCTORAL STUDENTS

Rui Wang: Worked on 3D scanning algorithms, real-time illumination models. Entered Fall 2001, graduated with M.CS degree in August 2003. Passed Ph.D. proposal June 2005, graduated August 2006. Now an Associate Professor at University of Massachusetts – Amherst.

Jeremy Sheaffer: Worked on power- and thermal-aware graphics architectures. Co-advised with Professor Kevin Skadron. Entered with M.S. in fall 2004. Passed Ph.D. qualifying exam January 2005, graduated August 2007. Winner, ATI Graduate Fellowship, 2005-2007. Now a post-doc at the University of Virginia.

MASTER'S STUDENTS

Kevin Dale: Worked on graphics architecture, 3D scanning (devices and algorithms). Entered fall 2004. Graduated with Master's degree May 2007, entered Ph.D. program at Harvard. Now at Facebook AI Research.

Tenghui Zhu: Worked on GPU-accelerated sample reprojection. Entered spring 2004. Graduated with Master's degree May 2006, now at Google Corporation.

John Tran: Worked on real-time illumination models, graphics-hardware-accelerated heart tissue simulation. Entered fall 2002. Graduated with M.CS degree August 2005. Now at NVIDIA.

Cliff Woolley: Worked on interruptible and frameless rendering. Graduated with M.CS degree August 2003. Now at NVIDIA.

Lingjia Tang: Worked on simplification of deformable objects using reduced deformable models. Entered fall 2003, completed Master's project August 2005.

Brenden Schubert: Worked on flexible and efficient view-dependent simplification (see UVA Technical Report CS-2004-05). Graduated with combined M.S./B.S. degree December 2003. Now at Pixar.

Chris Lutz: Worked on manual editing of laser rangefinder images. Graduated

with Master's degree December 2002.

Andrea Rowan: Worked on View-dependent Particles for Non-Photorealistic Rendering. Graduated with Master's degree May 2001.

SELECTED PH.D. COMMITTEES

Praneeth Chakravarthula (Computer Science, U. North Carolina), Spring 2021.

Qi Sun (Computer Science, Stony Brook University). Graduated Spring 2018.

David Dunn (Computer Science, U. North Carolina). Defending Fall 2018.

Andrew Maimone (Computer Science, U. North Carolina). Graduated Spring 2015

Cheuk Yiu Ip (Computer Science, U. Maryland). Defending Aug 2013.

Duane Merrill (Computer Science, U. Virginia). Graduated Fall 2012.

Abe Stephens (Computer Science, U. Utah). Graduated Spring 2011.

Aravind Kalaiah (Computer Science, U. Maryland). Graduated May 2005.

Jeanine Stefanucci (Psychology). Graduated August 2006.

Kevin Scott (Computer Science, U. Virginia). Proposed summer 2003.

PROFESSIONAL LEADERSHIP

Steering Committee:
High Performance Graphics 2009-Present

Papers Chair:
High Performance Graphics 2011 (Vancouver, Canada)
Graphics Hardware 2008 (Sarajevo, Bosnia)
2005 Symposium on Interactive 3D Graphics & Games (Washington, DC)

Program Chair:
Graphics Hardware 2004 (Grenoble, France)

General Chair:
High Performance Graphics 2021 (Virtual)
High Performance Graphics 2016 (Dublin, Ireland)
InPar 2012: Innovative Parallel Computing 2012 (San Jose, CA)
High Performance Graphics 2009 (New Orleans, LA)
IEEE Symposium on Interactive Ray Tracing 2008 (Los Angeles, CA)
Graphics Hardware 2007 (San Diego, CA)
Graphics Hardware 2005 (Los Angeles, CA)

Session Chair:
SIGGRAPH 2005 Special Session on Interactive 3D Graphics
SIGGRAPH 2007 Special Session on Graphics Hardware

PROGRAM COMMITTEES

(I stopped tracking these in 2007 but continue to serve frequently)
IEEE Symposium on Interactive Ray Tracing 2006-2007
2007 Symposium on Applied Perception in Graphics and Visualization
IEEE Visualization 2005-2007
Eurographics 2005-2007
Graphics Hardware 2006
ACM SIGGRAPH Symposium on Interactive 3D Graphics: 2003-2007
3DPVT 2006 (3rd Int'l Symp. on 3D Data Processing, Vis., and Transmission)
SIBGRAPI 06 (Brazilian Symposium on Computer Graphics & Image Processing)
Pacific Graphics 2005
VAST 2004/Second Eurographics Symposium on Graphics and Cultural Heritage
ACM Symposium on Eye-Tracking Research and Applications 2002-2003
2001 ACM SIGGRAPH Campfire on Perceptually Adaptive Graphics

MASTERS COMMITTEES

Joshua Stafford (Systems and Information Engineering). Defended April 28, 2005.
Sivakumar Velusamy (CS). Presented September 2004.

DEPARTMENT SERVICE

CS Diversity Committee (2005-2006)
CS Outreach Committee (2004-2005)
CS Graduate Admissions Committee (1998-2002)

I took active leadership roles on this committee, spearheading our department student recruiting web pages and leading an effort to quantitatively analyze the effectiveness of numeric predictors of student performance (e.g., GRE, GPA) to better guide the admissions process.

SCHOOL SERVICE

SEAS First-Year Advisor (2005-06)
Student Affairs Committee (2004-05)
Rodman Scholars Council (2003-2005)
Teaching Effectiveness/Evaluation Committee (2003-2004)
Ad hoc committee to establish a computer science program in CLAS (2002)
Dean's Committee, Computer Science Department Chair Reappointment (2000)

UNIVERSITY SERVICE

Chair and co-organizer, Virginia Visualization Group (2004-05)

Working with Bernard Frischer, then Director of the Institute for Advanced Technology in the Humanities (IATH), I organized a group of University faculty interested in virtual reality and visualization. The goals of the group were (1) to provide a forum for discussion, workshops, invited speakers, and collaborative research projects; (2) to jointly design, run, and use a 3D visualization theater funded by IATH; (3) to jointly develop, seek funding for, and build other visualization facilities as necessary. In short, the VVG was a collaborative interdisciplinary initiative to enable sharing of expensive resources (like visualization theaters and the staff to run them) and to catalyze new efforts in research and teaching. The School of Architecture School agreed to host our NSF-funded visualization theater, and redesigning one of their public jury rooms for the purpose.

UCIT: University Committee on Information Technology (2003-06)
Invited Speaker, Designing Matter Common Course (Fall 2003, Spring 2005)
SEAS Teaching Effectiveness and Evaluation Committee (2003-04)
University Committee on Information Technology (2003-04)
RAA Celebration: Rotunda Demos for UVA Capital Campaign Donors (2000)

OTHER SERVICE

NSF Panelist and Reviewer (2000, 2001, 2002, 2005)
Reviewer, Science Foundation Ireland (2004)

OUTREACH ACTIVITIES

UVA Computer Science "CS Day", April 2005
SEAS Technology Expo (Demos for Alumni Weekend 2004)
"Making movies: Reality and unreality in computer graphics", invited talk at U. Virginia Hereford College (2004)
Virtual Monticello exhibit at the New Orleans Museum of Art, see above (2003)
Demos, E3 Summer Science camp (1999, 2000, 2001, 2002)
Demos, The Fuqua School, Farmville, VA (1999)
Demos, SEAS Open House (1998-2005)

UNDERGRADUATE RESEARCHERS

2006 advisees: Ryan Schubert, Ewen Cheslack-Postava (went to Stanford), Meng Tan, Brian Repper (EE), Elizabeth White (Cognitive Sci Distinguished Major).

Nathan Hoobler: thesis: *A Deferred-Shading Photon Mapper*. Now at NVIDIA.

Lincoln Hamilton: thesis: *Simulating Frameless Real-Time Ray Tracing Through the Use of Chromium*. Went to Cryptic Studios, a video game studio in California.

Jesse Foster: thesis: *Simulation of Distributed Frameless Ray Tracer via Chromium and Doom3*.

David Hicks: thesis: *Perceptually-Guided Undersampling of the Visual Field in Interactive Raytracing*.

Chris Jarrell: thesis: *Faster View-Dependent Simplification and Rendering.*

Rebecca Rendall: Biomedical Engineering Capstone project: *Improved Disease Management for Individuals with Diabetes: Developing a Goal-Setting Management Tool.*

Jeff Peirson: thesis: *Optimizing the Real-Time Structured Light Scanner for Robustness and Ease of Use*. **Finalist, SEAS Undergraduate R&D Symposium**. Entered Ph.D. program at Carnegie-Mellon University.

Kristen Neal: thesis: *Real-time Simulation of Cloth for Computer Graphics*. Now at Electronic Arts. **CRA Outstanding Undergraduate Honorable Mention**.

Gordon Marx: thesis: *Solving Cellular Automata on the GPU*. Now at Raytheon.

Pete Capelluto: thesis: *Rendering and Modifying Large Point-Based Datasets.* **Finalist, SEAS Undergraduate R&D Symposium**.

Matt Hilliard: thesis: *Head Tracking as an Interface for Human Computer Interaction*. (joint project with David Del Veccio).

David Del Veccio: thesis: *Head Tracking as an Interface for Human-Computer Interaction*. (joint project with Matt Hilliard).

Kashyap Mehta: thesis: *Randomized Rendering for Real-Time Display of Very Large Point Clouds.*

Nathaniel Williams: Cognitive Science Distinguished Major thesis: *Perceptually Driven Simplification of Lit Polygonal Models.* Entered Ph.D. program at University of North Carolina.

Chris Hayden: thesis: *Redesigning the View-Dependent Simplification Library*.

Michael Kelley: *Perceptually Guided Simplification of Lit and Textured Meshes*.

Brian Salomon: thesis: *Design of a New Architecture for View-Dependent Simplification*. Entered Ph.D. program at University of North Carolina, now at Google.

Keith Shepherd: thesis: *Memory Management and Streaming of View-Dependent Data in the New VDS System.*

Brian Clarke: thesis: *Design and Implementation of a Prototype Memory Management System for Geometric Data in Out-of-Core Simplification.* Returned to UVA as M.S. student.

Ben Hallen: thesis: *Perception-Based Simplification*. Returned to UVA as an M.S. student. **Harrison Undergraduate Research Award**, **CRA Outstanding Undergraduate Honorable Mention**, **Finalist, SEAS Undergraduate R&D Symposium**. Entered Ph.D. program at Stanford.

Carlton Fraley: thesis: *Botanical Simplification for Rapid Rendering of Plants.* Entered Ph.D. program at Georgia Tech.

Derek Cornish: thesis: *Art-based Rendering*.