

# Peter Lincoln

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## EDUCATION

### University of North Carolina at Chapel Hill, Chapel Hill, NC

- Ph.D. in Computer Science May 2017
  - Thesis: Low Latency Displays for Augmented Reality
  - Advisors: Profs. Henry Fuchs and Greg Welch
- M.S. in Computer Science Dec 2008

### University of Washington, Seattle, WA

- B.S. in Computer Engineering Jun 2006
  - Graduated Cum Laude with College Honors
  - Minor in Applied Mathematics
  - Honors Thesis: Surface Projection Method for Visualizing Volumetric Data

## RESEARCH EXPERIENCE

### University of North Carolina at Chapel Hill, Department of Computer Science, Chapel Hill, NC

- Research Assistant Aug 2006 – May 2017
  - Focuses: Low Latency Optical See-through Augmented Reality (OST-AR), Spatial Augmented Reality (SAR), Physical-Virtual Avatars, Telepresence, and Teleconferencing
  - Project: Low Latency Display – In a team, developed an OST-AR system for optically mixing virtual and real imagery with 80 or 126 microseconds of average-case end-to-end latency (6 bit/pixel grayscale or 16 bit/color RGB); wrote Verilog and C++ HLS modules for controlling the correction algorithms and DMD control algorithms in an FPGA; wrote an embedded system in C to run in a MicroBlaze CPU on the FPGA to control the display; wrote a C#/C++ OpenGL application for rendering the imagery and calibrating the system.
  - Project: Multi-Projector Blending – In a team, developed a SAR system for transforming a 6D-tracked object into a different object with multiple digital projectors, both blending the projected imagery along the boundaries and updating as the object was moved by a user; wrote a C#/C++ application for generating 3D projector imagery in OpenGL and for calibrating the system.
  - Project: Telepresence Wall – In a team, worked on a system to provide a virtual window between two rooms; developed a Qt-based application in C++ for configuring the 2D+Depth video streams and segmentation algorithm parameters for the display wall in each room.
  - Project: Shader Lamps Avatars – In a team, developed a one-to-many teleconferencing system supporting gaze awareness (all users at the “many” site know which way the “one” site user is looking), where the single user is represented by a drivable 3D physical avatar at the remote site; wrote C#/C++ software for capturing the inhabitant’s face, displaying it on the avatar, actuating the avatar based on the inhabitant’s movements, and calibrating the system.
  - Project: Multi-View Telepresence – In a team, developed a two-site, four-user video teleconferencing system supporting gaze awareness (each user at each site receives a unique camera view of the users at the other site so that all users know at which person a user is looking); wrote C++/C# software for capturing and displaying video and calibrating the multi-view displays; wrote C# application for simulating optical paths in lenticular lens-based multi-view displays.

### University of Washington, Department of Biological Structure, Seattle, WA

- Undergraduate Research Student Oct 2005 – Jun 2006
  - Project: MindSeer – A 3D, Java, client-server application for visualizing patients’ brain scan data
  - Focus: Visualization Techniques – Investigated methods of visualizing volumetric fMRI data as 3D rendered surfaces on patients’ brains; developed a plugin for this type of visualization for MindSeer.

## PUBLICATIONS & PRESENTATIONS JOURNALS

- [3] [P. Lincoln](#), A. Blate, M. Singh, T. Whitted, A. State, A. Lastra, and H. Fuchs. “From Motion to Photons in 80 Microseconds: Towards Minimal Latency for Virtual and Augmented Reality.” *IEEE Transactions on Visualization and Computer Graphics*, 22(4): 1367–1376, 2016. Presented at *IEEE Virtual Reality Conference (IEEE VR)*, 2016.
- [2] [P. Lincoln](#), G. Welch, A. Nashel, A. State, A. Ilie, and H. Fuchs. “Animatronic Shader Lamps Avatars.” *Virtual Reality*, 15(2): 225–238, Jun 2011.
- [1] E. Moore, A. Poliakov, [P. Lincoln](#), and J. Brinkley. “MindSeer: A Portable and Extensible Tool for Visualization of Structural and Functional Neuroimaging Data.” *BMC Bioinformatics*, 2007.

## CONFERENCES

- [7] P. Lincoln, A. Blate, M. Singh, A. State, M. Whitton, T. Whitted, and H. Fuchs. "Scene-Adaptive High Dynamic Range Display for Low Latency Augmented Reality." *Proceedings of the 21<sup>st</sup> ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (I3D '17)*, 2017.
- [6] F. Zheng, T. Whitted, A. Lastra, P. Lincoln, A. State, A. Maimome, and H. Fuchs. "Minimizing Latency for Augmented Reality Displays: Frames Considered Harmful." *International Symposium for Mixed and Augmented Reality (ISMAR)*, 2014.
- [5] R. Schubert, G. Welch, P. Lincoln, A. Nagendran, R. Pillat, and H. Fuchs. "Advances in Shader Lamps Avatars for Telepresence." *3DTV*, 2012.
- [4] D. Rivera-Gutierrez, G. Welch, P. Lincoln, M. Whitton, J. Cendan, D. Chesnutt, and H. Fuchs. "Shader Lamps Virtual Patients: the Physical Manifestation of Virtual Patients." *Medicine Meets Virtual Reality (MMVR) 19 – NextMed, Studies in Health Technology and Informatics*, IOS Press, 2012.
- [3] P. Lincoln, G. Welch, and H. Fuchs. "Continual Surface-Based Multi-Projector Blending for Moving Objects." *IEEE Virtual Reality Conference (IEEE VR)*, 2011.
- [2] P. Lincoln, G. Welch, A. Nashel, A. State, A. Ilie, and H. Fuchs. "Animatronic Shader Lamps Avatars." *International Symposium for Mixed and Augmented Reality (ISMAR)*, 2009.
- [1] P. Lincoln, A. Nashel, A. Ilie, H. Towles, G. Welch, and H. Fuchs. "Multi-View Lenticular Display for Group Teleconferencing." *Proceedings of the 2<sup>nd</sup> International Conference on Immersive Telecommunications (IMMERSCOM '09)*, 2009.

## PATENTS

- [1] G. Welch, H. Fuchs, P. Lincoln, A. Nashel, and A. State. "Methods, systems, and computer readable media for shader-lamps based physical avatars of real and virtual people." US9538167 B2.

## AWARDS & HONORS

- 2<sup>nd</sup> Best Paper and 3<sup>rd</sup> Best Presentation, ACM i3D Symposium 2017 Feb 2017  
"Scene-Adaptive High Dynamic Range Display for Low Latency Augmented Reality"
- Invited Talk, IEEE TVCG Session on Virtual and Augmented Reality, SIGGRAPH 2016 Jul 2016  
"From Motion to Photons in 80 Microseconds: Towards Minimal Latency for Virtual and Augmented Reality"
- Best Paper Award, IEEE Virtual Reality Conference 2016 Mar 2016  
"From Motion to Photons in 80 Microseconds: Towards Minimal Latency for Virtual and Augmented Reality"
- Phi Beta Kappa Jun 2006

## PROFESSIONAL AFFILIATIONS & ACTIVITIES

- ACM SIGGRAPH Member
- IEEE Member

## TEACHING & OTHER WORK EXPERIENCE

**University of North Carolina**, Department of Computer Science, Chapel Hill, NC

- Instructor – Introduction to Programming (COMP 110) Jun 2012 – Jul 2012
  - Developed syllabus and overall course structure, lectured, and administered all grades in a class of about 40 students

**University of Washington**, Computer Science & Engineering, Seattle, WA

- Teaching Assistant – Introduction to Computer Graphics (CSE 457) Mar 2006 – Jun 2006
  - Met with students and graded assignments and exams in a class of about 50 students

**Sunriver Nature Center**, Sunriver, OR

- Assistant Instructor Summer 2003 – 2006
  - Co-taught groups of children (ages 8 and up) the basics of model rocketry by classroom instruction and one-on-one assistance
  - Presented talks to large groups about astronomical objects during a nightly observatory program
- Computer Technician Summer 2003 – 2004
  - Upgraded computer hardware, installed operating systems and software, and provided technical assistance to naturalists and supervisors

## SKILLS

**Languages:** C#, Verilog, C++, C, Java, L<sup>A</sup>T<sub>E</sub>X

**APIs:** .NET, OpenGL, OpenCV, GLSL, Point Grey FlyCapture, Qt, VRPN

**Applications:** Visual Studio, ISE Design Suite, Vivado Design Suite, Vivado HLS, MATLAB, SVN

[CV compiled on 2017-08-14]