Bruce Gooch

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Education

University of Utah, Salt Lake City, Utah

Doctor of Philosophy in Computer Science, May 2003.
Dissertation title: *Human Facial Illustrations: Creation and Evaluation using Behavioral Studies and fMRI*.
Advisor's: Professor Richard F. Riesenfeld and Professor Peter Shirley.

Master of Science in Computer Science, December 2000.
Thesis title: *Artistic Vision: Painterly Rendering Using Computer Vision Techniques*.
Advisor's: Professor Richard F. Riesenfeld and Professor Peter Shirley.

Bachelor of Science in Mathematics, June 1993.

Employment

Assistant Professor, University of Victoria, Victoria British Columbia   September 2006–Present

Rapid advances in computer technology fill computer screens with complex visual information at near real time rates. Simulations that once required the processing power of super-computers are now routinely run on desktop workstations. However, faster processors, larger disk drives and higher memory capacity have done little to help people understand the meaning of data. This lack of understanding stems from the fact that machines process data in numerical form, while humans more easily comprehend visual data. Graphics that visually emphasize key features and contextual relationships within and between data allow users to gain insights about the data.

Through the process of visualization, the transformation of numerical data into meaningful imagery using computer graphics, data can be represented as pictures, animations, or interactive applications. These representations allow viewers to detect, analyze and discover features in numerical data which they may not have recognized otherwise. My current research combines computer graphics techniques for creating artistic imagery with the evaluation methods of perceptual psychology to provide effective data visualization. This research combines concepts and methods from visual art, perceptual psychology, information processing, and cognitive science to facilitate a viewer in understanding and interpreting computer imagery.

Assistant Professor, Northwestern University, Evanston Illinois   August 2003–August 2006

Computers are becoming faster, smaller and more interconnected creating a shift in their primary function from computation to communication. Digital cameras and camcorders are making high-quality image acquisition ubiquitous. Advances in display technology allow a range of deployments, from high-definition wall displays to miniature embedded screens. As communication devices and viewing situations become more plentiful, we need imagery that facilitates visual communication across a wide range of display devices. In addition, producing effective and expressive visual content currently requires considerable artistic skill and can consume days. My work introduced techniques for automatically retargeting images and animations, that is, for adapting them for display at different sizes and aspect ratios while preserving the recognizability of important image features.

University of Utah, Salt Lake City, Utah   **August 1996–August 2003**
National Science Foundation Graduate Research Fellow   2001–2004
University Teaching Fellow   2000–2001
I investigated the computer graphics field of Non-Photorealistic Rendering (NPR). Measuring the communication content of a Non-Photorealistic image can be done only in an indirect way by observing the results of task performance based on visual stimulus. The ability to evaluate the effectiveness of an image could give NPR a successful image metric. In order to test this hypothesis I lead an interdisciplinary research team in investigating the effectiveness of NPR imagery using perceptual psychology experiments and and functional magnetic resonance imaging (fMRI).

Ford, Bacon and Davis Inc., Salt Lake City, Utah   **April 1995–August 1996**
I was a consulting analyst and researcher on a project to find and predict the size of corrosion caused defects in gas and oil pipelines. I designed and built a probe evaluation test loop consisting of seven hundred and fifty feet of pipeline into which four hundred defects were machined. I then wrote software to predict the size of defects based on three dimensional time dependent magnetic field data gathered during probe runs through the test loop.

Books Authored

Illustrative Visualization
Amy Gooch, Bruce Gooch and Mario Costa Sousa.
A.K. Peters Ltd. Publishers, 2006

Non-Photorealistic Rendering
Bruce Gooch and Amy Gooch.
A.K. Peters Ltd. Publishers, 2001

Research Publications

Visualizing DNS Traffic
Pin Ren, John Kristoff and Bruce Gooch.
To appear in the Proceedings of VizSEC 2006.

Detecting False Captioning Using Common Sense Reasoning
Sangwon Lee, David A. Shamma and Bruce Gooch.
6th Annual Digital Forensics Research Workshop

3D Role-Playing Games as Language Learning Tools
Yolanda Rankin, Rachael Gold and Bruce Gooch.
Eurographics 2006.

Retargeting Vector Animation to Small Displays
Vidya Setlur, Xing Qing and Bruce Gooch.
To appear in IEEE Transactions on Visualization and Computer Graphics.

Automatic Image Retargeting
Vidya Setlur, Saeko Takagi, Michael Gleicher, Ramesh Raskar and Bruce Gooch.
To appear in IEEE Computer Graphics and Applications.

A Top Down Method for Normal Cone Hierarchies
Tom Lechner, Mark Hartner and Bruce Gooch.
To appear in The Journal of Graphics Tools.

Real Time Video Abstraction
Holger Winnemoller, Sven Olsen and Bruce Gooch.
ACM Siggraph 2006.

Playing for Keeps: Second Language Learning in Online Games
Yolanda Rankin, Rachael Gold and Bruce Gooch.
ACM Siggraph 2006.

Interactive Fluid Jet Painting
Sangwon Lee, Sven Olsen and Bruce Gooch.
Non-Photorealistic Animation and Rendering 2006, NPAR 06.

Image Retargeting
Vidya Setlur, Saeko Takagi, Michael Gleicher, Ramesh Raskar and Bruce Gooch.
Best Paper Award, The 4th International Conference on Mobile Ubiquitous Multimedia, MUM 2005.

Animation Retargeting
Vidya Setlur, Xing Qing and Bruce Gooch.
The 4th International Conference on Mobile Ubiquitous Multimedia, MUM 2005.

Light Waving: Light Position Estimates From Photographs Alone
Holger Winnemoller, Ankit Mohen, Jack Tumblin and Bruce Gooch.
Eurographics 2005.

Semanticons: Semantically Enhanced Icons
Vidya Setlur, Conrad Albrecht-Buler, Amy Gooch, Sam Rosshoff and Bruce Gooch.
Eurographics 2005.

Color2Gray: Salience-Preserving Color Removal
Amy Gooch, Sven Olsen, Jack Tumblin, Bruce Gooch.
ACM Siggraph 2005.

The NPR Pipeline
Mario Costa Sousa, Amy Gooch and Bruce Gooch.
Eurographics 2005 Workshop on Computational Aesthetics.

Enhancing Depth Perception via Artistic Matting
Amy Gooch and Bruce Gooch.
Eurographics 2005 Workshop on Computational Aesthetics.

Interactive Fluid Vortex Painting
Sven Olsen and Bruce Gooch.
Graphics Interface 2005.

Is That a Smile? Gaze-Dependent Facial Expressions Vidya Setlur and Bruce Gooch.
Non-Photorealistic Animation and Rendering NPAR 2004.

Human Facial Illustrations: Creation and Psychophysical Evaluation
Bruce Gooch, Erik Reinhard and Amy Gooch.
ACM Transactions on Graphics (TOG) Volume 23, Issue 1.

Artistic Vision: Painterly Rendering Using Computer Vision Techniques
Bruce Gooch, Greg Coombe and Peter Shirley
Non-Photorealistic Animation and Rendering NPAR 2002.

Color Transfer Between Images
Erik Reinhard, Michael Ashikhmin, Bruce Gooch and Peter Shirley.
IEEE CG &A special issue on Applied Perception,
Vol. 21, No 5, September - October 2001.

Artistic Composition for Image Creation
Bruce Gooch, Erik Reinhard, Chris Moulding and Peter Shirley.
Eurographics Rendering Workshop 2001.

The Lit Sphere: A Model for Capturing NPR Shading from Art
Peter-Pike J. Sloan, William Martin, Amy Gooch and Bruce Gooch.
Proceedings of Graphics Interface 2001.

Interactive Artistic Rendering
Matt Kaplan, Bruce Gooch and Elaine Cohen.
Non-Photorealistic Animation and Rendering NPAR 2000.

Interactive Technical Illustration
Bruce Gooch, Peter-Pike J. Sloan, Amy Gooch, Peter Shirley and Richard Riesenfeld.
ACM Interactive 3D 1999.

A Non-Photorealistic Lighting Model For Automatic Technical Illustration
Amy Gooch, Bruce Gooch, Peter Shirley and Elaine Cohen.
ACM Siggraph 1998.

Research Publications in Submission

Minerva: Using Ontology to Bridge the Gap Between Scientific and Information Visualization,
Tom Lechner, David Chanin, Pin Ren and Bruce Gooch
Submitted to IEEE Transactions on Visualization and Computer Graphics

Visualizing Document Keywords for Situational Awareness and Analysis,
Pin Ren, Deidra Mortensen and Bruce Gooch
Submitted to IEEE Transactions on Visualization and Computer Graphics

YINX: a distributed Multi-user Windowing System,
Brian Cornell, Vani Oza, Bob Adolph, Sam Rosshoff and Bruce Gooch
Submitted to IEEE Transactions on Visualization and Computer Graphics

Interactive Architectural Drawing,
David Feng, Sang-Won Lee, Cindy Grimm and Bruce Gooch
Submitted to IEEE Computer Graphics and Applications

Line Textures for Architectural Rendering,
Kristi Potter, Peter Willemsen, Amy Gooch, Peter Shirley, Richard Riesenfeld and Bruce Gooch
Submitted to Computer Graphics Forum

Educational Publications

Computer Graphics
Bruce Gooch, Erik Reinhard, and Chris R. Johnson.
Encarta Encyclopedia, 2002.

Siam Book Review:
Realistic Image Synthesis Using Photon Mapping.
By Henrik Wann Jensen. Review by Bruce Gooch, Siam Review, 2002.

Mentoring

Computer science departments across North America suffer from low retention rates. Undergraduate students cite two main reasons for leaving the major: the failure to establish social networks and the failure to become academically involved in classes. However, students who work together on projects and course work are better able to form social networks, are more likely to be actively involved in the academic community, and, hopefully, will be more likely to graduate from computer science departments. Professor Gooch continues to focus his efforts on establishing a computer science culture that encourages peer-supported education and focuses on integrating meaningful research experience into the undergraduate curriculum.

The Undergraduate Research Team (UGRT)
A primary goal of the Undergraduate Research Team is to provide research experiences for undergraduates. Undergraduates in small research teams led by graduate students or advanced undergraduate students receive practical experience in the field while gaining mentoring and leadership skills. As team leaders, these students act as catalysts for the peer-centered learning experience by interacting one-on-one and in small group settings with novice and intermediate students.

Former Members of the UGRT

Greg Coombe Ph.D. Candidate, The University of North Carolina at Chapel Hill
NVIDA International Graduate Fellowship 2003 and 2004

Amy Williams Ph.D. Candidate, Massachusetts Institute of Technology
NSF Graduate Research Fellowship

Claurissa Tuttle Ph.D. Candidate, University of Utah
NSF Graduate Research Fellowship

Brian Budge Ph.D. Candidate, The University of California at Davis

Rachel Gold Ph.D. Candidate, Brown University

Aaron Johnson Ph.D. Candidate, Yale University

Brian Cornell Ph.D. Candidate, The University of North Carolina at Chapel Hill

David Feng Ph.D. Candidate, The University of North Carolina at Chapel Hill

Andrew Kaufmann Ph.D. Candidate, The University of British Columbia

Rebecca Flannery M.S., Texas A&M

Nathan Beddes M.S., The University of North Carolina at Chapel Hill

Samir Nayak M.S., The University of North Carolina at Chapel Hill

Teaching

I am interested in teaching graduate level courses in computer graphics and in algorithms: for example, realistic image synthesis, computer animation, geometric modeling, dynamic programming, and algorithm analysis. At the undergraduate level I am interested in teaching algorithms, data structures, introductory programming courses, human computer interaction, and graphics.

UGRT Course: Research Teams Fundamentals and Management
The first phase in implementing the Undergraduate Research Team was the development of a new course, CS 368 Research Teams: Fundamentals and Management (RTFM). The goals of the RTFM course include: giving students experience working on open-ended projects, and promoting a collaborative working environment.

RTFM is a research seminar geared toward undergraduate students with multiple programming skill levels. The course engages students in a bottom-up software engineering process where individual components of the system are specified and coded in detail and then linked together until a complete system emerges. The course is structured in a collaborative studio environment, augmented by lectures. Students work together to design software specifications, dividing coding projects to involve students at various skill levels. For instance, novice students write simple functions, intermediate students write more difficult and challenging functions, and skilled students serve as team leaders. Team leaders guide round-table discussions on software design and coach beginning students in the coding process. The RTFM course affords students the opportunity to work cooperatively with a group to solve problems collaboratively while completing complex, open-ended projects.

Northwestern University, Evanston, Illinois
Spring 2006, taught *CS395 Game Design on Multiple Hardware Platforms*, an undergraduate and graduate course on Computer Game Design as a software engineering problem. Enrollment: 15.

Spring 2004, Fall 2004, Winter 2005, Spring 2005, Fall 2005 taught *CS395 Research Teams: Fundamentals and Management*, an undergraduate course on leadership, forming working teams, software engineering and research infrastructure design. Enrollment: 8-14.

Fall 2003, 2004 and 2005, taught *CS130 Tools and Technology For the World Wide Web*, an undergraduate course on Web programming in HTML, Javascript and PHP. Enrollment: 35, 32, 33.

Winter 2004, taught *CS395 Non-Photorealistic Rendering*, an graduate course on Non-Photorealistic Rendering. Enrollment: 14. The course resulted in the submission of four research papers.

Spring 2004, taught *CS311 Data Structures and Algorithms*, an undergraduate course on Algorithms and Data Structures. Topics included; lists, trees, and hashing. Enrollment: 38.

Winter 2005, taught *CS395 Graphics and Perception*, an graduate course on Computer Graphics and the Human Visual System. The course resulted in the submission of three research papers. Enrollment: 12.

University of Utah, Salt Lake City, Utah

Fall 2002, taught *Siggraph Workshop*, a graduate course on conducting and reporting on research in computer graphics. Enrollment: 14.

Fall 2002, lecturer in CS 5540, *Human/Computer Interaction*, a undergraduate course on human factors in the context of designing interactive applications.

Spring 2001 & 2002, guest lecturer in ART 6810, *MFA Graduate Seminar*, a graduate art course divided into two areas: creative process and professional concerns for the working artist.

Spring 2001, computer graphics program leader for, *The Bennion Center Presents*, a program for at risk elementary age children.

Fall 2000 – Spring 2001, awarded a **University Teaching Fellowship**. Twenty-two such fellowships are awarded University wide.

Fall 1999 & 2000, computer graphics program leader for, *Engineering Week*, a program for junior high and high school students interested in engineering.

Service

Edition Editor: *IEEE Computer Graphics and Applications* (January 2008 Issue on Computational Aesthetics)

Program Committee: *Eurographics 2007* (September 2007 Prague, Czech Republic)

General Chair: *Non-Photorealistic Rendering and Animation* (NPAR) (July 2007 San Diego, California.)

Steering Committee: *Graphics Interface 2007* (GI) (June 2007 Montreal, Qubec)

General Chair: *Interactive 3D* (I3D) (April 2007 Seattle, Washington.)

Program Committee: *Non-Photorealistic Rendering and Animation 2006* (NPAR) (June 2006 Annecy, France)

Organizer: *Dachshul Seminar on Computational Aesthetics* (May 2006 Frankfort, Germany)

Technical Programme Committee: *Third European Conference on Colour in Graphics, Imaging, and Vision* (CGIV 2006) (June 2006 Leeds, United Kingdom)

Publicity Chair and Program Committee: *Interactive 3D* (I3D) (April 2006 Redwood City California)

Organizer: *Eurographics Workshop on Computational Aesthetics for Graphics, Visualization and Imaging* (May 2005 Girona, Spain)

Program Committee: *Interactive 3D* (I3D) (April 2005 Washington D.C)

Organizer: *Midgraph* (November 2004 Evanston, Illinois)

Founding Online Editor: *ACM Transactions on Applied Perception*

Speaking Engagements

IEEE Visualization 2006, Course: *Medical and Scientific Illustration*

Eurographics 2006, Course: *Medical and Scientific Illustration*

ACM Siggraph 2006, Course: *Medical and Scientific Illustration*

University of Tübingen, May 2006, Department of Computer Science: *Optimizing the Communication Content of Computer Generated Imagery*

Nvidia Inc., May 2006: *Optimizing the Communication Content of Computer Generated Imagery*

Purdue University, April 2006, Department of Computer Science: *Optimizing the Communication Content of Computer Generated Imagery*

College of William and Mary, March 2006, Department of Computer Science: *Optimizing the Communication Content of Computer Generated Imagery*

University of Victoria, March 2006, Department of Computer Science: *Optimizing the Communication Content of Computer Generated Imagery*

University of California at Santa Cruz, March 2006, Department of Computer Science: *Optimizing the Communication Content of Computer Generated Imagery*

Purdue University, October 2005, Department of Electrical Engineering: *Image Retargeting*

Cambridge University, June 2005, Rainbow Graphics Group: *Non-Photorealistic Rendering*

Oxford University, June 2005, Brasenose Computer Graphics Ice Cream Social: *Non-Photorealistic Rendering*

Washington University St. Louis, October 2004, Department of Computer Science: *Non-Photorealistic Rendering*

ACM Siggraph 2003, Course: *Theory and Practice of Non-Photorealistic Graphics: Algorithms, Methods, and Production Systems.*

Brigam Young University, April 2003, Department of Computer Science: *Non-Photorealistic Rendering*

University of Iowa, March 2003, Department of Computer Science: *Non-Photorealistic Rendering*

Northwestern University, March 2003, Department of Computer Science: *Non-Photorealistic Rendering*

Notre Dame University, February 2003, Department of Computer Science: *Non-Photorealistic Rendering*

Drexel University, January 2003, Department of Computer Science: *Non-Photorealistic Rendering*

ACM Siggraph 2002, Course: *Perceptual and Artistic Principles for Effective Computer Depiction*

Disney Feature Animation, August 2000: *Non-Photorealistic Rendering*

ACM Siggraph 1999, Course: *Non-Photorealistic Rendering*

Funding

Sony-Online, $7,500: *Interactive Gaming as a Tool for Learning French*

Microsoft, $80,000: *Game Development on Multiple Hardware Platforms*

Collaborative Research Experience for Women(CREW), $3,500: *Visualizing Uncertainty in Archeological Reconstruction using Non-Photorealistic Rendering*

National Science Foundation, $281,412.00: *Retargetable Images and Video.*

ATI Inc., $7,000: *Graphics Hardware*

Maya Inc., $160,000: *Maya Complete Software Package*