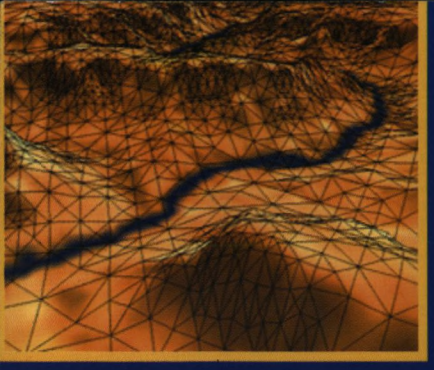
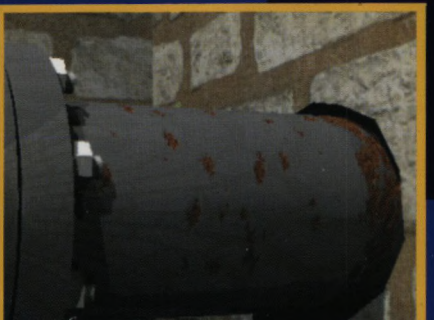




Proceedings

Graphics **Interface** 2001

7-9 June 2001
Ottawa, Ontario
Canadian Human-Computer
Communications Society

Proceedings

Graphics **Interface** 2001

Benjamin Watson and John W. Buchanan
Program Co-Chairs

www.graphicsinterface.org

Ottawa, Ontario
Canada
7–9 June 2001

Papers are reproduced here from electronic files prepared by the authors.

ISSN 0713-5424
ISBN 0-9688808-0-0

Proceedings Graphics Interface 2001, Benjamin Watson and John W. Buchanan (Program Co-Chairs), Ottawa, Ontario, 7–9 June 2001.

Graphics Interface is sponsored by:
The Canadian Human-Computer Communications Society (CHCCS)

Membership Information for CHCCS is available from:
Canadian Information Processing Society (CIPS)
One Yonge Street, Suite 2401
Toronto, Ontario
Canada M5E 1E5
Telephone: 416 861-CIPS (2477)
Fax: 416 368-9972
Web: `http://www.cips.ca/`

Additional copies of the proceedings are available from:
Canadian Information Processing Society (in Canada)

Morgan Kaufmann Publishers
340 Pine Street, Sixth Floor
San Francisco, CA 94104 USA
Telephone: 800 745-7323 or 415 392-2665
Email: `orders@mkp.com`
Web: `http://www.mkp.com/`

Published by the Canadian Human-Computer Communications Society
Printed in Canada by Graphics Services at the University of Waterloo, Waterloo, Ontario.
Cover Credits
Wireframe Meshes: Alexander Bogomjakov and Craig Gotsman (81). Math: Richard Zanibbi, Kevin Novins, and James Arvo, Katherine Zanibbi (127); Sumantro Ray and Hong Qin (47). Computer Program: Eric Paquette, Pierre Poulin, and George Drettakis (175). Colour images: Left to right (starting on back left): Taku Komura and Yoshihisa Shinagawa (27); Eric Paquette, Pierre Poulin, and George Drettakis (175); Derek Cornish, Andrea Rowan, and David Luebke (151); Jeff Orchard and Torsten Möller (191); A. James Stewart (91); Eric Paquette, Pierre Poulin, and George Drettakis (175); Taku Komura and Yoshihisa Shinagawa (27); Stephane Merillou, Jean-Michel Dischler, and Djamchid Ghazanfarpour (167). Top to bottom (skipping joint): Yadong Wu, Yushu Liu, Shouyi Zhan, and Xiaochun Gao (217); Balázs Csébfalvi and Eduard Gröller (209); Junho Kim and Seungyong Lee (101); Stephane Merillou, Jean-Michel Dischler, and Djamchid Ghazanfarpour (167). Design: Christine Goucher and Abby Van Dongen.

Message from the Program Co-Chairs

Benjamin Watson
Northwestern University

John W. Buchanan
Electronic Arts Canada

Welcome to Ottawa and Graphics Interface 2001, the 27th in this longest running of all graphics conferences. This is a homecoming for Graphics Interface, which began in 1969 in this very same city! Once again, Graphics Interface is being held in conjunction with the Vision Interface and Artificial Intelligence conferences, in an effort to promote the interchange of ideas and raise the profile of these conferences. Our thanks to the chairs of these conferences, Steven Beauchemin and Eleni Stroulia, for their collaborative efforts. In particular, Steven Beauchemin was indispensable in making local arrangements.

This year Graphics Interface received 56 full length submissions. Each paper was reviewed by two program committee members and was additionally reviewed by at least two external reviewers. Review was double blind: the authors did not know who reviewed their papers, and reviewers did not know the authors of the papers they reviewed. Conflicts of interest were studiously avoided in the review process. The program committee met on January 20 at Electronic Arts' Vancouver headquarters and selected 27 papers for inclusion in the conference. One paper, *Universal Rendering Sequences for Transparent Vertex Caching of Progressive Meshes*, by Alexander Bogomjakov and Craig Gotsman, was recognized as outstanding and recommended to the *Computer Graphics Forum* journal. The authors will be invited to submit an extended version of their paper that will be subject to that journal's normal review process.

Our thanks to the authors of *all* submitted papers, whether accepted or not. Great effort goes into the research and the crafting of any paper submission, and that effort ensures that Graphics Interface will continue to make a significant contribution to the computer graphics and HCI communities. Our thanks also the program committee members, who not only each provided detailed reviews of several papers, but also found and organized skilled external reviewers for each of many submissions. We owe a debt to our external reviewers, who provided indispensable field-specific expertise. Our gratitude is also extended to Electronic Arts Canada, which provided a beautiful facility and lunch for the committee meeting!

At press time, Rob Jacob, Sara Diamond, and Ken Perlin had accepted our invitations to present their thoughts on topics of interest to the Graphics Interface community. We look forward to their talks with gratitude and anticipation.

We owe a special thanks to Fred Peet, CHCCS Treasurer and this year's Graphics Interface Finance Chair. Dr. Fred Peet has for many years provided invaluable financial advice and service to CHCCS and the Graphics Interface conference. Unfortunately Fred Peet's name was accidentally omitted from the acknowledgements for Graphics Interface 1999 and 2000, an oversight we deeply regret, as he was a key contributor to the success of the Graphics Interface conference in both years.

Michael McCool has very capably handled the publication of the proceedings, again using a high-quality printing process directly from electronic submissions by the authors. James Stewart has been providing web server assistance to CHCCS and Graphics Interface for a few years now, but this year engineered an online submissions and reviewing system that proved invaluable. Previous chairs of this and other conferences will surely grimace painfully when they hear that we didn't have to copy or courier a single submission! We are spoiled indeed. Torsten Möller handled poster submissions, and Dave Forsey conjured our video show out of thin air (almost). Finally, we thank Pablo Figueroa and Ehud Sharlin, graduate students at U. Alberta, for crafting and maintaining the Graphics Interface 2001 web site, and Kelly Booth for his sage advice on—well, most everything.

We wish everyone an enjoyable and thought provoking time in Ottawa! Please visit our website and consider contributing to future Graphics Interface conferences:

`http://www.graphicsinterface.org/`

Organization

Conference and Program Chairs
Benjamin Watson, Northwestern University
John W. Buchanan, Electronic Arts Canada

Posters Chair
Torsten Möller, Simon Fraser University

Videos Chair
David Forsey, Radical Entertainment

Senior Student Volunteers
Ehud Sharlin, University of Alberta
Pablo Figueroa, University of Alberta

Online Services
James Stewart, University of Toronto

Proceedings Editor
Michael McCool, University of Waterloo

Program Committee
Kadi Bouatouch, IRISA & University of Rennes
Chris Bregler, Stanford University
Sheelagh Carpendale, University of Calgary
Mario Costa Sousa, Cambridge Software
Deborah Fels, Ryerson Polytechnic University
Dave Fracchia, Mainframe Entertainment
Craig Gotsman, Technion - Israel Institute of Technology
Carl Gutwin, University of Saskatchewan
Jessica Hodgins, Carnegie Mellon University
Yoshifumi Kitamura, Osaka University
Bob Lewis, Washington State University
Mikio Shinya, NTT, Japan
Thomas Strothotte, University of Magdeburg & Simon Fraser University
Wolfgang Stuerzlinger, York University

CHCCS Treasurer
Fred G. Peet, Canadian Forest Service

Referees

Alejandro Aceves
Robert Allison
John Amanatides
Ian Ashdown
Ulrike Axen
Lyn Bartram
Henning Biermann
Michael Black
Alexander Bogomjakov
Kadi Bouatouch
Doug Bowman
Chris Bregler
Joe Cafazzo
Marie-Paule Cani
Sheelagh Carpendale
Norishige Chiba
Dana Cobzas
Daniel Cohen-Or
Eric Cosatto
Mario Costa Sousa
David Cowperthwaite
Rudy Darken
Oliver Deussen
John Dill
Julie Dorsey
Philip Dutré
Ilya Eckstein
Jihad El-Sana
Thomas Ertl
Tony Ezzat
Cheng-Chih Fan-Chiang
Sidney Fels
Deborah Fels
George Fitzmaurice
Dave Fracchia
Issei Fujishiro
Marcelo Gattass
Patrick Gioia
Craig Gotsman
Saul Greenberg
Stefan Gumhold
Carl Gutwin
Wolfgang Heidrich
Daryl Hepting
Daniela Herlea-Damian
Aaron Hertzmann
Jessica Hodgins
Ruediger Hohmann
Hugues Hoppe
Martin Isenburg
Masaki Kameya
Kazufumi Kaneda
Zachi Karni
Rom Kimmel
Yoshifumi Kitamura
Leif Kobbelt
Rudolf Kruse
Hideaki Kuzuoka
Paul Lalonde
Francis Lazarus
Bob Lewis
Adrian Lieu
Micha Lindenbaum
Kenji Mase
Toshiyuki Masui
Richard May
Michael McAllister
Michael McCool
Torsten Möller
Tomas Möller
Jean-Michel Moreau
Yasushi Nakauchi
Bruce Naylor
John Olson
Nancy Pollard
Ivan Poupirev
Bernhard Preim
Jun Rekimoto
Lionel Reveret
Jon Rokne
Szymon Rusinkiewicz
Christian Rssl
Takafumi Saito
Yoichi Sato
Gernot Schaufler
Christophe Schlick
Roberto Scopigno
Greg Seale
Mikio Shinya
Mel Siegel
Vic Singh
Pavel Slavik
Philipp Slusallek
Jeffrey Smith
Oliver Staadt
Lisa Streit
Thomas Strothotte
Wolfgang Stuerzlinger
Oded Sudarsky
Vitaly Surazhsky
Haruo Takemura
Daniel Taranovsky
Luiz Velho
Anna Vilanova
Henrik Wann Jensen
Colin Ware
Robert E. Webber
Chris Welman
Andrew Woo

Table of Contents

Non-Photorealistic Rendering

Natural Phenomena

Visualization

Virtual Reality

Invited Speakers

Sensing What We Know

Sara Diamond
Banff Centre for the Arts

Drawing from examples at the prestigious Banff Centre for the Arts, and her own Code Zebra project, Diamond will explore the kinds of knowledge that artists and scientists can create through crossdisciplinary collaboration, including the capability to understand what we do not know. How does creativity in art and science parallel? Where does discovery rely on intuition, the sensorium, affective process and lateral thinking? Does science lose its credibility if it acknowledges these dynamics in research?

In the early part of the previous century, artists repurposed old or current technologies, interrogating and changing their values. From the dada movement on artists' works have offered a social and cultural critique of technology, at times suggesting new ways of understanding its potential. Since the late 1980s, artists have flowed more aggressively into actual invention and innovation. Have they contributed?

Artists are currently in the foreground of work in three areas: collaborative tool development, agent based software environments, and advanced visualization/sensory systems. Whether the Audience Project by Adam Frank, with its responsive characters, the ice cream code project by Simon Pope, Subtract the Sky by Sharon Daniels and Mark Bartlett, the No Time project by Victoria Vesna, or Code Zebra, by Diamond and her computer science collaborators, artists are providing another way of imagining our relationships to one another and the world. Diamond will offer current examples of projects as food for thought.

Biography

Sara Diamond is Artistic Director of Media and Visual Art at The Banff Centre in Canada and Executive Producer of Television and New Media. She is responsible for the development of new media research, for all television and new media coproduction and for the development and delivery and creative residencies, as well as exhibition. She created the Banff New Media Institute, a think tank and workshop environment for new media and knowledge exchange. Diamond develops new media content for festivals such as the Banff TV Festival and DEAF (Netherlands), curates shows and writes critical theory about new media. She teaches at UCLA (Design Media Dept.) as well as leading the program at Banff. She is curently developing Code Zebra, an advanced visualization software to express emotional dynamics in networked conversations and chats.

Elements of Next-Generation, Non-WIMP User Interfaces

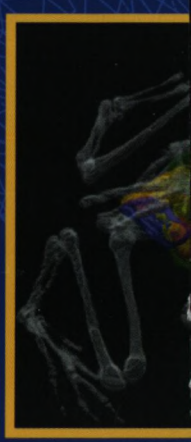
Robert J.K. Jacob
MIT Media Laboratory
and
Department of Electrical Engineering and Computer Science
Tufts University

I will survey some of the qualities I see as likely to characterize the next generation of emerging "non-WIMP" user interfaces. Rather than trying to predict specific future user interfaces, I am seeking to abstract across a range of these interfaces to find general properties that they will share, particularly those likely to affect how we build user interface software in the future—specifically: continuous input and output, merged with discrete interaction; parallel interaction across multiple modes; natural or "reality-based" interaction, particularly including virtual reality and tangible media; natural interaction augmented by artificial extensions; and lightweight, non-command, passive interactions, gleaning inputs from context and from physiological or behavioral measures. I will also describe my experimental work on new interaction techniques for eye movement-based interaction, lightweight techniques for browsing in a digital library, and tangible user interfaces, as examples of some of these characteristics. Finally, while new, more powerful interaction techniques and modes can make interfaces easier to learn and use, they are becoming more difficult to describe and build. I will discuss my work on developing new software models and abstractions for specifying and implementing non-WIMP interfaces, aimed at the problems raised by continuous and parallel interaction.

Biography

Robert Jacob is an Associate Professor of Electrical Engineering and Computer Science at Tufts University, where his research interests are user interface software and new interaction media and techniques. He is also currently a visiting professor at the MIT Media Laboratory, in the Tangible Media Group. Before coming to Tufts, he was in the Human-Computer Interaction Lab at the Naval Research Laboratory. He received his Ph.D. from Johns Hopkins University, and he is member of the editorial board of ACM Transactions on Computer-Human Interaction, former Vice-Chair of ACM SIGCHI, and Papers Co-Chair of the CHI 2001 conference.

Author Index



www.graphicsinterface.org

ISSN 0713-5424
ISBN 0-9688808-0-0