Message from the Program Co-Chairs

Sidney S. Fels
Department of ECE
University of British Columbia

Pierre Poulin
Département IRO
Université de Montréal

This year marked the return to Montréal of the Graphics Interface conference after 15 years of being held in different cities across Canada. Graphics Interface 2000 was held at the Palais des Congrès on May 15th to 17th in conjunction with four other conferences (Artificial Intelligence 2000, Vision Interface 2000, International Symposium on Robotics 2000, and the Annual PRECARN-IRIS Conference), as well as two trade shows (Robotics of Tomorrow and Montréal Machine Tool and Factory Automation).

We received 90 paper submissions on a wide range of topics related to computer graphics and human-computer interaction. From these, after considerable deliberation, the program committee selected the 27 papers that appear in these proceedings. With the very high overall quality of the submissions, the selection was very difficult. Each submission was reviewed by at least four experts, including two who sat on the program committee. The reviewing process was double-blind; no reviewer was informed of the authors or affiliations of any paper, even during the selection process at the program committee meeting. The program committee paper selection meeting was held in Toronto in January and was attended by 15 of the 19 committee members; each committee member paid their own expenses. Each committee member actively participated in discussing all submitted papers, except for those for which they had a conflict of interest, to try to ensure the fairness of the process. We greatly appreciate the enormous contribution the program committee made to keep GI an excellent, high quality conference.

We extend our gratitude to our three invited speakers: Henry Fuchs, University of North Carolina; Hiroshi Ishii, MIT Media Laboratory; and Demetri Terzopoulos, University of Toronto, who came to share their inspiration in their respective fields.

We wish to thank all the committee members for their strong involvement, all the reviewers for their critical analysis, James Stewart for developing all the necessary scripts for the electronic submission, reviewing, and final submission process, Michael McCool for the production of the printed proceedings, Wolfgang Stuerzlinger for taking care of everything involved in organizing the posters, Paul Johnston for bringing all these events together, Hélène Lamadeleine and Golden Planners Inc. for the organization of the joint conferences, Laurent Lefebvre for supporting the local website, and Luc Leblanc for lending his personal computer to the project for several months. All of these people took time out of their busy schedules to make this event a memorable success, and we sincerely regret if any omissions have been made in these acknowledgements. The devotion of these volunteers to fellow researchers and to their fields demonstrates the importance granted to Graphics Interface. Finally, we wish to extend our appreciation to all the authors whose papers could not be included in these proceedings. The quality of your work often deserved the honour of appearing in these proceedings, and we regret that time and space constraints prevented us from accepting more of the submitted papers.

With its wide distribution throughout the world and the quality of the scientific contributions of its papers, we expect these proceedings to become an invaluable resource for computer graphics and human-computer interaction researchers and practitioners. We invite you to visit our website and strongly encourage you to contribute to future Graphics Interface conferences:

http://www.graphicsinterface.org/
Organization

Conference and Program Chairs
   Sidney Fels, University of British Columbia
   Pierre Poulin, Université de Montréal

Posters Chair
   Wolfgang Stuerzlinger, York University

Videos Chair
   Pierre Poulin, Université de Montréal

Program Committee
   Kadi Bouatouch, Université de Rennes 1
   Mathieu Desbrun, Caltech
   Frédo Durand, Massachusetts Institute of Technology
   Deborah Fels, Ryerson Polytechnic University
   Mark Green, University of Alberta
   Carl Gutwin, University of Saskatchewan
   Christopher G. Healey, North Carolina State University
   Kori Inkpen, Simon Fraser University
   Paul Lalonde, Electronic Arts
   Michael McCool, University of Waterloo
   Dimitris N. Metaxas, University of Pennsylvania
   Chris Shaw, University of Regina
   Mikio Shinya, Nippon Telegraph and Telephone Corporation
   James Stewart, University of Toronto
   Wolfgang Stuerzlinger, York University
   Benjamin Watson, University of Alberta
   Shumin Zhai, IBM Almaden Research Center

Webmasters
   James Stewart, University of Toronto
   Laurent Lefebvre, Université de Montréal

Proceedings Editor
   Michael McCool, University of Waterloo
Referees

Mark Ackerman
John Amanatides
Steve Anderson
Jim Arvo
Norman Badler
Rui Bastos
Ben Bederson
Mark Billinghurst
Jules Bloomenthal
kadi Bouatouch
Armin Bruderlin
John W. Buchanan
Emilio Camahort
Marie-Paule Cani
Sheelagh Carpendale
Jim Carter
Frederic Cazals
Chun-Fa Chang
Anastasia Cheetham
Sean Cocks
Jonathan D. Cohen
Daniel Cohen-Or
Matt Conway
Satyan Coorg
Edward H. Cornell
Donald Cox
Sara Czaja
Rudy Darken
Doug DeCarlo
Gilles Debunne
Mathieu Desbrun
Ralph Deters
Jean-Michel Dischler
George Drettakis
Frederic Cazals
Daniel C. Fain
François Faure
Paul Fearing
Deborah Fels
Paul Ferry
Alain Fournier
Laure France
Issei Fujishiro
Michael Garland
Ricki Goldman-Segall
Ardeshir Goshtasby
Ambarish Goswami
Craig Gotsman
Mark Green
Saul Greenberg
Jonathan Grudin
Eduard Gruller
Yves Guiard
Thierry Guiard-Marigny
Stefan Gumhold
Carl Gutwin
James Hall
Li-Wei He
Christopher G. Healey
Pheng Ann Heng
Ken Hinckley
Jessica Hodgins
Scott Hudson
Kori Inkpen
Horace H.S. Ip
John Isidoro
Robert Jacob
Frederik W. Jansen
Ioannis Kakadiaris
Kazufumi Kaneda
Rob Kooper
Cyriaque Kouadio
Steve LaValle
David Laidlaw
Paul Lalonde
Joseph Laszlo
James Lester
Bruno Levy
Bob Lewis
Erik Lindholm
David Luebke
Scott MacKenzie
Jock Mackinlay
Eric Maisel
Stephen Mann
Dave Martindale
Claude Martins
David McAllister
Michael McCool
Leonard McMillan
Daniel Meneveaux
Mark Meyer
Eric Neufeld
Fabrice Neyret
Tomoyuki Nishita
Jun-Yong Noh
Ming Ouhyoung
Marc Olano
Mark Peercy
Catherine Plaisant
Zoran Popovic

Patrick Ratto
Penny Rheingans
George Robertson
Randy Rohrer
Martin Rumpf
Takafumi Saito
Gernot Schaufler
Eric Schenk
Christophe Schlick
Carlo Sequin
Elud Sharlin
Chris Shaw
Mikio Shinya
John Sibert
Maryann Simmons
Barton Smith
Tony C. Smith
Jim Spohrer
Robert St. Amant
Jos Stam
Marc Stamminger
James Stewart
Wolfgang Stuerzlinger
Ching Y. Suen
Tamara Sumner
Hanqiu Sun
Tokichiro Takahashi
Jim Tam
Toshimitsu Tanaka
Russell M. Taylor II
Demetri Terzopoulos
Joelle Thollot
Judi Thomson
Eric Tosan
Xiaoyuan Tu
Jack Tumblin
Michel van de Panne
Bill Verplank
Pascal Volino
John W. Senders
Benjamin Watson
Carolynn Whiteley
Turner Whitted
Laurel Williams
David Wong
Brian Wyvill
Shigeki Yokoi
R. Michael Young
Robert Zeleznik
Shumin Zhai
Table of Contents

Invited Speaker

Tangible Bits: Designing the Boundary between People, Bits, and Atoms .............................................................. 1
Hiroshi Ishii

Issues and Techniques for Interactive Information Spaces

Multi-resolution Amplification Widgets .............................................................. 3
Kiril Vidimcs and David Banks
Navigating Complex Information with the ZTree ..................................................... 11
Lyn Bartram and Axel Uhl
The Effects of Feedback on Targeting Performance in Visually Stressed Conditions ............................................ 19
Julie Fraser and Carl Gutwin

Modeling

Fast and Controllable Simulation of the Shattering of Brittle Objects .......................... 27
Jeffrey Smith, Andrew Witkin, and David Baraff
Skinning Characters using Surface-Oriented Free-Form Deformation ........................ 35
Karan Singh and Evangelos Kokkevis

Invited Speaker

Artificial Animals (and Humans): From Physics to Intelligence .................................. 43
Demetri Terzopoulos

Animation

Dynamic Time Warp Based Framespace Interpolation for Motion Editing .......................... 45
Golam Ashraf and Kok Cheong Wong
Automatic Joint Parameter Estimation from Magnetic Motion Capture Data .................. 53
James O’Brien, Bobby Bodenheimer, Gabriel Brostow, and Jessica Hodgins
Animating Athletic Motion Planning By Example ................................................. 61
Ronald Metoyer and Jessica Hodgins

Image-based Modeling and Rendering

Image-Based Virtual Camera Motion Strategies ..................................................... 69
Eric Marchand and Nicolas Courty
Analysis and Synthesis of Structural Textures ....................................................... 77
Laurent Lefebvre and Pierre Poulin
High-Quality Interactive Lumigraph Rendering Through Warping .......................... 87
Hartmut Schirmacher, Wolfgang Heidrich, and Hans-Peter Seidel
Collaborative and Community Spaces

Effects of Gaze on Multiparty Mediated Communication ........................................... 95
Roel Vertegaal, Gerrit van der Veer, and Harro Vons
Towards Seamless Support of Natural Collaborative Interactions ........................... 103
Stacey Scott, Garth Shoemaker, and Kori Inkpen
The ChatterBox: Using Text Manipulation in an Entertaining Information Display .......... 111
Johan Redström, Peter Ljungstrand, and Patricija Jaksetic

Rendering

Approximation of Glossy Reflection with Prefiltered Environment Maps .......................... 119
Jan Kautz and Michael D. McCool
Adaptive Representation of Specular Light Flux .............................................................. 127
Normand Brière and Pierre Poulin
Multiscale Shaders for the Efficient Realistic Rendering of Pine-Trees ......................... 137
Alexandre Meyer and Fabrice Neyret

Image Processing and Visualization

Anisotropic Feature-Preserving Denoising of Height Fields and Images ....................... 145
Mathieu Desbrun, Mark Meyer, Peter Schroeder, and Alan Barr
A Fast, Space-efficient Algorithm for the Approximation of Images by an Optimal Sum of Gaussians ................................................................. 153
Jeffrey Childs, Cheng-Chang Lu, and Jerry Potter
Oriented Sliver Textures: A Technique for Local Value Estimation of Multiple Scalar Fields ................................................................. 163
Chris Weigle, William Emigh, Geniva Liu, Russell Taylor, James Enns, and Christopher Healey

Advances in HCI Design and Applications

Using a 3D Puzzle as a Metaphor for Learning Spatial Relations ................................. 171
Bernhard Preim, Felix Ritter, Oliver Deussen, and Thomas Strothotte
Affordances: Clarifying and Evolving a Concept ......................................................... 179
Joanna McGrenere and Wayne Ho
Are We All In the Same “Bloat”? .................................................................................. 187
Joanna McGrenere and Gale Moore

Geometry

Triangle Strip Compression ......................................................................................... 197
Martin Isenburg
Incremental Triangle Voxelization ............................................................................... 205
Frank Dachille and Arie Kaufman
Dynamic Plane Shifting BSP Traversal ..................................................................... 213
Stan Melax
Model Simplification Through Refinement .................................................................. 221
Dmitry Brodsky and Benjamin Watson
Author Index

Banks, David ........................................ 3
Baraff, David ........................................ 27
Barr, Alan ............................................ 145
Bartram, Lyn ......................................... 11
Bodenheimer, Bobby .............................. 53
Brière, Normand ..................................... 127
Brodsky, Dmitry ..................................... 221
Brostow, Gabriel ..................................... 53
Childs, Jeffrey ....................................... 153
Courty, Nicolas ....................................... 69
Dachille, Frank ....................................... 205
Desbrun, Mathieu .................................... 145
Deussen, Oliver ....................................... 171
Emigh, William ...................................... 163
Enns, James .......................................... 163
Fraser, Julie .......................................... 19
Golam, Ashraf ........................................ 45
Gutwin, Carl ......................................... 19
Healey, Christopher ............................... 163
Heidrich, Wolfgang ................................. 87
Ho, Wayne ............................................. 179
Hodgins, Jessica ..................................... 53, 61
Inkpen, Kori .......................................... 103
Isenburg, Martin ..................................... 197
Ishii, Hiroshi .......................................... 1
Jaksetic, Patricija .................................... 111
Kaufman, Arie ........................................ 205
Kautz, Jan ............................................. 119
Kokkevis, Evangelos ............................... 35
Lefebvre, Laurent ................................... 77
Liu, Geniva .......................................... 163
Ljungstrand, Peter ................................... 111
Lu, Cheng-Chang ..................................... 153
Marchand, Eric ....................................... 69
McCool, Michael ...................................... 119
McGrenere, Joanna ................................. 179, 187
Melax, Stan .......................................... 213
Metoyer, Ronald ..................................... 61
Meyer, Alexandre .................................... 137
Meyer, Mark .......................................... 145
Moore, Gale .......................................... 187
Neyret, Fabrice ...................................... 137
O’Brien, James ........................................ 53
Potter, Jerry .......................................... 153
Poulin, Pierre ......................................... 77, 127
Preim, Bernhard ...................................... 171
Redström, Johan ..................................... 111
Ritter, Felix .......................................... 171
Schirmacher, Hartmut ............................. 87
Schroeder, Peter ..................................... 145
Scott, Stacey .......................................... 103
Seidel, Hans-Peter .................................. 87
Shoemaker, Garth ................................... 103
Singh, Karan .......................................... 35
Smith, Jeffrey ......................................... 27
Strothotte, Thomas .................................. 171
Taylor, Russell ....................................... 163
Terzopoulos, Demetri .............................. 43
Uhl, Axel .............................................. 11
van der Veer, Gerrit ................................. 95
Vertegaal, Roel ........................................ 95
Vidimcs, Kiril .......................................... 3
Vons, Harro .......................................... 95
Watson, Benjamin .................................... 221
Weigle, Chris ......................................... 163
Witkin, Andrew ...................................... 27
Wong, Kok Cheong ................................... 45
Call for Papers

GI 2001 will be a unique event presenting the latest results in computer graphics and human-computer interaction. It offers three days of invited speakers, posters, and refereed paper presentations. A banquet and electronic theatre will provide additional opportunities to meet speakers and other attendees for informal discussion in a social setting.

This year will be the 27th annual Graphics Interface. It is the oldest regularly scheduled computer graphics and human-computer interface conference in the world. Graphics Interface has established a reputation for a high-quality technical program and excellent invited speakers. Full details can be obtained through the Graphics Interface web site at www.graphicsinterface.org.

GI 2001 will be held at the University of Alberta, in Edmonton, Canada. Edmonton is a beautiful Canadian city located on the North Saskatchewan River. It is served by Air Canada, Canadian, Northwest and Horizon Airlines. As the location for the University of Alberta and the provincial capitol, Edmonton has a thriving intellectual and cultural life. Spring will be at its full force in May, and the beauty of the river park, with its hundreds of miles of paths, will be at its peak.

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

Posters Chair
Torsten Moeller, Simon Fraser University

Videos Chair
Dave Forsey, Radical Entertainment

Important Dates
Papers Due .................. 19 November 2000
Decision for Papers ............... 8 February 2001
Posters Due .................. 26 March 2001
Videos Due .................. 26 March 2001
Final Submission Due .............. 2 April 2001
Decision for Posters ............... 16 April 2001
Decision for Videos ................ 16 April 2001

For the latest information on the call for papers, the submission process, and the 2001 conference, visit the Graphics Interface web site at:
www.graphicsinterface.org

This conference is sponsored by the Canadian Human-Computer Communications Society.
Submissions

Contributions are solicited describing unpublished research results and applications experience in all areas of computer graphics and human-computer interaction, specifically including the following:

- Image synthesis & realism
- Shading & rendering algorithms
- Geometric modeling & meshing
- Computer animation
- Medical graphics
- Computer-aided building design
- Visualization
- Mobile computing
- User interfaces & modeling
- Windowing systems
- Computer cartography
- Image processing
- Graphics for CAD/CAM
- Graphics & the arts
- Graphics in business
- Haptic interfaces
- Image-based rendering techniques
- Hardware techniques
- Computer supported cooperative work
- Interaction techniques
- Graphics in education
- Industrial & robotics applications
- Graphics in simulation
- Human interface devices

Papers, formatted as they would appear in the final proceedings, must be received by 19 November 2000. Submissions will be entirely electronic in the form of PDF files; please visit the Graphics Interface web site for a detailed description of the submission process and format requirements. In exceptional cases, traditional hardcopy submissions will be accepted; first contact one of the conference co-chairs. Refereeing will be double blind. Only the title, without any indication of authorship or author location, should appear on the manuscript body. A separate file (sheet) should contain the manuscript title, abstract, and the full names, postal addresses, phone numbers, fax numbers, and email addresses for all authors. One author should be designated the contact author for subsequent correspondence regarding the paper. Accepted papers will be published in an archival-quality proceedings to be distributed by both ACM and Morgan-Kaufmann.

Notification of acceptance or rejection will be emailed to the contact author by 8 February 2001. The final versions of accepted papers are due 2 April 2001. Each paper will be allotted up to eight (8) pages in the proceedings free of charge. Extra charges will be made for pages exceeding the limit and for colour pages. All printing will be done on an offset press using a high-resolution imagesetter and CMYK process colour, directly from electronic files (PDF) submitted by the authors. Exceptionally good papers will be considered for publication in journals; arrangements exist for the best graphics papers to be considered by Computer Graphics Forum and for the best human-computer interface papers to be considered by Behaviour & Information Technology.

Conference Co-Chair Addresses

John Buchanan
Electronic Arts Canada
4330 Sanderson Way
Burnaby, BC Canada
V5G 4X1
Phone: +1 604-419-3037
Fax: +1 604-729-6370
Email: juancho@ea.com

Benjamin Watson
Department of Computer Science
Northwestern University
1890 Maple Ave
Evanston, Illinois 60201, USA
Phone: +1 847-467-1332
Fax: +1 847-491-5258
Email: watsonb@cs.nwu.edu