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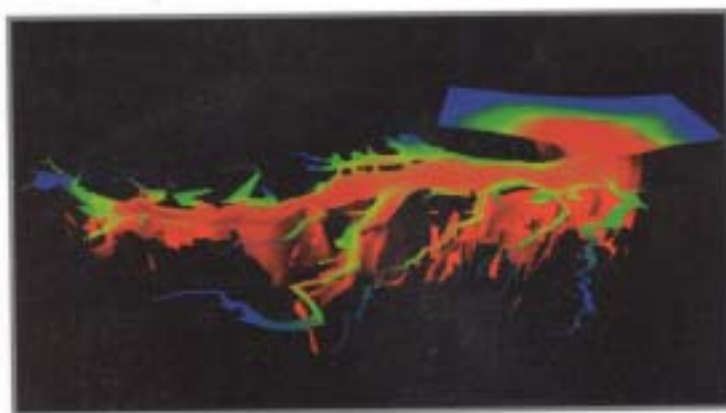
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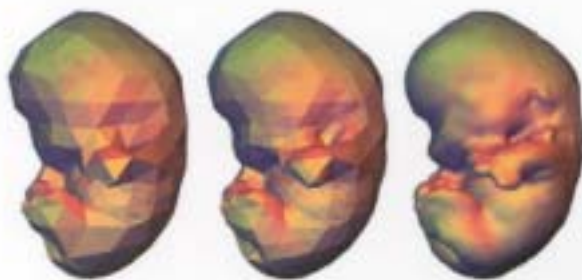
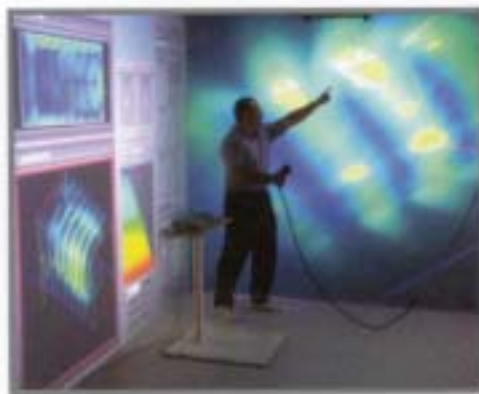
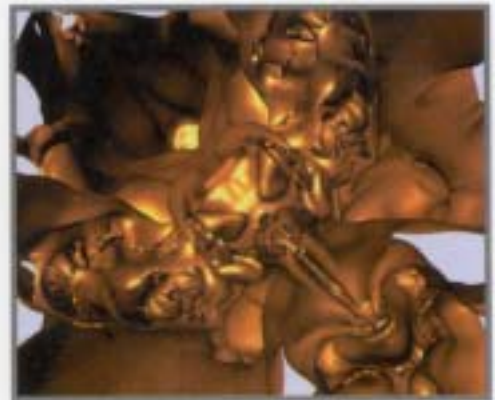
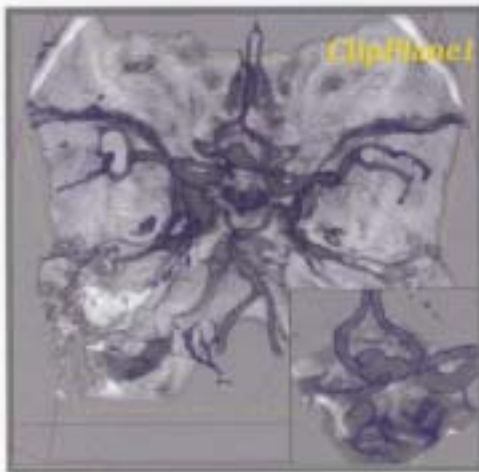
OCTOBER 8 - OCTOBER 13, 2000
SALT LAKE CITY, UTAH
EDITED BY THOMAS ERTL, BERND
HAMANN AND AMITABH VARSHNEY



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Preface

Welcome to IEEE Visualization 2000! We are pleased to present to you in this volume the proceedings of IEEE Visualization 2000, being held during October 8 — 13, 2000 in Salt Lake City, Utah. As we move forward to a new millennium, we find that the visualization technologies have permeated almost all facets of human endeavors in science, engineering, medicine, and entertainment and are undeniably influencing the very quality of our lives. As the ubiquity of visualization has grown over the last few decades, so too has the scope of this conference. This year the conference provides an intellectually stimulating program spanning a diverse set of applications, a rich set of data and information representations, and a variety of algorithms and systems. We see this conference as fulfilling the important mission of providing a forum to promote interaction amongst researchers, developers, and users of various visualization technologies and applications. This annual Visualization Conference series is sponsored by the IEEE Computer Society's Technical Committee on Visualization and Graphics in cooperation with ACM SIGGRAPH. We hope that you will find this year's program tightly packed with exciting papers, educational case studies, and thought-provoking panels between the visionary keynote and the capstone sessions.

Keynote and Capstone Addresses

We are delighted to have Michael Cohen from Microsoft Research as this year's keynote speaker. In his Keynote address "Visualization of Everyday Things", he shares with us his insights on how visualization can help us reveal the hidden structure and beauty around us in our everyday lives.

It is our pleasure to have Olivier Faugeras from INRIA, France and EE and CS Departments at MIT, conclude the conference with his Capstone address "Variational Methods in Medical Imagery: Application to the Segmentation of Anatomical Structures". He will discuss general design principles behind the use of variational methods for solving segmentation problems based on the geometric information about the target structures.

Papers

This year the conference received 151 paper submissions of which 52 were selected by peer review to appear in these proceedings. This represents an increase of about 20% in paper submissions over the previous year. Another milestone this year has been the introduction of electronic submission of papers in addition to the regular hardcopy submissions. We were pleasantly surprised by the enthusiastic and hearty response to our introduction of electronic submissions. As many as 128 papers were submitted electronically this year. We also received several positive comments from members of the Papers Committee and reviewers on electronic availability of papers which allowed them to download the papers from home and while traveling. Although this mode of dual submissions increased the work load of ensuring consistency in the conference databases, we view this as an essential step in the longer-term vision of an all-electronic submission and review process. The

electronic submissions and review for the conference were greatly assisted by the START conference management software written by Rich Gerber, Jeff Hollingsworth, and Adam Porter from the University of Maryland at College Park.

To maintain the high quality and fairness of the selection process, this year's Papers Committee consisted of 23 visualization researchers, all leaders and visionaries in their respective areas of research from around the world. Each member of the Papers Committee was responsible for reviewing, summarizing, and calibrating the scores of reviewers for all the papers assigned to him/her. We feel that this process allowed a better comparative evaluation of papers as well as distributed the decision-making process more fairly. In case of a potential conflict of interest for a reviewer, a Papers Committee member, or a Papers Co-Chair, the paper was reviewed and evaluated by alternates. The members of the Papers Committee this year were:

Georges-Pierre Bonneau
Alan Chalmers
Daniel Cohen-Or
Leila De Floriani
David Ebert
Stephen G. Eick
A. Robin Forrest
Tom Funkhouser
Markus Gross
Hans Hagen
William Hibbard
Victoria Interrante

David Kenwright
Hans-Georg Pagendam
James Painter
Alex Pang
Hanspeter Pfister
Holly Rushmeier
Jarek Rossignac
Claudio Silva
Samuel P. Uzelton
Jarke van Wijk
William Wright

The growing influence of the visualization algorithms, software, and systems is clear from the rise in the quality as well as the quantity of papers submitted and accepted by the conference this year. The accepted papers cover a broad spectrum of research topics including biomedical and scientific applications, information visualization, visual and haptic displays, visual perception, flow visualization, tetrahedral grids, volume rendering, isosurfaces and polygonal meshes, and multi-dimensional visualization systems. This compilation of high-quality research would not have been possible without the hard work and diligence of the authors as well as the reviewers. The authors of the selected papers are acknowledged through their work presented in these proceedings. We would especially like to acknowledge the conscientious and thorough reviews provided by the reviewers, several of whom took precious time off from their jobs, job searches, sabbaticals, and even summer vacations, with hardly any tangible rewards, except for the satisfaction from a job well done and from furthering the cutting-edge in visualization research. This year we solicited expert opinions from the following 227 reviewers:

James P. Ahrens
Marc Alexa
Lisa Sobierajski Avila
Norman Badler
Mike Bailey
Chandrajit Bajaj
H. Harlyn Baker
Pauline M. Baker
David C. Banks
Dirk Bartz
Stephen A. Benton
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Michael Cox
Roger A. Crawfis
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Frank Dachille
Tali Dafner
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José Encarnação
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Robert F. Erbacher
Francine Evans
Norberto Ezquerro
Shiaofen Fang
Steve Feiner
James D. Foley
David F. Fracchia
Sarah F. Frisken
Bernd Fröhlich
Martin Frühauf
Henry Fuchs
Issei Fujishiro
Fabio Ganovelli
Michael Garland
Michael J. Gerald-Yamasaki
Martin Göbel
Michael Goss
Craig Gotsman
Michel Grave
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Georges Grinstein
Eduard Gröller
Andre P. Guezic
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Baining Guo
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Lichan Hong
Matthew C. Humphrey
Alfred Inselberg
Takayuki Itoh
T.J. Jankun-Kelly
Chris Johnson
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Leif P. Kobbelt
Martin Kraus
Kevin Kreeger
Oliver Kreylos
Shankar Krishnan
Yair Kurzion
Tosiyasu Kunii
Eric LaMar
David Laidlaw
Asish Law
Wim de Leeuw
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Yarden Livnat
Mark Livingston
Suresh K. Lodha
William Lorenzen
Lin Luo
Kwan-Liu Ma
Raghu Machiraju
Nadia Magnenat-Thalmann
Gordon D Mallinson
Tom Malzbender
Dinesh Manocha
Kenneth M. Martin
Robert McDermott
Kevin McDonnell
Michael Meißner
Dimitri Metaxas
Jörg Meyer
Christopher Migdal
Torsten Möller
Robert J. Moorhead
Heinrich Müller
Klaus Mueller
Shigeru Muraki
Ken Musgrave

Karol Myszkowski
Peter Neugebauer
Ulrich Neumann
Gregory Nielson
Chris North
Art Olson
Renato Pajarola
Rick Parent
Jun Park
Steve Parker
Valerio Pascucci
Ronald Peikert
Andreas Pommert
Frits Post
Enrico Puppo
Werner Purgathofer
Huamin Qu
Christoph Ramshorn
Dave Reed
Freek Reinders
Penny Rheingans
Theresa-Marie Rhyne
Bill Ribarsky
Kay A. Robbins
Jonathan C. Roberts
Lawrence Rosenblum
Martin Roth
Martin Rumpf
Georgios Sakas
Richard Salter
Andrea Sanna
Dietmar Saupe
Gerik Scheuermann
Daniel R. Schikore
Florian Schröder
Will Schroeder
Roberto Scopigno
Hans-Peter Seidel
Hikmet Senay
Jonathon Shade
Ariel Shamir
Nacem O. Shareef
Raj Shekhar
Han-Wei Shen
Peter Shirley
Ben Shneiderman

David Sigiety
Kris Sikorski
Deborah Silver
Kenneth R. Sloan
Peter-Pike Sloan
Hans J.W. Spoelder
Oliver G. Staadt
Detlev Stalling
Wolfgang Straßer
Werner Stuetzle
Philip M. Sutton
Edward Swan
Ayellet Tal
Russell M. Taylor
Demetri Terzopoulos
Jim Thomas
Ulf Tiede
Lloyd Treinish
Greg Turk
Mike Vannier
Luiz Velho
Guy Vezina
Keith Voegelé
Stefan Walter
Matthew Ward
Gunther Weber
Manfred Weiler
Henrik Weimer
David Weinstein
Daniel Weiskopf
Rüdiger Westermann
Ross T. Whitaker
Mary C. Whitten
Allan R. Wilks
Craig M. Wittenbrink
Hans Jurgen Wolters
Pak C. Wong
Helen Wright
John R. Wright
Yunnan Wu
Roni Yagel
Terry S. Yoo
Ilmi Yoon
Suya You
Michael Zyda

The Papers Co-Chairs are particularly thankful to Aravind Kalaiah and Xuejun Hao, graduate students at SUNY Stony Brook and now at the University of Maryland at College Park, for their substantial help in keeping the papers submission and reviewing process moving smoothly. We would also like to acknowledge the timely and generous cooperation of several staff at the Center for Visual Computing, SUNY Stony Brook, including Brian Tria, Anne Kilarjian, and Stella Mannino.

Case Studies

This year the Visualization conference has selected an eclectic mix of 21 Case Studies that document and report the experiences of visualization researchers and practitioners on a diverse set of visualization applications and techniques. The application areas cover biomedical, scientific, environmental, information, and physics applications. This uniquely impressive, educational, and high-quality track at this conference has been organized by the Case Studies Co-Chairs, David Kao, (NASA Ames) and Robert van Liere (Center for Mathematics and Computer Science, Amsterdam). They were assisted in their efforts by the conscientious and diligent reviewing by these 43 experts:

Dirk Bartz	Wim de Leeuw
Barry Becker	Wilfred Lefer
Dan Bergeron	Kwan-Liu Ma
Edwin Blake	Robert Moorehead
Ken Brodli	Jurriaan Mulder
Tom Crockett	Heinrich Müller
Shiaofen Fang	Patrick J. Moran
Issei Fujshiro	Frits Post
David F. Fracchia	Freek Reinders
Michael Gerald-Yamasaki	Georgios Sakas
Martin Göbel	Dieter Schmalstieg
Eduard Gröller	Han-Wei Shen
Hans Hagen	Deborah Silver
Robert Haines	Lloyd Trensih
Andrew Hansen	Keith Voegel
Helwig Hauser	Val Watson
Chris Henze	Peter Williams
Ivan Herman	Craig Wittenbrink
William Hibbard	Jack van Wijk
Victoria Interrante	Hans Wolters
Jaap Kaandorp	Pak Wong
Ulrich Lang	

Panels

The panels track at the Visualization conference provides an interactive forum to present and debate interesting and controversial topics of current and future interest. The Panels Co-Chairs Rachael Brady (Beckman Institute, Urbana-Champaign), Jamie Painter (TurboLinux Turbolabs, New Mexico), and Michael Goss (Hewlett-Packard Laboratories) have selected a set of three panels presented and moderated by the experts in the field. The panels will discuss the impact of computer games on the field of visualization, the selection and role of transfer functions in visualization, and next-generation visualization displays.

Video

As every year, the proceedings are accompanied by a collection of submitted videos. Thanks are due to the Video Chair, Robert J. McDermott, for his professional work and dedication in producing the video proceedings.

CD-ROM

As in the years before, the papers, case studies, panels, tutorials, and symposia are also provided electronically on a CD-ROM as a supplement to the proceedings. Thanks are due to Torsten Möller, this year's Publications Chair, for assembling and producing this material.

Additional Material

In addition to the material in the proceedings, IEEE Visualization 2000 includes two symposia, "Information Visualization" and "Volume Visualization and Graphics," and a workshop on "Semantic Visualization of Nonquantitative Relationships". The conference also features tutorials, demonstrations, a Creative Applications Lab, and Work in Progress.

Additional Acknowledgments

Many individuals, whose names are not mentioned above, have contributed many hours and significant efforts in making IEEE Visualization 2000 and these proceedings a success. We would like to warmly thank Conference Co-Chairs Charles Hansen, Chris Johnson, and Steve Bryson for their tireless dedication, coordination of all the activities, and valuable advice at every stage. We also thank the Program Co-Chairs David Ebert and Mike Bailey for being in constant touch with us and helping ensure that the process of submission, review, selection, and compilation proceeded smoothly. We would like to thank Richard Coffey and Nathan Galli, our logo designers. Finally, we owe a huge thanks to Torsten Möller (Simon-Fraser University), for his invaluable assistance in assembling the proceedings. Torsten's meticulous attention to detail, dedication, and talent are self-evident in the high quality production of the proceedings and CD-ROM. We would also like to thank Stephen Spencer for serving as a great resource and help in ensuring the smooth production of these proceedings.

We hope that you find Visualization 2000 conference and proceedings informative, thought-provoking, and useful and participate again in the Visualization '01 in San Diego, California.

Thomas Ertl, Bernd Hamann, and Amitabh Varshney
Papers Co-Chairs and Co-Editors of the IEEE Visualization
2000 Proceedings