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Message from the Editor-in-Chief

Thomas Ertl

EIC IEEE *TVCG*
Universität Stuttgart

Welcome to the November/December 2009 issue of the *IEEE Transactions on Visualization and Computer Graphics* (*TVCG*)! I am pleased to introduce this 738 page issue containing all papers presented at the IEEE Visualization Conference and the IEEE Information Visualization Conference in Atlantic City, New Jersey, USA, from October 11 to 16, 2009. This is the fourth time that the papers recommended for acceptance by the paper cochairs of these two prestigious conferences are being published in this journal after undergoing a rigorous two-round review process. The goal of this cooperation between IEEE Computer Society Publications and the IEEE Visualization and Graphics Technical Committee (VGTC) is to present more high-quality research results from the world's top visualization conferences to *TVCG*'s readership while at the same time improving the overall paper quality of the conferences through a rigorous journal-style review. This conference issue again clearly demonstrates that the goal has been achieved. I welcome the readers to appreciate this unique collection of high quality visualization research.

Many individuals have committed their time and effort to this *TVCG* issue and I would like to thank them for their diligent work. The guest editors of this journal issue, the Visualization 2009 and Information Visualization 2009 papers cochairs, Kwan-Liu Ma, Torsten Möller, Hanspeter Pfirster, Sheelagh Carpendale and Jean-Daniel Fekete, took on extra work and enthusiastically drove the two-round review process with tight deadlines to deliver this issue. The papers committee of each conference also played a crucial role by agreeing to oversee a second round of reviews for papers accepted pending minor revision. I would also like to recognize the outstanding work which went into the timely production of this issue which is the results of a close cooperation between the VGTC publication team, namely Meghan Haley, and the staff at IEEE Computer Society Publications, namely Alicia Stickley, Jennifer Carruth, Erin Espriu, Hilda Carman and Steve Wareham. I would like to acknowledge the support from behind the scenes from the conference steering committees, the IEEE VGTC Executive Committee and the IEEE Computer Society Publications Board.

If you are a new reader of *TVCG* exposed to this journal as a conference participant, please let me encourage you to also have a look at the regular issues of *TVCG* which are published bimonthly. *TVCG* is one of the top journals presenting important research results and state-of-the-art seminal papers related to computer graphics and visualization techniques, systems, software, hardware, and user interface issues. *TVCG* is the place to find extended versions of the best papers of many leading conferences, symposia, and workshops in the field. *TVCG* is well known for its fast reviewing cycles and for the early availability of preprints in the IEEE Computer Society Digital Library and in IEEE Xplore. I encourage you to browse through www.computer.org/tvcg and I ask you to consider to submit your work to *TVCG* and to become a personal subscriber.

Preface

Message from the Paper Chairs and Guest Editors

Vis 2009 Papers Chairs and Guest Editors

Kwan-Liu Ma
University of California, Davis

Torsten Möller
Simon Fraser University

Hanspeter Pfister
Harvard University

InfoVis 2009 Papers Chairs and Guest Editors

Sheelagh Carpendale
University of Calgary

Jean-Daniel Fekete
INRIA

These are the proceedings of the IEEE Visualization Conference 2009 (Vis 2009) and the IEEE Information Visualization Conference 2009 (InfoVis 2009) held during October 11 to 16, 2009 in Atlantic City, New Jersey, USA. The power of using computing technology to create useful, effective imagery for analysis, understanding, and communication continues to inspire visualization researchers around the world. Both conferences spotlighted the most innovative and the very best research results. Historical acceptance rates for the two conferences can be found at: http://vgtc.org/wpmu/techcom/conferences/sponsored-events/.

Vis 2009

This year marks the 20th anniversary of our conference and we celebrate this anniversary with the best visualization research has to show. The IEEE Visualization 2009 papers program, contained in this special issue, accepted 54 papers describing state-of-the art tools, techniques and technology in the field of visualization. They were selected from 202 submissions by an international program committee of 57 members and supported by 868 reviews from 509 experts. The acceptance rate for IEEE Visualization 2009 is 26.7%.

This year, for the first time, we solicited five distinct type of papers - technique papers, system papers, design studies, evaluation papers, and model papers. The papers submitted to the Visualization conference were diverse in many dimensions, including a wide range of visualization techniques, their mathematical foundations, the computational environment considered, and the potential application areas, as well as a number of evaluation techniques. All of the authors put considerable effort into preparing their manuscripts.

The IEEE Visualization 2009 review process began with selecting a program committee of experts and issuing a general call for review volunteers. The submitted papers were assigned to program committee members based on a match of paper topic, committee member expertise, and committee member preferences. A great effort was made to identify potential conflicts of interests at all levels, and to preclude them from the review process. All reviewers were asked to read and agree to our new ethics guidelines [http://vis.computer.org/VisWeek2009/ethics.html].

As with the standard journal process, reviewing was done as a two-stage procedure. In the first review cycle, each paper was normally reviewed by four reviewers. Two international program committee members acted as the primary and secondary reviewers.

Like last year, a double-blind reviewing process was used for this cycle, where the authors' names and affiliations were only known to the primary and secondary reviewers. The responsibilities of the primary reviewer included appointing two external (tertiary) reviewers, discussing reviews with all reviewers, and writing a summary review and recommendation. The responsibilities of the secondary reviewer were to appoint one external (tertiary) reviewer, prepare a review of the paper, discuss the reviews with all reviewers, and make a joint recommendation with the primary. The paper chairs then read the reviews, the paper discussion between all reviewers, the confidential comments from the reviewers, and considered the recommendation of the primary and secondary reviewers in conjunction with the scores and the expertise levels of the reviewers. The paper chairs then finalized collectively the decisions of the first review cycle. Both the committee members and the paper chairs based their decisions on the detailed reviewer's comments, not on raw numerical scores alone. In only few cases the papers chairs reached a conclusion that was different from the recommendation of the primary and secondary reviewers. In these cases, the primary and secondary were consulted to reach a consensus decision.

At the end of the first review cycle, 54 papers were conditionally accepted subject to minor revisions, and underwent a second review cycle for publication in TVCG and presentation at IEEE Visualization 2009. In this second review cycle the corresponding program committee members checked the revised manuscripts. Authors were also advised to provide a cover letter with comments on how they addressed the reviewers' comments and on changes that they incorporated. In the second review cycle the program committee members again provided a recommendation by determining if the authors satisfactorily addressed the issues raised by the reviewers in the first review cycle.

A discussion board facilitated the (anonymous) discussion of authors with primary and secondary reviewers, which made a big difference in improving the quality of the papers. At the end of the second review cycle there were six papers that still had conceptual issues to address. The primaries and the authors worked well together to improve these papers to the highest journal standard for publication

in TVCG. The final decision was made by the paper chairs by taking the recommendations of the committee members into account.

Papers that contained significant results but required more additional work than what could be accommodated in the tight conference revision schedule were rejected from IEEE Visualization 2009 but offered a fast track through the regular TVCG review process, where the Visualization 2009 review outcome is taken as first TVCG review cycle. Only about 5% (10 papers) of all submissions were offered this possibility.

The range of topics in IEEE Visualization 2009 papers show a very healthy, thriving visualization research community. Traditional areas, such as topology-based techniques, efficient and accurate volume rendering, and the analysis and visualization of time-varying data, are represented as well as growing interest evaluation studies, perceptually guided visualization, and visually supported analysis. Of the application areas, the medical domain still dominates our conference with a steady interest in diffusion tensor imaging and a growing interest in visualization and analysis of microscopy data. We hope you enjoy this year's compendium of work as it represents some of the best research in our field today.

The IEEE Visualization 2009 conference also features panels, tutorials, workshops, posters, the visualization contest, birds-of-a-feather meetings, the doctoral colloquium, the discovery exhibition, and the interactive demonstrations lab. Many individuals have contributed a great deal of time and energy to making the IEEE Visualization 2009 conference and this special issue a success. We thank the authors of all the submitted papers, the Program Committee, and all the other reviewers for the many hours of hard work.

InfoVis 2009

InfoVis 2009 is the 15th annual InfoVis meeting and our third year as the IEEE Information Visualization Conference. InfoVis is the primary meeting in the field of information visualization. Computer-based information visualization centers around helping people explore or explain data through interactive software that exploits the capabilities of the human perceptual system. A key challenge in information visualization is designing a cognitively useful spatial mapping of a dataset that is not inherently spatial and accompanying the mapping by interaction techniques that allow people to intuitively explore the dataset.

Information visualization draws on the intellectual history of several traditions, including computer graphics, human-computer interaction, cognitive psychology, semiotics, graphic design, statistical graphics, cartography, and art. The synthesis of relevant ideas from these fields with new methodologies and techniques made possible by interactive computation are critical for helping people keep pace with the torrents of data confronting them. One of the few resources increasing faster than the speed of computer hardware is the amount of data to be processed.

Information visualization papers were solicited in five categories: technique, system, design study, evaluation, and model. The InfoVis Conference received 141 submissions. This year the vitality in information visualization research was expressed in a 33% increase from the submissions from last year. All the 141 submissions were reviewed thoroughly. Each paper was reviewed by at least two Program Committee members and two external experts. Based on the reviews, the Papers Chairs carefully selected the papers for the 2009 conference. From the initial set of submissions, 37 papers were given a conditional acceptance with a set of prescribed changes and edits based on the reviews. The authors then revised their articles according to the reviewers' comments and resubmitted the new versions. The Papers Chairs evaluated the revised papers, assessing whether the edits made by the authors met the required conditions. Ultimately, all 37 of the conditionally accepted papers were accepted to appear at the conference. The overall acceptance rate was 26%.

The 2009 Best Paper Award Committee, Stuart Card, George Robertson, and Colin Ware, made their selection from the highest rated papers as determined by the reviewers. This year the Best Paper committee chose two Best Papers: ABySSexplorer: Visualizing Genome Sequence Assemblies, by Cydney Nielsen, Shaun Jackman, Inanc Birol, and Steven Jones; and Visual Overviews of Text with Phrase Nets, by Martin Wattenberg, Frank van Ham, and Fernanda Viegas. The ABySSexplorer looks at the large-scale genome sequencing problem and presents an approach that emphasizes the global assembly structure while also providing salient data features such as sequence length. The Phrase Net technique addresses text visualization issues and provides a method that generates visual overviews of unstructured text. The Best Paper awards recognize these papers as examples of excellent work that will stimulate further discussion and motivate new directions in the field. There are also four Honorable Mention Paper Awards: MizBee: A Multiscale Synteny Browser, by Miriah Meyer, Tamara Munzner, and Hanspeter Pfister; Configuring Hierarchical Layouts to Address Research Questions, by Aidan Slingsby, Jason Dykes, and Jo Wood; SellTrend: Inter-Attribute Visual Analysis of Temporal Transaction Data, by Zhicheng Liu, John Stasko, and Timothy Sullivan; and Interaction Techniques for Selecting and Manipulating Subgraphs in Network Visualizations, by Michael McGuffin, and Igor Jurisica.

InfoVis 2009 will for the first time host a Discovery Exhibition. This new venue will be a showcase for everyone in the visualization community, making it possible to share stories about the impact of visualization research on everyday life. Sharing these stories with the community will help us all improve our understanding about the role of visualization in many venues such as work, research, and entertainment. The Discovery Exhibition Chairs are Petra Isenberg, Bongshin Lee, and Jing Yang. The highly successful Interactive Posters program also continues for its ninth year, organized by Frank van Ham and Chris Weaver. We also thank our Panels Co-Chair Penny Rheingans, Tutorials Co-Chair Robert Kosara, Workshops Co-Chair Lyn Bartram, Exhibits Co-Chair Ming Hao, Birds-of-a-Feather Co-Chair

TJ Jankun-Kelly, and Doctorial Consortium Co-Chair Melanie Tory who collaborated with their Vis counterparts to produce an excellent overall program.

We thank the authors of all the submitted papers, the Program Committee, and all the other reviewers for the many hours of hard work that went toward making the conference a success. We deeply appreciate the efforts of InfoVis General Chair Chris North for many hours in coordinating all the conference activities in collaboration with Vis 2009 to ensure a successful event. We thank Jeff Heer for assistance in preparing the conference materials and Mike Sips for publicizing InfoVis 2009. Finally, we gratefully acknowledge the support of the IEEE Visualization and Graphics Technical Committee (VGTC), including sponsorship of the conference.

Acknowledgments

As usual, we are indebted to the IEEE Visualization and Graphics Technical Committee (VGTC) Publications team, especially the Publications Coordinator, Meghan Haley, for coordinating schedules, collecting materials, and producing these beautiful color conference proceedings. Furthermore, we thank Steve Lamont for all his efforts and prompt edits to the conference website. This year, again, the IEEE Visualization and IEEE Information Visualization Paper Chairs made use of the SRM review system. We wish to acknowledge the great support and quick response from René Berndt and Stefanie Behnke at the Graz University of Technology whose outstanding support with the SRM system greatly enhanced the chairs experience. We warmly thank the IEEE Visualization Conference Chairs, Klaus Mueller, and Raghu Machiraju, and the IEEE Information Visualization Conference General Chair, Chris North, for their tireless dedication and valuable advice at every stage. We thank the Program Chairs, Rachael Brady and Han-Wei Shen, for their considerable help in numerous ways. We especially acknowledge the support of Thomas Ertl as Editor-in-Chief of TVCG, and Amitabh Varshney as Chair of VGTC. Lastly, we would like to thank the TVCG team for their time and many efforts in helping VGTC produce these proceedings, namely Alicia Stickley, Erin Espriu, Steve Wareham, Hilda Carman and Mari Padilla.

Paper Chairs and Guest Editors

Kwan-Liu Ma

University of California, Davis

Kwan-Liu Ma is a Professor of Computer Science at the University of California at Davis and the Director of the DOE SciDAC Institute for Ultra-Scale Visualization. He received his PhD in Computer Science from the University of Utah in 1993. He presently serves as an associate editor for both the *IEEE TVCG* and CG&A, and the VisFiles editor for the ACM SIGGRAPH Computer Graphics Quarterly.

Torsten Möller

Simon Fraser Uiversity

Torsten Möller is an associate professor at the School of Computing Science at Simon Fraser University. He received his PhD in Computer and Information Science from Ohio State University in 1999 and a Vordiplom (BSc) in mathematical computer science from Humboldt University of Berlin, Germany. His research interests include the fields of Visualization and Computer Graphics, especially the mathematical foundations thereof. He currently serves as an associate editor of IEEE *TVCG* and *Computer Graphics Forum*.

Hanspeter Pfister

Harvard University

Hanspeter Pfister is Gordon McKay Professor of the Practice in the School of Engineering and Applied Sciences at Harvard University. His research lies at the intersection of visualization, computer graphics, and computer vision. Before joining Harvard he worked for 11 years at Mitsubishi Electric Research Laboratories where he was most recently Associate Director and Senior Research Scientist. Pfister has a Ph.D. in Computer Science from the State University of New York at Stony Brook and an M.S. in Electrical Engineering from the Swiss Federal Institute of Technology, Zurich, Switzerland.

Sheelagh Carpendale

University of Calgary

Sheelagh Carpendale is an Associate Professor in Computer Science at the University of Calgary. She holds a Canada Research Chair in Information Visualization and an NSERC/SMART/iCORE Industrial Research Chair in Interactive Technologies. Her research focuses on creating interactive visualizations of information, currently including: visualizing linguistic and biological data, visualizing uncertainty particularly in medical data, and the developing methodologies to support collaborative data analysis with visualization.

Jean-Daniel Fekete

INRIA

Jean-Daniel Fekete is a Senior Research Scientist (DR2) at INRIA. He leads the AVIZ team since 2007, which focuses on analysis and visualization of large datasets, combining machine learning approaches with information visualization and multiscale interaction techniques to help analysts explore and understand massive data. His research is applied in several fields such as biology, business intelligence and social network analysis.

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http://vgtc.org

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The IEEE Visualization and Graphics Technical Committee (VGTC) is a formal subcommittee of the Technical Activities Board (TAB) of the IEEE Computer Society. The VGTC provides technical leadership and organizes technical activities in the areas of visualization, computer graphics, virtual and augmented reality, and interaction.

The VGTC sponsors not only the annual VisWeek and Virtual Reality conferences, but also many focused symposia and conferences including EuroVis, 3D User Interfaces, VAST, Volume Graphics, PacificVis, Haptics and ISMAR.

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To recognize its members for their outstanding technical accomplishments, the VGTC established a series of technical awards in 2005. The awards honor outstanding technical achievements in visualization and virtual reality. The VGTC awards chair for visualization is Bill Lorensen, and the awards chair for virtual reality is Larry Hodges.

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The VGTC is actively involved in national initiatives that study and promote the immediate and long-range challenges in visualization and computer graphics and related research areas. For more information visit our web page at http://vgtc.org.

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Nathalie Henry Riche
Martin Hering-Bertram
Harry Hochheiser
Heike Hofmann
Danny Holten
Seok-Hee Hong
Wei-Dong Huang
Alfred Inselberg
Victoria Interrante
Petra Isenberg
Yuri Ivanov
T.J. Jankun-Kelly
Waqas Javed
Mikael Jern
Jimmy Johansson
Ted Johnson
Fabien Jourdan
Ilir Jusufi
Nivedita Kadaba
Hyunmo Kang
Karrie Karahalios
Weimao Ke
Johannes Kehrer
Daniel Keim
Jessie Kennedy
Eamonn Keogh
Andruid Kerne
Andreas Kerren
Robert Kincaid
Barend Kobben
Stephen Kobourov
Alfred Kobsa
Jörn Kohlhammer
John Kolojejchick
Shawn Konecni
Yehuda Koren
Robert Kosara

Per Ola Kristensson
Bill Kules
Heidi Lam
Tim Lammarsch
Andy Law
Guy Lebanon
Bongshin Lee
Shixia Liu
Zhicheng Liu
Aidong Lu
Martin Luboschik
Kwan-Liu Ma
Alan MacEachren
Raghu Machiraju
Jock Mackinlay
Stephan Mantler
Kresimir Matkovic
Michael McGuffin
Matt McKeon
Peter McLachlan
Guy Mélançon
Iain Milne
Rosane Minghim
Kazuo Misue
Torsten Möller
Jaime Montemayor
Klaus Mueller
Wolfgang Mueller
Michael Muller
Tamara Munzner
Robert Nadon
Ai Nakatani
Chris North
Stephen North
Matej Novotný
Daniela Oelke
Adam Perer
Mark Phillips
Emmanuel Pietriga
Harald Piringer
Mathias Pohl
Irani Pourang
Zach Pousman
A. Johannes Pretorius
Florian Reitz
Ron Rensink
Penny Rheingans
George Robertson
Anthony Robinson
Peter Rodgers
Bernice Rogowitz
Stuart Rose
Rinzivillo Salvatore
Rodrigo Santamaria
Giuseppe Santucci
Amit Sawant
Peter Sbarski
Gerik Scheuermann
Joern Schneidewind
Jean Scholtz
mc schraefel
Tobias Schreck
Falk Schreiber
Heidrun Schumann
Jinwook Seo
John Sharko
Chia Shen
Ben Shneiderman
Yedendra Shrinivasan
Mike Sips
Aidan Slingsby
Bettina Speckman
Robert Spence
Anselm Spoerri
John Stasko
Chad Steed
Maureen Stone
Margaret-Anne Storey
Bongwon Suh
Alexandru Telea
Roberto Therón
Martin Theus
Mark Tigges
Christian Tominski
Melanie Tory
Christoph Treude
Xavier Tricoche
Ali Ünlü
Antony Unwin
Simon Urbanek
Huub van de Wetering
Frank van Ham
Jarke Van Wijk
Maria Velez
Frederic Vernier
Fernanda Viegas
Tatiana von Landesberger
Levi Waldron
Chaoli Wang
Matt Ward
Benjamin Watson
Martin Wattenberg
Chris Weaver
Gunther Weber
Daniel Weiskopf
Michel Westenberg
Hadley Wickham
Leland Wilkinson
Max Wilson
Kent Wittenburg
Pak Wong
Michael Wybrow
Zaixian Xie
Jing Yang
Ji Soo Yi
Tamara Yu
Xiaoru Yuan
Shengdong Zhao
Jianping Zhou
Hong Zhou
Michelle Zhou
Caroline Ziemkiewicz
Torre Zuk

The 2008 Visualization Career Award

Lawrence J. Rosenblum

Lawrence Rosenblum
Award Recipient 2008

The 2008 Visualization Career Award goes to Lawrence (Larry) Rosenblum, in recognition of early technical contributions and unselfish work to nurture and sustain the field of visualization.

In the 1980s and early 1990s Larry developed visualization techniques that produced scientific advances in physical oceanography, ocean acoustics, ocean geophysics, and ocean engineering. He also initiated numerous activities to develop visualization as a recognized research field. Subsequent research by his group has advanced VR/AR, graphics, and visual analytics while he has continued to perform significant service to organizations and conferences in visualization and VR/AR. As a Program Officer at NSF and ONR, Larry developed new visualization research programs. For his outstanding contributions in research and in governmental program development, and for his pioneering work to nurture and sustain the field of visualization, the IEEE VGTC is pleased to award Larry Rosenblum the 2008 Visualization Career Award.

Biography

Larry Rosenblum is Director of the Virtual Reality Laboratory at the U.S. Naval Research Laboratory (NRL). He is currently detailed to the U.S. National Science Foundation (NSF), where he is Program Director for Graphics and Visualization. Majoring in Mathematics, he received his BA from Queens College (CUNY) and his MS and PhD (in Number Theory) from The Ohio State University. His introduction to visualization came when he used his wife's molecular modeling kit to visualize complex surfaces.

Larry has worked at NRL for the last thirty years, except for two assignments elsewhere. While working alongside NRL's scientists, he became convinced that many ocean science problems were actually visualization-limited. He took a graduate course in computer graphics from Jim Foley at GWU in 1981 and then set out to apply visualization to scientific data. In a sequence of papers in J Geophysical Research, Larry and George Marmorino used visualization to demonstrate a longstanding conjecture about ocean "finestructure", to understand how it arises, and to statistically categorize it. Larry also animated physical oceanography simulations to gain new knowledge (e.g., Double Diffusive Convection Saltfingering, SIGGRAPH Video Review).

Subsequently, Larry and Behzad Kamgar-Parsi applied volume graphics and image processing to sonar data and demonstrated that high-resolution sonar imaging was possible, leading to new sonar systems. Larry's visualization research also impacted ocean geophysics, matched-field acoustic processing, and bathymetric mapping.

Recognizing that an important new field was coalescing, Larry conceived and co-founded the IEEE Visualization Conference. While serving as Liaison Scientist for Computer Science at the Office of Naval Research (ONR) European Office (1992-1994), he provided electronic reports on European activity, several of which were published in SIGGRAPH's Computer Graphics. During this period he also served as lead editor on the book Scientific Visualization: Advances & Challenges, which helped define the field and was used in many of the early visualization courses in academia.

Returning to NRL, Larry focused primarily on virtual reality research, including seminal work in U.S. Responsive Workbench technology with encouragement from Wolfgang Krueger, and on augmented reality (AR) systems research. His group's research into uncertainty visualization produced interesting results (CACM Aug. 2004 cover), in part due to the availability of data from a large scientific experiment to quantify underwater uncertainty.

Larry also served as a Program Officer at ONR and NSF. At ONR, he formulated new research programs in volumetric modeling (e.g., volume graphics, level sets, tetrahedral modeling) and in augmented reality. At NSF, Larry worked with Jim Thomas to develop a jointly funded DHS/NSF program that is utilizing mathematics and computational science to place a firm scientific base under visual analytics data issues.

Larry has published over 80 technical articles. His work has appeared on The Learning Channel and CNN Headline News and in such media as the NYT Science Times, MSNBC, and Popular Science. He has served on several editorial boards including IEEE TVCG and IEEE CG&A, where he initiated and edited the Visualization Blackboard and the Projects in VR Departments. He has a long history of significant service to numerous organizations and conferences in visualization and VR. A Senior Member of the IEEE, Larry has received the IEEE Meritorious Service Award, the IEEE Outstanding Contribution Award, the NRL Alan Berman Research Publication Award, and a DHS/NVAC Award.

Award Information

The IEEE VGTC Visualization Career Award was established in 2004. It is given every year to an individual to honor that person's lifetime contribution to visualization. VGTC members may nominate individuals for the Visualization Career Award by contacting the awards chair, Bill Lorensen, at http://tab.computer.org/vgtc/.

The 2008 Visualization Technical Achievement Award

David Laidlaw

The 2008 Visualization Technical Achievement Award goes to David Laidlaw, Brown University, in recognition of outstanding technical work in the area of multi-valued data visualization.

David participated in the formative stages of the field of visualization as a co-architect of the first commercial scientific visualization system, AVS. This early work formed a strong foundation for his subsequent academic career. David has also used his interest and talents in painting, art and design to enhance the presentation of complex information. This award recognizes David's technical work on methods for visualization of vector and tensor fields. He has been able to identify and create new techniques that are technically innovative yet can still be applied to clinical problems. The IEEE VGTC is pleased to award David Laidlaw the 2008 Visualization Technical Achievement Award.

David Laidlaw
Brown University
Award Recipient 2008

Biography

David H. Laidlaw is a professor of computer science at Brown University. He received his PhD from Caltech in computer science, where his research centered around how to extract geometric geometric information from volumetric magnetic resonance imaging data and how to optimally acquire such data. He then did three years of postdoctoral research in the Caltech Division of Biology applying image and acquisition results to help advance research in developmental neurobiology.

Dr. Laidlaw has long been interested in the application of computational and visaulzation tools to science. Starting in high school, he has developed collaborations with researchers in many disciplines, including biophysics, developmental neurobiology, evolutionary biology, medical imaging, neuropathology, orthopedics, art, cognitive science, remote sensing, and fluid mechanics. Applications from other disciplines give a real-world direction to computational research and are also compelling because they can provide concrete answers to questions about how our world works. Through these collaborations, he has been studying how computers can help scientists, developing new computational applications, and improving our understanding of the strengths and weaknesses of these applications.

Some research problems of particular interest to Prof. Laidlaw are visualization and modeling of multivalued multidimensional imaging data, comparisons of virtual and non-virtual environments for scientific tasks, and applications of art, perception, and cognition to visualization.

Dr. Laidlaw has published more than 70 peer-reviewed journal and conference papers, has served on or co-chaired dozens of conference committees, and has been an associate editor of IEEE Transactions on Visualization and Computer Graphics. He has been a recipient of several best-poster, best-case-study, and best-panel awards from IEEE Visualization, two best-student-poster awards from ACM SIGGRAPH, and placed first with a collaborative submission to the 2008 NSF/Science International Science and Engineering Visualization Challenge.

Award Information

The IEEE VGTC Visualization Technical Achievement Award was established in 2004. It is given every year to recognize an individual for a seminal technical achievement in visualization. VGTC members may nominate individuals for the Visualization Technical Achievement Award by contacting the awards chair, Bill Lorensen, at http://tab.computer.org/vgtc/.

The 2009 Visualization Career Award

Hans Hagen

Hans Hagen
University of Kaiserslautern
Award Recipient 2009

This 2009 Visualization Career Award goes to Hans Hagen, University of Kaiserslautern, in recognition of sustained and seminal contributions to Scientific Visualization.

Dr. Hagen has made significant scientific contributions, especially in the fields of geometric modeling and scientific visualization. Many of these contributions have influenced substantially the evolution of these research agenda in visualization and modeling. He is among the top leaders in these fields worldwide. It is particularly noteworthy that Hans Hagen established the first "International Research Training Group" (IRTG) involving his home university, UC Davis (lead US partner), University of Utah and Arizona State University. Over a period of nine years about 60 Ph.D. students will be supported to receive an integrated research training in the area of visualization and analysis of large unstructured data sets.

Inter alia, Dr. Hagen is the "spiritus rector" behind the highly successful Dagstuhl Visualization Conference series.

The IEEE VGTC is pleased to award Hans Hagen the 2009 Visualization Career Award.

Biography

Dr. Hagen earned his Ph.D. degree in mathematics from the University of Dortmund, Germany. In his doctoral dissertation he solved problems in differential geometry, directly related to the mathematical foundations of general relativity. This scientific background allowed him to enter and make relevant contributions to the field of geometric modeling, a field now providing the basis for computer aided design (CAD) technology and systems. Over the past two decades his research efforts have had substantial impact in many engineering disciplines, especially in mechanical and civil engineering.

Dr. Hagen's research contributions are as diverse as they are significant. Specifically, Dr. Hagen has substantially contributed to the development of modern approaches to "variational design", a branch of geometric modeling concerned with a class of methods for smooth curve and surface design. These methods, many of them developed by Dr. Hagen, use the mathematical principle of minimizing energy functionals, with diverse applications in engineering. Dr. Hagen's contributions in this area have led to the establishment of new industry standards.

Dr. Hagen has also pioneered research in vector and tensor field visualization. For example, the "stream ball concept" was originally proposed by him, making a major contribution to effective analysis of complicated vector fields. Especially over the past decade, Dr. Hagen has also established himself as one of the world's leading scientists in topology-based visualization. This branch of scientific visualization has gained increasing significance in recent years due to the emerging need for radically different approaches for the characterization and analysis of complex, large data sets. Up to the present, Dr. Hagen has co-authored nearly 250 papers, His research efforts were supported by roughly $18M over the past twenty years. He obtained funding from a variety of agencies, including the German Research Foundation (DFG), the European Union (EU), the German Federal Ministry of Education and Research (BMBF), and industry.

The journal and conference papers co-authored by Dr. Hagen have appeared in premier places and are characterized by a high degree of originality, clear presentation style and mathematical rigor. He has presented his work at all leading international conferences in scientific visualization and geometric modeling and has published in all leading journals. Dr. Hagen served as Editor-in-Chief of the IEE Transactions on Visualization and Computer Graphics (TVCG) and has served as an associate editor for several major journals. These activities clearly document that Dr. Hagen is one of the most highly recognized leaders in his field, and is highly regarded by the scientific community.

Dr. Hagen is a highly talented speaker and gifted teacher. The list of Dr. Hagen's Ph.D. advisees is extremely impressive. Many of his former Ph.D. students have gone on to become chaired and full professors at top universities within Germany, across Europe and in US. A number of his Ph.D. advisees are also serving in influential positions in the industry and in national laboratories in US and around the world. Clearly, Dr. Hagen has produced a large number of next-generation scientists who have already started making their own major contributions.

Award Information

The IEEE VGTC Visualization Career Award was established in 2004. It is given every year to an individual to honor that person's lifetime contribution to visualization. VGTC members may nominate individuals for the Visualization Career Award by contacting the awards chair, Bill Lorensen, at http://tab.computer.org/vgtc/.

The 2009 Visualization Technical Achievement Award

Jock Mackinlay
Tableau Software
Award Recipient 2009

Jock Mackinlay

This 2009 Visualization Technical Achievement Award goes to Jock D. Mackinlay, Tableau Software, in recognition of his seminal work on automatic presentation tools and new visual metaphors that helped to shape the field of information visualization.

Jock's 1986 Ph.D. dissertation at Stanford University developed a formal algebraic approach for the automatic design of graphical presentations of relational information. After graduation, he joined Xerox PARC, where he focused on user interaction. In 1991, he co-presented three papers at the CHI conference that established the field of information visualization. Over the next decade, he developed many visual metaphors, some inspired by his dissertation formalism. In 2004, Jock joined Tableau Software, where he is working to broaden the adoption of information visualization. His 2007 IEEE InfoVis paper described how his dissertation work on automatic presentation finally became widely available when it was added as a core function to a commercial visual analysis application. The IEEE VGTC is pleased to award Jock D. Mackinlay the 2009 Visualization Technical Achievement Award.

Biography

Jock D. Mackinlay is Director of Visual Analysis at Tableau Software. In 1975, he received a BA with honors in Mathematics and Computer Science from UC Berkeley. His graduate work was done at Stanford University under Professor Michael R. Genesereth. His 1986 Ph.D. dissertation codified the semiology of graphics developed by the French cartographer Jacques Bertin. In particular, he developed algebraic operators that were used to automate the design of effective presentations of relational data.

At Xerox PARC, Jock focused on using 3D graphics and interactive animation to help people work with abstract information and data. Working in close collaboration with Stuart K. Card and George G. Robertson, he developed a system called the Information Visualizer that grew to contain many novel visualizations of information. Their work was foundational for the field of information visualization, a term they coined to distinguish their research from scientific visualization.

In 1999, Jock wrote and edited a book with Stuart K. Card and Ben Shneiderman titled Readings in Information Visualization: Using Vision to Think, which is a key reference work in the field of visualization. A reference model inspired by the formalism from Jock's dissertation was used in this book to describe a wide range of visualization systems.

Other interaction work at PARC included a collaboration with Polle T. Zellweger and Bay-Wei Chang. They developed Fluid Documents, which used interactive animation to incorporate additional material in documents. During a sabbatical to the University of Aarhus, Denmark in 2000-1 as visiting professors, Polle and Jock extended this work to Web standards with collaborators Niels Olof Bouvin and Kaj Grønbæk.

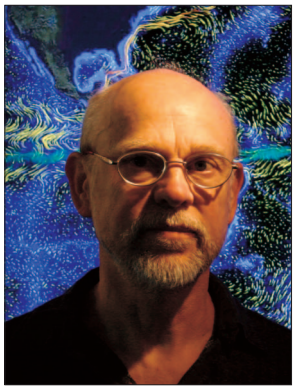
In 2004, Jock joined Tableau Software to work with founders Chris Stolte and Professor Pat Hanrahan after serving on Chris's Ph.D. dissertation committee at Stanford University. Inspired by Jock's dissertation, Chris and Pat had developed a formal specification language that combines query, analysis, and visualization into a single framework. Their current joint work focuses on using this formalism to develop intuitive visual analysis applications for a wide range of users.

Jock has co-authored many scientific publications on visualization and human-computer interaction in a variety of refereed journal and conference publications, including IEEE TVCG, IEEE InfoVis, IEEE CG&A, IEEE Computer, Communications of the ACM, ACM SIGGRAPH, ACM TOIS, ACM TOG, ACM CHI, ACM UIST, WWW, and AAAI. He received the best paper award at IEEE Visual Languages'98 (co-authored with Polle T. Zellweger, Bay-Wei Chang, and Takeo Igarashi). He has served as a member of program committees and as a reviewer for most of the conference and journals in the fields of visualization and human-computer interaction. He was UIST'91 program chair and UIST'92 conference chair. He was co-papers chair for CHI'96. He was on the editorial boards for ACM TOCHI (1997-2003) and IEEE CG&A (2004-6). Jock is a co-inventor on almost 50 patents. In 2003, he received a Valuable Patent Award from PARC.

Award Information

The IEEE VGTC Visualization Technical Achievement Award was established in 2004. It is given every year to recognize an individual for a seminal technical achievement in visualization. VGTC members may nominate individuals for the Visualization Technical Achievement Award by contacting the awards chair, Bill Lorensen, at http://tab.computer.org/vgtc/.

Vis / InfoVis Keynote Address



Visual Thinking and Visual Thinking Tools

Colin Ware
Data Visualization Research Lab, University of New Hampshire

Abstract

"We know next to nothing about how collective cognition works, or when it works, or how to make it work better; we have some ideas about it, but at best they've the status of artisanal rules of thumb."
— Bactra review of Edwin Hutchins's book Cognition in the Wild.

I like to think of visualization designers as skilled craftspeople who make tools to help other people think better. As Edwin Hutchins and others have pointed out, most real world thinking occurs with external aids such as paper and pencil, maps and diagrams. This means that a real world psychology must incorporate cognitive tools and their interfaces together with classic constructs of perceptual psychology, like pattern perception mechanisms and visual working memory. Perception is an active process and visual thinking can be thought of as a set of distributed processes involving pattern finding, eye movements and visual working memory operations. Interacting with a computer is also an active process, involving activities like zooming in and out, or hiding and saving information. In visual thinking using visualizations some activities occur in the head and others in the computer. The visualization is the bridge. Using studies of visualizations designed to help analyze data — from social networks and from tagged foraging humpback whales — I suggest some "artisanal rules of thumb" that can be used to generalize from the specific examples. The exciting thing for those of us who design, is that half of the emerging discipline of real world cognition (it is too early to call it a science), has to be about things that are changing and evolving. It can be constructivist in the very literal sense of building tools.

Bio

Ware has a special interest in applying theories of perception to the design of geospatial data interfaces. He has advanced degrees in both computer science (MMath, Waterloo) and in the psychology of perception (PhD,Toronto). He has published over 130 scientific articles ranging from rigorously scientific contributions to the Journal of Physiology and Vision Research to applications oriented articles in the fields of data visualization and human-computer interaction. His book Information Visualization: Perception for Design is now in its second edition. His new book, Visual Thinking for Design, appeared in 2008. Ware also likes to build practical visualization systems. Fledermaus, a commercial 3D geospatial visualization system widely used in oceanography, was developed from his initial prototypes. His trackPlot software is being used by marine mammal scientists and his flowVis2D software will shortly be serving images on NOAA websites. Colin Ware is Director of the Data Visualization Research Lab which is part of the Center for Coastal and Ocean Mapping at the University of New Hampshire.

Vis / InfoVis Capstone Address

Visual aids: Use of Paintings and Photography for Lighting in the Theater

Brian MacDevitt
Broadway Lighting Designer

Abstract

MacDevitt will discuss the role of a lighting designer in live Theatre, Dance and Opera. He will discuss the process lighting designers apply from "page to stage", how they communicate visual ideas to directors and collaborators, and show examples of how the outside references have aided and furthered his work. Numerous examples from Broadway shows will be discussed and examined for principles of design involving the use of light, color, and visual aids. As a lighting designer in live theater, dance and opera, he must translate emotional responses to text, imagery, movement and music to an audience through light. Before arrival at the theater, he needs to find ways to communicate lighting ideas to directors and other collaborators. Many times he uses paintings and photography to support ideas and to inspire new ways lighting the stage. By exploring images from outside of the theater, he then can arrive at stage pictures that can challenge the "way it is done" or "what works", which are handed down stage techniques that he believes are insular and stale.

Bio

Brian has designed lighting for Dance, Theater, and Opera internationally for over 30 years. Some highlights last season include, The Three Sisters at The Abbey Theater in Dublin, Dr Atomic at The MET and ENO, Speed the Plow with Jeremy Piven, Blithe Spirit with Angela Lansbury, Joe Turner's Come and Gone, You're Welcome America with Will Farrell on Broadway, and Puncture by Nancy Bannon at the Chocolate Factory. Some of MacDevitt's other Broadway credits include The Pillowman, The Coast of Utopia (Voyage), Love! Valour! Compassion!, Urinetown, The Musical, Invention of Love, True West, The Diary of Anne Frank, Present Laughter, Nine, A Raisin In the Sun, The Color Purple, and Sideshow. MacDevitt has worked with such dance companies as American Ballet Theatre, Tere O'Connor Dance, Baryshnikov's White Oak Dance Project, Doug Varone and Dancers, Boston Ballet, and Nancy Bannon. Brian has received four Tony Awards, OBIE, Bessie (with Tere O'Connor), Outer Critics' Circle Awards, Hewes Awards and Drama Desk Awards. He has been on the faculty of New York University's Tisch School and SUNY Purchase, and is presently an Assistant Professor at the University of Maryland, College Park.