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Welcome to the November/December 2008 issue of the IEEE Transactions on Visualization and Computer Graphics (TVCG)! I am pleased to introduce this 622 page issue containing all papers presented at the IEEE Visualization Conference and the IEEE Information Visualization Conference in Columbus, Ohio, from 19 October to 24 October, 2008. This is the third 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 the IEEE Computer Society 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 IEEE Visualization 2008 and IEEE Information Visualization 2008 papers cochairs, Min Chen, Charles Hansen, Kwang-Liu Ma, Sheelagh Carpendale, and Chris North, 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 IEEE VGTC, namely, Meghan Haley and Torsten Möller, and the staff at the IEEE Computer Society, namely, Alicia Stickely, Jennifer Carruth, Erin Espriu and Elaine Stephenson. 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 submitting your work to TVCG and to become a personal subscriber.
Preface

Message from the Paper Chairs and Guest Editors

These are the proceedings of the IEEE Visualization Conference 2008 (Vis 2008) and the IEEE Information Visualization Conference 2008 (InfoVis 2008) held during October 19 to 24, 2008 in Columbus, Ohio. 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://tab.computer.org/vgtc/conferences/acceptance.html

Vis 2008

The IEEE Visualization 2008 papers program, contained in this special issue, has 50 research and application papers describing state-of-the-art tools, techniques and technology in the field of visualization. They were selected from 197 submissions by an international program committee of 58 members and supported by reviews from 440 experts.

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. Furthermore, as visualization matures, the papers become increasingly sophisticated and build on a substantial body of previous work. All of the authors put considerable effort into preparing their manuscripts.

The organization of the IEEE Visualization 2008 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.

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 five reviewers. Two international program committee members acted as the primary and secondary reviewers. This year, a double-blind reviewing process was used for this cycle, where the authors’ names and affiliations were only known to the primary reviewer. The responsibilities of the primary reviewer include appointing three external (tertiary) reviewers, making an independent assessment of the paper, discussing reviews with the secondary reviewer, and writing a summary review and recommendation. The responsibilities of secondary reviewer were to blindly review the paper, discuss reviews with the primary reviewer and make a joint recommendation. The paper chairs then read the reviews, the log of the paper discussion between primary and secondary reviewers, and the confidential comments from the reviewers, and considered the recommendation of the primary and secondary reviewers in conjunction with the scores and the levels expertise 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.

At the end of the first review cycle, 50 papers were conditionally accepted subject to minor revisions, and underwent a second review-cycle for publication in TVCG and presentation at IEEE Visualization 2008. 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. The final decision was taken by the paper chairs by normalizing the recommendations of the corresponding committee members.

The decision process was very competitive this year. We feel that through the elaborate, double-blind, two-cycle review process every paper received the necessary attention to come to a fair decision. We are confident that you will find the work in this special issue useful, interesting and inspiring. The acceptance rate for IEEE Visualization 2008 is 25.38%. Papers, which contained significant results but required more additional work than what could be accommodated in the tight conference revision schedule, were rejected from IEEE Visualization 2008 but offered a fast track through the regular TVCG review process, where the Visualization 2008 review outcome is taken as first TVCG
review-cycle. Only about 4% of all submissions were offered this possibility.

The range of topics in IEEE Visualization 2008 papers show a very healthy, thriving visualization research community. Traditional areas, such as surfaces and volume rendering, are represented as well as growing interest in topology and flow visualization. Some newer focus areas are starting to emerge as well, such as illustrative visualization, uncertainty visualization and perceptual issues. Research efforts continue to tackle challenges posed by visualizing large multivariate data sets. This body of work is represented by papers dealing with multifield techniques, GPU acceleration, and parallel processing.

Making visualization systems easier to use and learn, whether through better search and navigation methods, or incorporating sound and force feedback, is also of practical importance and reported in many of the papers. Finally, the reason why we are all in this field is to address the needs of the application domain. This year we have a diverse set of applications ranging from biomedical papers (coronary disease, pre-operative planning) to flow and particle visualization to seismic interpretation to visualization of general relativity. 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 2008 conference also featured panels, tutorials, workshops, posters, the visualization contest, birds-of-a-feather meetings, doctoral colloquium, a scientific animation theater and the interactive demonstrations lab. Many individuals have contributed a great deal of time and energy to making the IEEE Visualization 2008 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 2008

InfoVis 2008 is the 14th annual InfoVis meeting and our second 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 107 initial submissions. One paper was rejected by the Papers Chairs as being off topic. All of the remaining 106 submissions were reviewed thoroughly by two tiers of reviewers. The 41 Program Committee members invited 168 other experts to review the submissions. 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 acceptable papers. From the initial set of submissions, 28 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 28 of the conditionally accepted papers were accepted to appear at the conference. The overall acceptance rate was 26%.

The Best Paper Award Committee, Stuart Card, John Stasko, and Matthew Ward, made their selection from the highest rated papers as determined by the reviewers. The InfoVis 2008 Best Paper Award this year goes to “Rolling the Dice: Multidimensional Visual Exploration using Scatterplot Matrix Navigation”, by Niklas Elmqvist, Pierre Dragicevic, and Jean-Daniel Fekete. This paper discusses interactive animated methods for navigating multidimensional datasets. The award recognizes this paper as an example of excellent work that will stimulate further discussion and motivate new directions in the field. This paper discusses interactive animated methods for navigating multidimensional datasets. New to this year, InfoVis also has three Honorable Mention Paper Awards. These go to “A Framework of Interaction Costs in Information Visualization”, by Heidi Lam; “Stacked Graphs – Geometry and Aesthetics”, by Lee Byron and Martin Wattenberg; and “The Shaping of Information by Visual Metaphors”, by Caroline Ziemkiewicz and Robert Kosara.

The program for this year includes the sixth annual InfoVis Contest, organized this year by Robert Kosara, Jing Yang, and Eleanor Chlan. Submissions were invited that analyzed a very large spatiotemporal surveillance dataset containing 30 million data records from 200 motion sensors in an instrumented building. The highly successful Interactive Posters program also continues for its eighth year, organized by Jean-Daniel Fekete and Frank van Ham. Continuing as an exciting venue, the Art Exhibit showcases the merge of artistic intention and visualization techniques. Golan Levin and Fernanda Viégas chaired the Art Exhibit. In accordance with our status as a sister conference of Vis, we also thank our Panels Cochair Penny Rheingans, Tutorials Cochair Martin Wattenberg, Workshops Cochair Chris Weaver, Interactive Demos Cochair Lyn Bartram, Exhibits Cochair Ming Hao, and Birds-of-a-Feather Cochair TJ Jankun-Kelly, 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 Jarke J. van Wijk for many hours in coordinating all the conference activities in collaboration with Vis 2008 to ensure a successful event. We thank Jeff Heer for preparing the Conference Compendium and Mike Sips for publicizing InfoVis 2008. 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 Chair, Torsten Möller, and 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 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, Raghu Machiraju, Roger Crawfis and Ken Joy, and the IEEE Information Visualization Conference General Chair, Jarke J. van Wijk, 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 Hanspeter Pfister 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 and Steve Wareham.

Paper Chairs and Guest Editors
Min Chen
University of Swansea

Min Chen received his B.Sc. degree in Computer Science from Fudan University in 1982, and his Ph.D. degree from University of Wales in 1991. He is currently a professor in Department of Computer Science, University of Wales Swansea. In 1990, he took up a lectureship in Swansea. He became a senior lecturer in 1998, and was awarded a personal chair (professorship) in 2001. His main research interests include visualization, computer graphics and interactive computing. His has published over ninety refereed research papers, including his recent contributions in areas of volume graphics and video visualization. He is a fellow of British Computer Society, and a member of the IEEE, Eurographics and ACM SIGGRAPH.

Charles Hansen
University of Utah

Charles (Chuck) Hansen is a Professor of Computer Science in the School of Computing and an Associate Director of the Scientific Computing and Imaging Institute at the University of Utah. Prior to joining the faculty at Utah, he led the visualization group in the Advanced Computing Laboratory (ACL) located at Los Alamos National Laboratory. He is a recipient of the VGTC Technical Achievement Award and a past Associate Editor in Chief of IEEE TVCG.

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.

Chris North
Virginia Tech

Dr. Chris North is an Associate Professor of Computer Science at Virginia Polytechnic Institute and State University, where he is Director of the GigaPixel Display Laboratory. He received his Ph.D. at the University of Maryland, College Park. His current research interests are information visualization, high-resolution displays, and user interface evaluation methods.

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.
Mission

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 Visualization, Information Visualization and Virtual Reality conferences, but also many focused symposia and conferences, including but not limited to Interactive Ray Tracing, Symposium on 3D User Interfaces, Shape Modeling and Applications, Visual Analytics Science and Technology, Symposium on Haptic Interfaces, Pacific Visualization, Volume Graphics, and EuroVis (formerly VisSym).

Awards

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 2007 Visualization Career Award

Stuart Card

The 2007 Visualization Career Award goes to Stuart Card, PARC, in recognition of sustained work in information visualization and human-machine interaction.

Since the 1970’s, Stuart Card and his colleagues at PARC have developed methods based on task analysis, approximation, and calculation for analyzing human-machine interaction at design time and have built novel interfaces based on these methods. The mouse, the use of lines to group pull-down menus, and multiple desktop workspaces are examples of elements in common use in GUI interfaces as a result of these methods. He pioneered the area of information visualization, developing a reference model and a taxonomic characterization of the space of possible designs. In collaboration with his colleagues in PARC’s User Interface Research group, which he headed, he developed user attention-reactive visualizations that used models of the user and task to increase the information communication rate to the user, for example, the information visualizer, the cone-tree, the perspective wall, degree-of-interest trees, the time-tree, the information grid, the web forager, and the 3Book. The IEEE VGTC is pleased to award Stuart Card the 2007 Visualization Career Award.

Biography

Stuart Card is a Senior Research Fellow at the Palo Alto Research Center. He received an A.B. degree in physics from Oberlin College in 1966. When Oberlin got its first computer, he became interested in computing and stayed for a year after graduation, first as assistant to the director and then as acting director of the Oberlin College Computing Center. Watching users, he became fascinated by the systematic subgoal structure of user behavior as users sought to overcome computer and program obstacles. Herbert Simon visited the campus to give a lecture on the emerging field of artificial intelligence, and after talking with him, Card decided to go to Carnegie Mellon University to study with Simon and his colleague Allen Newell, who became his thesis advisor.

At Carnegie Mellon, Card followed his own program of study combining computer science and psychology. Newell envisioned a new applied science of human with computers based on the theories of information processing psychology. He convinced the newly formed Xerox PARC to create a research unit with a ten year mandate to create this science. Newell, Card, and another student of Newell’s, Tom Moran, formed the pioneering team.

As one of the first fruits of this effort, Card studied alternative input devices for the new office systems PARC was building. His theoretical characterization of why the mouse emerged as the best device in terms of Fitts’s Law was a major factor leading to the mouse’s commercial introduction by Xerox, Apple, and the industry. Other computational theories and methods for analyzing human-machine system designs followed. The Model Human Processor allowed simple calculations like maximum typing or handwriting rates and animation requirements. The GOMS and Keystroke-Level Model allowed estimates of task time for computer-based routine cognitive skills. These were summarized in the book The Psychology of Human-Computer Interaction, the first book to use the term “human-computer interaction” in its title.

Later work expanded the areas of human-machine interaction addressed. For example, Card worked with George Robertson and Jock Mackinlay to lay out the design space of possible computer input devices. With Austin Henderson, he generated the window working set characterization of user behavior with windows, leading to the Rooms multiple workspace system. He then began to focus with Robertson and Mackinlay on visualization of non-physical, abstract information, leading to a series of user attention-responsive “focus-context” visualizations, such as the cone tree and the web forager, collectively called the information visualizer. The design space of possible visualizations and examples of these were summarized in the book Readings in Information Visualization: Using Vision to Think with Mackinlay and Ben Shneiderman. Work with Peter Pirolli on information foraging theory and sensemaking extended the work into human interaction with information generally, especially the Internet.

The work of his group has resulted in a dozen Xerox products as well as the contributing to the founding of three software companies, Inxight Software, Outride, and Content Guard. Card is a Fellow of the Association for Computing Machinery (ACM), the first recipient of the ACM Computer-Human Interaction (SIGCHI) Lifetime Achievement Award, the first member of the ACM CHI Academy and a member of the National Academy of Engineering. He is the recipient of the 2007 Bower Award and Prize for Achievement in Science for fundamental contributions to the fields of human-computer interaction and information visualization. He has also received an honorary Doctor of Science from Oberlin College.

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/.

 IEEE Computer Society  
 IEEE VGTC  
 Stuart Card

Palo Alto Research Center  
 Award Recipient 2007

IEEE VGTC Visualization Career Award Information

http://tab.computer.org/vgtc/
The 2007 Visualization Technical Achievement Award

Jarke J. van Wijk

This 2007 Visualization Technical Achievement Award goes to Jarke J. van Wijk, Eindhoven University of Technology, in recognition of seminal achievements in Flow Visualization.

Jarke became interested in flow visualization in the late eighties. One challenge here is to find suitable metaphors. He was inspired by the clear patterns shown by real world flow and started to explore if moving textures, aligned by the flow, could be generated automatically. In 1991 he presented the Spot Noise technique for this. Other results in flow visualization were the use of oriented particles (with Johan Stolk), implicitly defined stream surfaces, a probe for flow patterns (with Wim de Leeuw), and clustering of flow fields (with Alex Telea). In 2002 he introduced IBFV, Image Based Flow Visualization, a surprisingly simple technique that can be used to generate moving textures, particles, streamlines, and topological decompositions for 2D flow fields at real-time speed using commodity graphics hardware. Later he showed how this technique could also be used to visualize flow on 2D surfaces embedded in 3D. The IEEE VGTC is pleased to award Jarke J. van Wijk the 2007 Visualization Technical Achievement Award.

Biography

Jarke J. van Wijk is a full professor of Visualization at the Eindhoven University of Technology, the Netherlands. He received a MS with honors in Industrial Design Engineering in 1982 from Delft University of Technology. His final project was about computer simulation of crash victims. As part of this, he developed a system to visualize the results of 3D simulations. As a result, he became fascinated by the combination of challenging puzzles and visual results offered by computer graphics in particular visualization. His PhD project concerned ray tracing and geometric modeling. He continued at Delft University of Technology to obtain his PhD with honors in Computer Science in 1986. After a brief period working in the software industry, Jarke started at the Netherlands Energy Research Foundation (ECN) as a staff member in 1988. He contributed there to the development of custom graphical interfaces for a variety of applications, varying from energy research, molecular dynamics, finite element simulations, to environmental simulation, and did research on scientific visualization. In 1998 Jarke was appointed to a position at the Technische Universiteit Eindhoven, becoming a full professor in 2001.

At ECN, besides flow visualization, he has studied computational steering (with Robert van Liere and Jurriaan Mulder). Since 1998 his main focus is information visualization. He has worked on tree visualization, graph visualization, and software visualization, together with coworkers and students, including Frank van Ham, Danny Holten, Jing Li, Hannes Pretorius, Yedendra Shrinivasan, Alex Telea, Roel Vliegen, Lucian Voinea, and Huub van de Wetering. Finding new visual metaphors, using techniques from computer graphics and geometric modeling, is a leading theme in his work. A typical result was the Cushion Treemap technique, used in SequoiaView, a tool for the visualization of the contents of a hard disk. This in turn led to MagnaView, a spin-off company focusing on the visualization of business data. Recently, he became interested in visual analytics and mathematical visualization.

Jarke co-authored more than 100 scientific publications in visualization and computer graphics, which appeared in a variety of journals and conferences, including IEEE Visualization, IEEE TVCG, IEEE InfoVis, IEEE CG&A, Eurographics, CACM, ACM SIGGRAPH, ACM TOG, ACM CHI, and ACM TAP. He obtained the best research paper award at IEEE InfoVis 2003 and at IEEE Visualization 2005. He has served as a member of program committees and as a reviewer for most of the conferences and journals in the field. He acted as paper cochair for IEEE Visualization in 2003 and 2004, and IEEE InfoVis in 2006 and 2007. He is currently a member of the steering committee of the IEEE InfoVis conference.

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/.
InfoVis Keynote Address

Visualization in vivo

Jake Kolojejchick
Chief Scientist
Viz, a business of General Dynamics

Abstract
Why aren’t visualizations more central in our day-to-day work? At a prior InfoViz, an attendee lamented that visualization hadn’t yet reached the mainstream, because there was no significant community of users performing their day-to-day work in a visualization-based interface. What are the characteristics of visualizations and visualization-based interfaces that will bring them to the fore in future systems?

For visualizations to succeed as a primary interface, they must go beyond their conventional role solely as information presentators and become a medium that serves the many demands of workers in information-intensive environments. A visualization that stimulates sense-making should also provide a medium to capture the observations and potential actions that are inspired by a user’s greater understanding. Such visualizations can be an ideal tool to explain new-found understanding to others. Visualizations also can create a forum for teams of experts to collaboratively solve problems.

Scalable, distributed architectures enable powerful new collaboration capabilities that take us beyond conventional pixel sharing. But to reap the true benefits of Metcalfe’s Law, organizations must develop a new level of collaboration literacy, moving beyond PowerPoint to exploit the full capabilities of shared information.

In this talk, I’ll relay some experiences with large-scale visualization systems used daily – sometimes 24/7 – by hundreds of collaborating users. I’ll also talk about challenges we’ve faced in developing the systems and talk about some of characteristics that affect their success or failure.

Bio
Jake Kolojejchick, chief scientist at Viz (formerly MAYA Viz), now a business of General Dynamics C4 Systems, is an entrepreneur and innovator. Jake and his team have developed a collaborative visualization technology that allows distributed teams with diverse expertise to understand each other’s thinking in highly uncertain, information-intensive settings.

Between 2003 and 2005, his quest to see the technology adopted took him to Baghdad with the Army’s First Cavalry Division. His team’s technology is being used to create effective, natural decision-making environments for problems spanning the spectrum from military command and control to pharmaceutical drug discovery and clinical trials management.

Prior to co-founding MAYA Viz, Jake was a researcher at Carnegie Mellon University. As a member of the SAGE group, he studied automated visualization design throughout the development of the SAGE and Visage systems. Over the years, the team’s focus shifted to the information-centric interaction paradigm and visualization as a component of exploratory data analysis and decision support tools.

His research interests include information-centric user interfaces, information visualization and collaboration environments, and artificial intelligence, specifically, learning technology, knowledge representation, and expert systems.
ABSTRACT

Artists have been doing experiments on vision longer than neurobiologists. Some major works of art have provided insights as to how we see; some of these insights are so fundamental that they can be understood in terms of the underlying neurobiology. For example, artists have long realized that color and luminance can play independent roles in visual perception. Picasso said, “Colors are only symbols. Reality is to be found in luminance alone.” This observation has a parallel in the functional subdivision of our visual systems, where color and luminance are processed by the newer, primate-specific What system, and the older, colorblind, Where (or How) system. Many techniques developed over the centuries by artists can be understood in terms of the parallel organization of our visual systems. I will explore how the segregation of color and luminance processing are the basis for why some Impressionist paintings seem to shimmer, why some op art paintings seem to move, some principles of Matisse’s use of color, and how the Impressionists painted “air”. Central and peripheral vision are distinct, and I will show how the differences in resolution across our visual field make the Mona Lisa’s smile elusive, and produce a dynamic illusion in Pointillist paintings, Chuck Close paintings, and photomosaics. I will explore how artists have intuited important features about how our brains extract relevant information about faces and objects, and I will discuss why learning disabilities may be associated with artistic talent.

Bio

Dr. Livingstone is best known for her work on visual processing. In collaboration with David Hubel she did groundbreaking work on the parallel processing of visual information. In 1984 they described a new subdivision in primate primary visual cortex involved in processing information about color, and described the anatomy and physiology of this previously unknown system. This body of work has been richly confirmed by many other investigators over the last 30 years and is now widely used to explore parallel visual processing in humans. Furthermore these findings provided a deep structure for linking a large body of perceptual and physiological work, and this idea has had a profound impact on both fields. Livingstone went on to apply objective, quantitative mapping techniques to primary and extrastrate visual areas, revealing fundamental computational strategies used by the visual system in processing information. Her work has led to a deeper understanding of how we see color, motion, and depth, and how these processes are involved in generating percepts of objects as distinct from their background.

Livingstone in collaboration with Albert Galaburda’s laboratory looked at differences in visual processing in subjects with dyslexia, and found a selective slowing of the fast achromatic visual channel. This work has been confirmed by several laboratories and has had wide-reaching influence in the learning-disability field. Most recently Doris Tsao in Livingstone’s laboratory used functional magnetic resonance imaging in alert monkeys and found that macaques, like humans, have specialized regions of the temporal lobe that are selectively involved in face processing. Then they used functional imaging to target single-unit recording to these regions and found that an astonishing 97% of the cells in this region were highly selective for faces, as opposed to non-face objects. This is the first time functional magnetic resonance imaging has been used to target single-unit recording, and this study sets a new standard for localizing neuronal function. This study further shows that monkeys, like people, use specialized regions of the brain to process faces. This work has already had wide repercussions because it resolves a major controversy in the field of face processing as to whether face processing is unique or simply one of many forms of expertise.

Lastly, Livingstone has explored the ways in which vision science can understand and inform the world of visual art. She has written a popular lay book, Vision and Art, which has brought her acclaim in the art world as a scientist who can communicate with artists and art historians, with mutual benefit. She generated some important insights into the field, including a simple explanation for the elusive quality of the Mona Lisa’s smile (it is more visible to peripheral vision than to central vision) and the fact that Rembrandt, like a surprisingly large number of famous artists, was likely to have been stereoblind.
Abstract
Are we keeping enough perspective on our discipline of visualization? Attention is scarce; we all focus it locally most of the time. As our field is maturing, it is time to step back and evaluate the state of the discipline. One of this year’s conference chairs asked me to study the direction of our discipline as represented in the content of the conference. I will report on themes within this year’s contributions, pick out some trends across years, and interpret what this might mean for our discipline in the future.

Over the past few years, there have been a handful of disciplinary analyses, open-problem statements, and research agendas. More of us should step back more often and study these, asking whether we are advancing in the right directions and at the right pace. This attention and perspective will help increase the longevity of our visualization contributions.

I posit that a theory of visualization could play an organizing role for our discipline and give us a different perspective. Currently, there is no such theory, but Chris Johnson referred to the concept in his 2004 list of open visualization problems. I will develop the concept of a theory of visualization at an abstract level and apply it to the contributions of our conference. It provides an interesting alternative perspective from which to evaluate our work.

Humans clearly think visually; as a discipline, we can be proud of having created tools and tool-building knowledge that has helped accelerate science and engineering. With some introspection, we can do even better in the future.

Bio
David H. Laidlaw is a professor of computer science at Brown University. He received his PhD from Caltech in computer science, where he also did postdoctoral work in the Division of Biology. His research interests revolve around visualization and modeling applications of computer graphics and computer science to other scientific disciplines. Applications 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. He is working with researchers in, for example, archeology, developmental neurobiology, evolutionary biology, medical imaging, neuropathology, orthopedics, art, cognitive science, remote sensing, and fluid mechanics to develop new computational applications and to understand their strengths and weaknesses. Some research problems of particular interest are visualization of multivalued multidimensional imaging data, comparisons of virtual and nonvirtual environments for scientific tasks, and applications of art, perception, and cognition to visualization. Dr. Laidlaw has published more than 60 peer-reviewed journal and conference papers; has served on or cochaired dozens of conference committees; has been an associate editor of IEEE Transactions on Visualization and Computer Graphics; and has been a recipient of a number of best panel, poster, and visualization awards from IEEE Visualization, ACM SIGGRAPH, and NSF.