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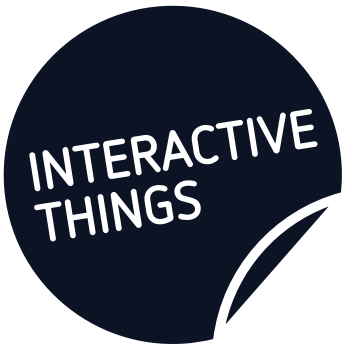
INTERACTIVE
THINGS

EUROGRAPHICS 2015 / O. Sorkine-Hornung and M. Wimmer
(Guest Editors)
Volume 34 (*2015*), *Number 2*

Preface

The Eurographics conference has a long tradition of attracting high-quality technical contributions across a wide spectrum of computer graphics topics, and this year is no exception. The 36th edition of Eurographics was held in Zurich, Switzerland, on May 4-8, 2015. The proceedings of the Technical Papers Program of Eurographics 2015 are presented in this special issue of the Computer Graphics Forum journal.

The technical paper selection process involved a group of 77 experts forming the International Programme Committee (IPC). After receiving 271 abstracts, the IPC members indicated conflicts with the submitting authors and bid on papers they felt competent to review. Finally, 207 full papers were submitted by the full papers deadline.

A sorting committee, consisting of the two Co-Chairs and three advisory board members, subsequently assigned to each IPC member, as either primary or secondary reviewer, up to 7 papers, according to their preferences, expertise, conflicts, and automatically computed matching scores between IPC members and submitted papers. Each paper was then assigned another three reviewers, two selected by the primary reviewer and one by the secondary. A few papers received more reviews, depending on the variance of the evaluations, the need for additional expertise, or to answer specific questions raised during the initial review cycle.

After the initial reviews were collected, authors had five days to consult these reviews and write a 1000-word rebuttal, addressing questions and potential misinterpretations. Finally, all reviewers assigned to a paper read the rebuttal and all reviews, and together reached an initial decision.

The most critical phase in the decision process is the IPC meeting, where the fate of each submission is finally decided. This year saw a major change in the way the IPC meeting was conducted. Instead of a virtual IPC meeting that mimics a physical meeting, with everybody synchronously discussing one paper at a time, we decided to introduce an asynchronous meeting, where IPC members followed their individual schedules in looking at papers. To make this happen, we worked very hard with the SRM team to provide all necessary functionality for this IPC meeting with the SRM system itself. This is a major step forward, since all necessary information is available to the IPC members automatically, including paper lists sortable by average scores and various other criteria, paper abstracts, and individual paper discussion boards. Furthermore, conflicts were handled automatically by the system.

To allow the process to converge, we scheduled a full week for this virtual IPC meeting. The IPC members were instructed to look at the paper list sorted in various ways. Each paper had a public discussion board, and the IPC members contributed to discussions where they felt competent. The IPC members could also request access to the full information of particular papers, making them extra readers and allowing them to write additional reviews.

Overall, we believe this new form of the virtual IPC meeting worked extremely well. The IPC members had access to all the information they needed and could invest their time into looking at papers that were suitable. There was no need to continuously update shared files, install discussion boards or chatrooms in an external system, or manage conflicts. We saw that many papers were thus assigned additional IPC members that helped shape the final decision. Furthermore, each IPC member had a good overview of the overall process at any one time, which facilitated calibration across the different fields.

In the end, 55 papers were accepted with minor revisions, and 20 were recommended to a fast-track review process with major revisions for publication in a future issue of the Computer Graphics Forum journal. All papers accepted with minor revisions went through a short second review cycle, with evaluations from the primary reviewer (and sometimes the secondary reviewer), before being finally accepted. A total of 55 papers out of the 207 submitted papers were finally accepted, resulting in a 26.57% acceptance rate. The entire paper selection process was extremely demanding to everyone involved. Our community is unique and lucky to be built on so many dedicated individuals willing to share their time and expertise to maintain Eurographics' high standards. We are immensely grateful to all the members of the IPC who committed a remarkable amount of their time to finding tertiary reviewers, reviewing and discussing papers, shepherding papers undergoing minor revisions and, above all, coping with the imperfections of an evolving process. We also wish to thank our advisory board, Marc Alexa, Ming Lin and Sylvain Paris, for their help in the paper sorting and assignment and for sharing their experience, wisdom and advice. We thank all tertiary reviewers for their in-depth reviews and, of course, all authors for their efforts in

preparing high-quality submitted papers. Last but not least, we thank Stefanie Behnke and Christian Caldera, who listened to our every suggestion for improving SRM and managed the huge feat of incorporating the virtual IPC meeting directly in SRM. We firmly believe that this will be extremely useful for future events, not limited to the Eurographics conference alone.

We are very happy with the resulting full paper proceedings of Eurographics 2015. These papers are amongst the best samples of the extraordinary computer graphics research throughout the world. We did our best to offer our time, efforts and ideas to ensure continuity and improvements of the selection process, and we hope that the papers and the conference as a whole will inspire you and your future research.

Olga Sorkine-Hornung and Michael Wimmer

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Eurographics Outstanding Technical Contributions Award: Eduard Gröller

Eduard Gröller is a professor at the Institute of Computer Graphics and Algorithms (ICGA), Vienna University of Technology. In 1993 he received his PhD from the same university. His research interests include computer graphics, visualization and visual computing.

Eduard Gröller is heading the visualization group at ICGA since 1995. The group performs basic and applied research projects in all areas of visualization. Eduard Gröller has given lecture series on scientific visualization at various other universities (Tübingen, Graz, Praha, Bahia Blanca, Magdeburg, Bergen). He is a scientific proponent and Key Researcher of the VRVis Research Center. The center performs applied research on visual computing topics like visualization, rendering, and visual analysis. Since 2005 Eduard Gröller is also an adjunct professor of computer science at the University of Bergen, Norway.

He has co-authored more than 230 scientific publications and acted as a reviewer for numerous conferences and journals in the field. He also has served on many program and paper committees. His early work on flow visualization introduced the concept of oriented line integral convolution to encode direction and orientation. He also worked on curvature-based transfer functions for direct volume rendering and discussed grid-based volume representations by investigating a specific, body-centered regular lattice. The illustrative exploration of volume data has been another of his research topics. He has proposed algorithms to interactively inspect the interior of volumetric datasets in a feature-driven, context-preserving way, also proposing the concept of style transfer functions to integrate multiple non-photorealistic, expressive renders into a single framework. He used these techniques for the efficient and comprehensive visualization of object contours. He co-authored research work on automatically computing importance-driven viewpoints by using a mutual information measure and a simple focus selection from a set of predefined features. His work on exploded views and on importance-driven feature enhancement has also been seminal in the field. His context-based approach works by automatically detecting and removing less important parts of the volume dataset in order to reveal more important underlying information. Along with his research work, Eduard Gröller has supervised many students who have since established themselves as leading faculty and well-known researchers.

Eduard Gröller is the head of the working group on computer graphics of the Austrian Computer Society and member of IEEE Computer Society, ACM (Association of Computing Machinery), GI (Gesellschaft für Informatik) and OCG (the Austrian Computer Society). Eduard Gröller has also served Eurographics in numerous ways including Paper Co-Chair of the conference in 2006, Co-Chair of the conference in 2011, Editor-in-Chief of the Computer Graphics Forum Journal and member of the Executive Committee. He has had a strong leadership in the visualization community as Symposium Co-chair of Eurographics/IEEE VisSym 1999, as EuroVis 2012 conference chair, as member since 2002 and head since 2011 of the steering committee of the Eurographics Working Group on Data Visualization, as Paper Co-Chair of the IEEE Visualization Conference 2005 and 2006, organizer of Dagstuhl Seminars on Scientific Visualization, and as Associate Editor of the IEEE Transactions on Visualization and Computer Graphics between 2003 and 2007.

Eduard Gröller has made significant contributions to the field of Scientific and Data Visualization that have impacted the work of many other researchers in the field, and he has build up one of the strongest visualization groups in Europe.

Eurographics is extremely pleased to recognize Eduard Gröller with the 2015 Outstanding Technical Contributions Award.

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Eurographics Young Researcher Award: Chris Wojtan

Chris Wojtan received his PhD from Georgia Tech in 2010. He is an assistant Professor at Institute of Science and Technology in Austria since 2011, where he has established an independent research program.

Chris Wojtan's work focuses on animation. He has developed sophisticated physically accurate algorithms for complex fluid flows. The main insight in Chris Wotjan's research is coupling high-resolution embedded surface geometry with low resolution simulations in order to simulate detailed animations of natural phenomena, with results that produce stunning visual images. He has also worked on effectively dealing with topological changes during simulations, and on fluid/solid interactions.

He has designed efficient methods for animating viscoelastic materials with detailed surface and arbitrarily thin features, and for robustly handling topological changes for the resulting deformable triangular meshes, with results that were published at Siggraph 2008 and 2009. In 2012 he presented the first efficient algorithm for tracking and morphing an incoherent sequence of individual meshes with a single, temporally coherent mesh by combining robust multi-resolution non-rigid registration with topology-changing techniques. In 2013, he introduced one of the first practical algorithms for the animation of extremely large-scale liquids, with surface extracted from particles. His algorithm enables efficient, robust and minimally-dissipative simulations that can undergo sharp changes in spatial resolution while minimizing artifacts. He also proposed the first general method for enabling topological changes of arbitrary surfaces – not only solids, being tolerant to a variety of surface aberrations. Afterwards, in 2014, he introduced the first method for blending and interpolating between liquid simulations, enabling to explore a space of plausible results at interactive rates. This includes a first solution to the challenge of finding corresponding space-time features in animations, and is a huge advance towards animation control. More recent contributions include an algorithm for computing pressure corrections to simplify the pressure projection step in fluid simulations in a way that exactly satisfies the free surface boundary conditions while using very few degrees of freedom, and a method for animating water waves through the interpolation of wavefront parameters.

Chris Wojtan has a remarkable career. He is probably the best specialist, worldwide, on liquid simulation. Moreover, he has also solved more general problems on the way, such as enabling general surface topology changes and improving multi-resolution simulation methods. One of his last contributions is a new paradigm towards animation control, which is likely to get a lot of impact and to be generalized to other contexts.

This remarkable research record has resulted on a significant number of high-impact publications., including papers in all main Journals and Conferences in Computer Graphics and animation. He has succeeded in setting up a strong computer animation and simulation group in Austria, also contributing to increase the European research potential in this particular area. Moreover, his present international visibility has been corroborated by the fact that he has already served in many program committees at an early stage of his career.

Eurographics is pleased to recognize Chris Wojtan with the 2015 Young Researcher Award.

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Eurographics Young Researcher Award: Daniele Panozzo

Daniele Panozzo's research work has focused on digital geometry processing, shape modeling and fabrication, an area of computer science with strong ties to applied mathematics, physics and engineering. His PhD thesis mainly dealt with processing raw acquired 3D data, which is nearly always noisy, unstructured and represented simply by dense point-sampled surface coordinates and irregular mesh connectivity. Such data is hard to process by downstream applications, like modeling software, finite-element simulations or computer animation. Daniele proposed a method for extracting a coarse base mesh that enables approximating high-resolution data by a subdivision surface.

During his postdoc at ETH, Daniele further worked on creating mesh structures particularly suited for computer animation and games, namely coarse quad meshes. Together with colleagues at ETH and Pisa, he co-authored works on sketch-based coarse quad meshing and extraction of such meshes from scanned moving geometry sequences such as human body motions and facial expressions. He has also done some very interesting work on volumetric meshing of self-intersecting surfaces, proposing a new formulation of the problem. This type of work finds increasing applications as 3D data becomes widely spread, e.g. by 3D reconstruction from photo collections and devices like Kinects. Extracting structure from such unorganized data is essential for numerous downstream applications of 3D acquisition and geometric modeling.

Daniele Panozzo's work has also contributed to the effective and user-controlled modification of freeform geometric shapes, also establishing mappings between different shapes. He has proposed novel algorithms for robust and valid surface and volume editing, where the deformation is defined as a minimizer of a given objective and obeys positional constraints on parts of the shape. Such variational deformations are very powerful shape modeling tools, being also notorious for introducing surface and volume self-intersections. He has proposed novel algorithms that incorporate surface collision response and produce bijective mappings between original and deformed shapes. These co-authored works have been the first ones in tackling the problem in a geometric modeling context and are already finding applications in industry. They have also been applied to digital restoration of historical parchments by the London Metropolitan Archives.

Daniele Panozzo also presented a highly efficient, interactive method to establish a mapping between arbitrarily different shapes by means of weighted averages on surfaces. He extended the so-called Fréchet mean to piecewise-linear surfaces and managed to make its computation extremely fast by using metric embedding in higher dimensions. This contribution is specially interesting from a theoretical, discrete differential geometry standpoint, and it is also highly relevant for practical applications of reusing surface attributes like materials, textures and rigging data by transferring them from one model to another. This is a widely applicable research field in the entertainment industry, as nearly every physically manufactured object today is first modeled digitally on a computer. His research has also focused on freeform shapes, which are especially relevant for artistic expression, the design of medical prosthetics and modern architecture. He has also worked on designing self-supporting masonry structures as an efficient and aesthetic tessellation of self-supporting surfaces. His scheme uses blocks and novel construction methods that minimize support material usage for such structures. Daniele's approach is able to simplify current workflows while reducing planning and construction costs.

His research work has always been shaped by creativity and technical excellence. Daniele's work has a solid theoretical foundation while being highly practically relevant. It has been published at the top venues of computer graphics, such as ACM SIGGRAPH and SIGGRAPH ASIA, ACM Transactions on Graphics, IEEE Transactions on Visualization and Computer Graphics, EUROGRAPHICS and the Symposium on Geometry Processing (SGP). Some of his papers are becoming deeply influential research results that will certainly inspire new research work.

Eurographics is pleased to recognize Daniele Panozzo with the 2015 Young Researcher Award.

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Computational Imaging and Display - Hardware-Software Co-design for Imaging Devices

Wolfgang Heidrich

Director, Visual Computing Center, King Abdullah University of Science and Technology

Abstract

Computational Imaging aims to develop new cameras and imaging modalities that optically encode information about the real world in such a way that it can be captured by image sensors. The resulting images represent detailed information such as scene geometry, motion of solids and liquids, multi-spectral information, or high contrast (high dynamic range), which can then be computationally decoded using inverse methods, machine learning, and numerical optimization. Computational Displays use a similar approach, but in reverse. Here, the goal is to computationally encode a target image that is then optically decoded by the display hardware for presentation to a human observer. Computational displays are capable of generating glasses-free 3D displays, high dynamic range imagery, or images and videos with spatial and/or temporal super-resolution. In this talk I will give an overview of recent advances and current challenges in rapidly expanding research area.

1. Biography

Prof. Wolfgang Heidrich is the director of the Visual Computing Center at King Abdullah University of Science and Technology (KAUST). He is also affiliated with the University of British Columbia, where he held the Dolby Research Chair until 2013. Dr. Heidrich received his PhD in Computer Science from the University of Erlangen in 1999, and then worked as a Research Associate in the Computer Graphics Group of the Max-Planck-Institute for Computer Science in Saarbrucken, Germany, before joining UBC in 2000. Dr. Heidrich's research interests lie at the intersection of computer graphics, computer vision, imaging, and optics. In particular, he has worked on computational photography and displays, High Dynamic Range imaging and display, image-based modeling, measuring, and rendering, geometry acquisition, GPU-based rendering, and global illumination. Dr. Heidrich has written well over 150 refereed publications on these subjects and has served on numerous program committees. His work on High Dynamic Range Displays served as the basis for the technology behind Brightside Technologies, which was acquired by Dolby in 2007 Dr. Heidrich has served as the program co-chair for Graphics Hardware 2002, Graphics Interface 2004, the Eurographics Symposium on Rendering, 2006, and PROCAMS 2011. Dr. Heidrich is the recipient of a 2014 Humboldt Research Award.

EUROGRAPHICS 2015 / O. Sorkine-Hornung and M. Wimmer
(Guest Editors)

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Imagineering and Computer Graphics

Bei Yang

Creative Technology Executive, Walt Disney Imagineering Research and Development

Abstract

Walt Disney Imagineering is responsible for the design and implementation of all Disney theme parks, cruise-lines, and vacation properties around the world. We not only use computer graphics to aid in design, production, and management of our attractions, but also make use of it heavily in the attractions themselves. We utilize technologies from across industries such as architecture, visual effects, automotive, robotics, and training simulations. Come see how Imagineering has utilized computer graphics in the past and what we hope for in the future, as well as how we look at computer graphics through the lens of the human perceptual system.

1. Biography

Bei Yang is an executive at Walt Disney Imagineering and part of the Creative Technology Studio, a team that works with cross disciplinary teams to create new technology tools to aid in theme park design and production. He has been with the company for 8 years and is currently director of the Imagineering Research and Development Northern California office. He received his Masters of Entertainment Technology degree from Carnegie Mellon University prior to joining Disney.

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Design of New Materials for Health, Energy and the Environment

Chiara Daraio

Department of Mechanical and Process Engineering, ETH Zurich

Abstract

Throughout history, the discovery of new materials and the ability to shape them has been the seed for technological innovation. Today, the boundary between structures and materials is blurred, enabling a new way to think about materials' innovation. Materials can now be engineered not only by manipulating their atomic structure and composition, but also by designing the geometry of their microstructure. Additive manufacturing approaches allow constructing arbitrary shapes with different materials, controlling geometries from the nanometer to the meter scale. These new fabrication technologies have enabled the concept of programmable materials, or materials made-to-order, to fulfill specific needs of applications. By exploiting geometrical effects, like bending and buckling of beams or contact between particles, it is possible to design materials with customized deformation responses, controllable stiffness and multifunctional properties. We have constructed new materials that exploit nano-scale geometries to absorb impacts most effectively, we have 3-D printed acoustic lenses that allow sound to travel as compact bullets that can be used in medical applications, and we are designing new, seismic meta-materials that can protect buildings from earthquakes.

1. Biography

Professor Daraio received her 5 year Laurea degree in Mechanical Engineering from the Universita' Politecnica delle Marche, Italy (2001). She received her M.S. (2003) and Ph.D. degrees (2006) in Materials Science and Engineering from the University of California, San Diego. She joined the Aeronautics and Applied Physics departments of the California Institute of Technology (Caltech) in fall of 2006 and was promoted full professor in 2010. In January 1st, 2013, she joined the department of Mechanical and Process Engineering at ETH Zurich, with a chair in Mechanics and Materials. She has won several awards. Among these, she received a Presidential Early Career Award (PECASE) from the White House in 2012, was elected as a Sloan Research Fellow in 2011 and received an ONR Young Investigator Award in 2010. She is also a winner of the NSF CAREER award (2009), of the Richard Von Mises Prize (2008) and received recently the Hetenyi Award (2015). She was selected by Popular Science magazine among the "Brilliant 10" (2010). She published over 100 peer-reviewed papers, two book chapters and several patents. For a complete list of publication and research information: http://www.mechmat.ethz.ch.