

Graphics **Interface** 2016

Victoria, British Columbia

1–3 June 2016

Proceedings

Edited by

Tiberiu Popa
Karyn Moffatt



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President's Welcoming Letter



Canadian Human-Computer Communications Society /
Société canadienne du dialogue humain-machine

Paul G. Kry
School of Computer Science
McGill University, Canada

The Canadian Human-Computer Communications Society (CHCCS) / Société Canadienne du Dialogue Humaine Machine (SCDHM) is a non-profit organization dedicated to advancing research and education in computer graphics, visualization, and human-computer interaction. The primary activity of CHCCS/SCDHM is sponsoring the annual Graphics Interface conference, the longest-running regularly scheduled conference on interactive computer graphics. In most years, Graphics Interface is held as part of a larger suite of conferences. This year the AI/GI/CRV 2016 conference, encompassing Artificial Intelligence and Computer and Robotic Vision along with Graphics Interface, is located in Victoria, British Columbia. The conference promises to be an excellent event, with a selection of high quality papers in computer graphics, visualization, and human-computer interaction, accompanied by a lively posters and demo session featuring new and late breaking ideas as well as work in progress.

In addition to its annual conference, CHCCS/SCDHM sponsors several awards. The annual Michael A.J. Sweeney Award recognizes best student papers presented at the conference. The annual Alain Fournier Dissertation Award and the Bill Buxton Dissertation Award recognize the best Ph.D. dissertations awarded in Canada during the previous year for computer graphics and human-computer interaction, respectively. The annual CHCCS/SCDHM Achievement Award is presented to a Canadian who has made substantial research contributions to computer graphics, visualization, or human-computer interaction. The CHCCS/SCDHM Service Award is presented to a Canadian who has rendered substantial service contributions to the society or to the research community. Each year the Awards Committee receives nominations and selects a winner of the Achievement Award and, from time to time, a winner of the Service Award. The current committee is chaired by Marilyn Tremaine, Rutgers University, and has as members Kellogg Booth, University of British Columbia, and Brian Wyvill, University of Victoria. I thank the Awards committee for their efforts in finding a very well-deserving recipient. Winners of the Alain Fournier Award and Bill Buxton Award are selected by independent committees coordinated by Pierre Poulin. I am very grateful to Pierre and the members of the respective committees for their work in identifying the top dissertations of 2015. The Michael A.J. Sweeney Award winners are selected by the program co-chairs in consultation with the program committee. Finally, the CHCCS/SCDHM will again be sponsoring and hosting the Canadian Digital Media Pioneer awards which were first initiated by the GRAND NCE in 2011.

The Annual General Meeting of CHCCS/SCDHM is held every year during the Graphics Interface conference, to review the previous year's activities and elect the executive committee. Current members of the executive committee are

- Paul Kry, *McGill University, president*
- Pierre Poulin, *Université de Montréal, vice president*
- Michael McGuffin, *École de Technologie Supérieure, treasurer*
- William Cowan, *University of Waterloo, past president*
- Derek Reilly, *Dalhousie University, editor-in-chief*
- James Stewart, *Queen's University, web master*

All Graphics Interface attendees are invited to attend the General Meeting. I encourage everyone interested in the future of Graphics Interface to attend and get involved.

On behalf of the society, and of all those who have worked to put on this year's conference, I extend a warm welcome to all the attendees of AI/CRV/GI 2016. I wish to thank this year's co-chairs, Tiberiu Popa and Karyn Moffatt, along with the committee members and referees for all their hard work in creating the conference program. And most important, I wish to thank all the authors who submitted their research. Without their commitment there would be no conference.

Preface

A Message from the Program Co-chairs

GRAPHICS CO-CHAIR

Tiberiu Popa
Concordia University, Canada

HCI CO-CHAIR

Karyn Moffatt
McGill University, Canada

Graphics Interface is the oldest continuously-scheduled conference in computer graphics and human-computer interaction. The conference dates back to 1969, when it was the “Canadian Man-Computer Communications Seminar”, changing its name in 1982 to Graphics Interface. This year is Graphics Interface’s 42nd year, and it takes place in Victoria, British Columbia from June 1st to 3rd.

The program for Graphics Interface 2016 features 26 papers. We received 33 (HCI) + 29 (Graphics) submissions. Among these high-quality submissions, we were able to accept 13 papers from the HCI track (39%), and 13 papers from the Graphics track (45%).

The program committee comprised 29 experts from Graphics and HCI. Each paper was formally reviewed by two committee members, at least two external reviewers, and often received informal reviews from more. A fully double-blind reviewing process was used: the identity of the paper authors was known only to the program committee and to the primary committee member assigned to the submission.

We thank the program committee and the external reviewers for ensuring rigor and integrity in the reviewing process. The Michael A. J. Sweeney Award will be awarded at the conference to the best student papers in graphics and HCI. This year, SideFX and Microsoft Research have kindly sponsored Graphics Interface with prizes for best papers.

Since 2012, authors of selected top papers in graphics have been invited to submit extended and revised manuscripts to be considered, with partial reviewer continuity, for journal publication in a special section of *IEEE Transactions on Visualization and Computer Graphics (TVCG)* and *Computers & Graphics*. We look forward to seeing the final extended versions of these selected papers later this year in the special section on graphics interaction.

We are proud to include keynote talks from two invited speakers, one Achievement Award winner, and two dissertation award winners. The two invited speakers, Kori Inkpen (Microsoft Research) and Marie-Paule Cani (Grenoble University & Inria) are both well known for their exemplary contributions to their disciplines. Our congratulations to Michiel van de Panne (University of British Columbia), this year’s recipient of the recipient of the CHCCS/SCDHM Achievement Award. We also congratulate the two dissertation award winners, Adam Fourney (University of Waterloo)—2015 Bill Buxton Dissertation Award, and Ibraheem Alhashim (Simon Fraser University)—2015 Alain Fournier Dissertation Award.

We are excited this year to continue the very well received Graphics Interface Speaker Series, sponsored in part by Microsoft Research. We have seven speakers this year, each with an exemplary track record, and a leader in his or her respective fields: Andrea Bunt (University of Manitoba), Elmar Eisemann (TU Delft), Vladimir Kim (Adobe Systems), Edith Law (University of Waterloo), Tamara Munzner (University of British Columbia), Bernhard Thomaszewski (Disney Research Zurich), and Khai Truong (University of Toronto).

We would like to thank various people who contributed to the behind-the-scenes conference organization, especially Paul Kry, Pierre Poulin, Kelly Booth, Marilyn Tremaine, and Meghan Haley. Thanks also go out to Afroza Sultana and Spencer Rose for the conference web design and maintenance, James Stewart and Precision Conference Solutions for handling the electronic submission and review system, Andrea Tagliasacchi—the Poster Chair, Brian Wyvill and Melanie Tory—the AI/GI/CRV General Co-Chairs, and Li Ji (Lucky) for help with the local arrangements and AI/GI/CRV website.

For further information about the conference series, you can visit the official web site, <http://www.graphicsinterface.org>

Organization

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Michael A. J. Sweeney Award 2016



Canadian Human-Computer Communications Society /
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The CHCCS/SCDHM honours the memory of Michael A. J. Sweeney through an annual award to the best student papers presented at each year's Graphics Interface conference. The winning papers selected by the program committee, one graphics paper and one HCI paper, are chosen from among accepted papers that have a student as lead author and for which one or more student authors are presenting the paper.

Best Student Papers 2016

In Memory
Michael A. J. Sweeney, 1951-1995

Graphics 2016 Award Winner

“Perceptual Real-time 2D-to-3D Conversion Using Cue Fusion” by Thomas Leimkühler (MPI Informatik), Petr Kellnhofer (MPI Informatik), Tobias Ritschel (University College London), Karol Myszkowski (MPI Informatik), Hans-Peter Seidel (MPI Informatik).

BIOGRAPHIES

Thomas Leimkühler is a PhD student at the Max Planck Institute for Informatics and Saarland University in Saarbrücken, Germany under supervision of Tobias Ritschel. His research interests include stereo 3D, efficient high-dimensional filtering, and image-based rendering.

Petr Kellnhofer is a PhD student at the Max Planck Institute for Informatics and Saarland University in Saarbruecken, Germany under supervision of Karol Myszkowski and Hans-Peter Seidel. His research focuses on perceptual issues in computer graphics with a special interest in stereo 3D. He has spent part of his study at MIT CSAIL as a visiting student with Professor Wojciech Matusik.

Tobias Ritschel is a Senior Lecturer at University College London. His research interests include interactive and non-photorealistic rendering, human perception and data-driven graphics. He received the Eurographics PhD dissertation award in 2011 and the Eurographics Young Researcher Award 2014.

Karol Myszkowski is a senior researcher at the Max Planck Institute for Informatics, Saarbruecken, Germany. He received his PhD (1991) and habilitation (2001) degrees in computer science from Warsaw University of Technology (Poland). In 2011 he was awarded with a lifetime professor title by the President of Poland. His research interests include global illumination and rendering, perception issues in graphics, high dynamic range imaging, and stereo 3D.

Hans-Peter Seidel is the scientific director and chair of the computer graphics group at the Max Planck Institute for Informatics and a professor of computer science at Saarland University, Saarbrücken, Germany. He has been on the

program committee of all major international graphics conferences, and chaired several of these events. His publication list includes more than 60 papers in ACM SIGGRAPH/ACM TOG and more than 100 papers in Eurographics/CGF. More than 30 former members of his group have received offers for tenured faculty position, in Germany and abroad. Seidel has received numerous awards for his work, including the DFG Leibniz Prize (2003), and the Eurographics Distinguished Career Award (2012).

HCI 2016 Award Winner

“A Field Study of On-Calendar Visualizations” by Dandan Huang (University of Victoria), Melanie Tory (Tableau Software), Lyn Bartram (Simon Fraser University).

BIOGRAPHIES

Dandan Huang received a M.Sc. in Computer Science in 2009 (University of Victoria, Canada). She is currently pursuing her PhD in Computer Science at University of Victoria. She was a recipient of a Graduate Studies Fellowship Award of University of Victoria (2011-2013) and a University of Victoria Graduate Award (2015). Her research includes information visualization and human computer interaction, and her current interest focuses on personal visualization used in the context of everyday life.

Lyn Bartram is Associate Professor in the School of Interactive Arts + Technology at Simon Fraser University and the Director of the Human-Centred Systems for Sustainable Living research group. Her research interests include information visualization, ubiquitous HCI, perception and computational aesthetics, particularly applied to personal visual analytics in conservation, green buildings and health. She holds a BA from UBC in Political Science (1975), an M.Math for the University of Waterloo in Computer Science (1988), and a Ph.D. in Computing Science from Simon Fraser University (2001).

Melanie Tory is a Senior Research Scientist at Tableau Research in Palo Alto, California, USA. Previously, Melanie was an Associate Professor at the University of Victoria where she directed the Visual Interaction Design research group. She earned her PhD in Computer Science from Simon Fraser University in 2004 and her BSc from the University of British Columbia in 1999. Melanie is an active member of the visualization research community. She is Associate Editor of IEEE Computer Graphics and Applications and

has served as Papers Co-chair for Graphics Interface, IEEE Information Visualization, and ACM Interactive Tabletops and Surfaces conferences. Her research focuses on supporting the workflow of interactive visual data analysis. This includes intuitive interactions with visualizations and the design and evaluation of tools that support the holistic data analysis process, including sensemaking, analytical guidance, and collaboration.

Alain Fournier Award 2015



Canadian Human-Computer Communications Society /
Société canadienne du dialogue humain-machine

On August 14th, 2000, Dr. Alain Fournier passed away. He was a leading international figure in computer graphics, and a strong and frequent contributor to the Graphics Interface conference. His insights, enthusiasm, wisdom, vast knowledge, humour, and genuine friendship touched everyone he met.

The “Alain Fournier Memorial Fund” was created to celebrate his life, to commemorate his accomplishments, and to honour his memory. It rewards an exceptional computer graphics Ph.D. dissertation defended in a Canadian University over the past year. The winning dissertation is selected through a juried process by a selection committee consisting of accomplished researchers in computer graphics.

For more information about the “Alain Fournier Memorial Fund”, and information about donation, please visit <http://graphicsinterface.org/awards/alain-fournier/>.



Ibraheem Alhashim

Simon Fraser University
CHCCS/SCDHM Alain Fournier
Award Recipient 2015

Ibraheem Alhashim is the recipient of the 2015 Alain Fournier Ph.D. Dissertation Award. His dissertation, entitled Topology-Varying Shape Matching and Modeling, made exceptional research contributions to computer graphics, which will impact the field for years to come.

The thesis makes important contributions in the area of topology-varying shape correspondence and interpolation, enabling an entirely new set of shape synthesis options for plausible and nontrivial shape inbetweens. Earlier approaches have been successful in dealing with rigid alignments, near-isometric shape articulations, or nonrigid shape deformations involving part stretching. But what separates Ibraheem’s work from the state of the art is that for the first time, topological variations are brought into the equation. This allows the matching and interpolation of shapes that differ in their fundamental topology. Ibraheem’s work on deformation-driven topology-varying shape correspondence provides an unsupervised solution, where the key contribution is a novel deformation energy that drives the search for

a best part correspondence. These results have appeared in multiple prominent venues and promise to have a significant influence on the many varied fields that now utilize 3D models.

Ibraheem completed his B.Sc. with honours in Computer Science at the Portland State University in 2008, followed by his M.Sc. in Computer Science under the supervision of Dr. Hao Zhang and his Ph.D. in Computer Science under the supervision of Drs. Hao Zhang and Ghassan Hamarneh at Simon Fraser University. He has co-authored, among others, two SIGGRAPH papers, two SIGGRAPH Asia papers, and journal articles in Computer Graphics Forum and The Visual Computer. He has also been a reviewer in the top computer graphics conferences and journals. In addition to his commitment to academic publishing, Ibraheem is also dedicated to reproducible research, releasing his code, data, and the implementation details of his work as open source.

Bill Buxton Dissertation Award 2015



Canadian Human-Computer Communications Society /
Société canadienne du dialogue humain-machine

The award is named in honour of Bill Buxton, a Canadian pioneer who has done much to promote excellence, both within Canada and internationally, in the field of Human-Computer Interaction. Bill truly advocates HCI. He challenges how academics and practitioners think, and inspires them to do things differently. This is why we are proud to name this award after him.

The award is determined through a juried process by a selection committee consisting of accomplished researchers in Human-Computer Interaction. This year, the jury was Dr. Jeremy Cooperstock (McGill University) and Dr. Roel Vertegaal (Queens University). Dr. Pourang Irani (University of Manitoba) facilitated the process.



Adam Fourney

University of Waterloo
CHCCS/SCDHM Bill Buxton
Award Recipient 2015

The recipient of the 2015 award for the best doctoral dissertation completed at a Canadian university in the field of Human-Computer Interaction is Dr. Adam Fourney.

In his dissertation, *Web Search, Web Tutorials & Software Applications: Characterizing and Supporting the Coordinated Use of Online Resources for Performing Work in Feature-Rich Software*, he examines how web search queries, web content, and user activity can be used to model how the public uses, or wants to use, consumer products on a daily basis. He succeeds in his goals by developing three proof-of-concept systems that all aim to minimize the amount of effort end-users need to execute basic actions at the interface level. For example, Adam's InterTwine system enables a desktop application to share context with a web browser, enabling actions performed in either environment to inform the feedforward mechanisms, contextual help, and information scent cues presented in the other.

Adam's work is characterized by fluidly transplanting key ideas from one discipline to another, with useful and insightful results. In his thesis he weaves together elements of human-computer interaction (HCI), information retrieval (IR), machine learning, and natural language processing (NLP) toward the development of innovative proof-of-concept systems. His scholarly work has already gained recognition in his field through multiple citations.

Adam Fourney earned his PhD in Computer Science from the University of Waterloo, with a specialization in Human-Computer Interaction, under the supervision of Professor Michael Terry. He has published at top-tier venues in the field, including first author publications at ACM SIGCHI 2011, 2012, 2014, and 2015, ACM UIST 2011, 2012, and 2014, and AAAI ICWSM 2013. He interned at Microsoft Research, where he currently is advancing his field as a full-time researcher.

Achievement Award 2016



Canadian Human-Computer Communications Society /
Société canadienne du dialogue humain-machine

The CHCCS/SCDHM Achievement Award is presented periodically to a Canadian researcher who has made a substantial contribution to the fields of computer graphics, visualization, or human-computer interaction. Awards are recommended by the CHCCS/SCDHM Awards Committee, based on nominations received from the research community. The 2016 members of the Awards Committee are Kellogg Booth, Marilyn Tremaine, and Brian Wyvill.

The 2016 CHCCS/SCDHM Achievement Award of the Canadian Human Computer Communications Society is presented to Michiel van de Panne of the University of British Columbia.

Michiel van de Panne is a Professor in the Department of Computer Science at UBC, with research interests that span computer graphics, computer animation, and robotics, with a strong focus on modeling human and animal motion and the motor skills that underly their movement. He recently completed 10 years as a Tier 2 Canada Research Chair in Computer Graphics and Animation at UBC. In 2002, he co-founded the ACM/Eurographics Symposium on Computer Animation (SCA), the leading forum dedicated to computer animation research, and has served for many years on its steering committee. He has served as Associate Editor of ACM Transactions on Graphics and regularly serves on program committees for ACM SIGGRAPH and SCA. He

has served as co-chair for CAS 1997, SCA 2002, Graphics Interface 2005, SBIM 2007, and SCA 2011. His research has been recognized with an NSERC Discovery Accelerator Supplement and grants from NSERC, GRAND, Adobe, and MITACS. He recently served as Associate Head for Research and Faculty Affairs. His students have gone on to faculty positions at CMU, UCLA, the National University of Singapore, University College Dublin, as well as INRIA, CNRS, Google, NVIDIA, and numerous companies related to games and visual-effects. His work with M.Sc. student Ivan Neulander helped form the basis of the Rhythm & Hues hair rendering pipeline for The Chronicles of Narnia and other films.



Michiel van de Panne

University Of British Columbia
CHCCS/SCDHM Achievement
Award Recipient 2016

Keynote Speaker

Expressive 3D Modeling: User-centered models for seamless creation through gestures

Marie-Paule Cani
University of Grenoble INP – Ensimag



ABSTRACT

Could digital media be turned into a tool, even more expressive and simpler to use than a pen, to convey and refine both static and dynamic 3D shapes? This would make shape design directly possible in virtual form, from early drafting to progressive refinement and finalization of an idea.

To this end, models for shape and motion need to be redefined from a user-centered perspective, and in particular embed the necessary knowledge to make them respond in an intuitive way to users actions.

In this talk, I will illustrate this methodology in three use cases: the creation of 3D models from 2D sketches, transfer operations that automatically adapt objects to another context, and virtual sculpture systems enabling to progressively edit and refine 3D content.

BIOGRAPHY

Marie-Paule Cani is a Professor of Computer Science at Grenoble University & Inria. She contributed over the years to a number of models for shapes and motion, such as implicit surfaces, multi-resolution physically-based animation methods and hybrid representations for real-time natural scenes. Following a long lasting interest for virtual sculpture, she has been recently searching for more efficient ways to create 3D contents such as combining sketch-based interfaces with user-centered 3D models. She received the Eurographics outstanding technical contributions award in 2011, an advanced grant from the ERC and a silver medal from CNRS in 2012 for this work. She was elected at Academia Europaea in 2013 and was granted the Informatics and Computational Sciences Chair at Collège de France in 2014-2015. She represented Computer Graphics in the ACM Publication Board from 2011 to 2014 and is Associate editor of ACM Transactions on Graphics. Fellow of Eurographics since 2005, she is currently Vice-Chair of the Eurographics association.

Keynote Speaker

The Video Invasion: How video is changing the way we engage with the world

Kori Inkpen
Microsoft Research



ABSTRACT

Netflix, YouTube, Hulu, Amazon Video. Online video today accounts for a huge percentage of Internet traffic, and these numbers are expected to continue to rise at a dramatic rate. Although these numbers reflect the huge appetite consumers have for visual media, the true game-changer has yet to come. Streaming video provides opportunities for users to watch video when and where they want, and opens up new creation and distribution channels, but, consumption is still a relatively passive experience. Instead, the truly magical experiences that video can provide will come when video connects and engages people in new ways. This talk will examine insights on how the intersection of social media and video is changing the way we engage with the world, and the potential this medium has to transform our lives.

BIOGRAPHY

Dr. Kori Inkpen is a Principal Researcher at Microsoft Research and Manager of the neXus Group. Her work focuses on how video is changing the way we engage and communicate with others, and the potential it offers to transform the way we interact with friends, families, colleagues, and strangers. Her research interests are in the fields of Computer-Supported Cooperative Work and Human-Computer Interaction, exploring next generation computing to connect people in new ways. Dr. Inkpen has organised many prestigious international conferences including CHI 2015 in Seoul, Korea (Technical Program Co-Chair), CSCW 2010 in Savannah, GA, USA (Conference Co-Chair), and Group 2007 in Sanibel Island, FL, USA (Conference Co-Chair). Prior to joining Microsoft she was a Professor of Computer Science at Dalhousie University (2001-2007) and Simon Fraser University (1998-2001).