

Graphics **Interface** 2019

Kingston, Ontario

28–31 May 2019

Proceedings

Edited by

Andrea Tagliasacchi

Robert J. Teather



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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 2019 conference, encompassing Artificial Intelligence and Computer and Robotic Vision along with Graphics Interface, is located in Kingston, Ontario at Queen's University. 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 Brian Wyvill (University of Victoria), and has as members Sheelagh Carpendale (University of Calgary), and Michiel van de Panne (University of British Columbia). I thank the Awards committee for their efforts in finding very well-deserving recipients. 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 2018. The Michael A.J. Sweeney Award winners are selected by the program co-chairs in consultation with the program committee. Finally, while there will not be an award presented at the conference this year, the CHCCS/SCDHM continues to host the Canadian Digital Media Pioneer awards which were first initiated by the GRAND NCE in 2011, with Eugene Fiume serving to coordinate the selection committee.

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

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. News and topics of discussion at this year's meeting include efforts to reduce costs and registration fees for future AI/GI/CRV conferences.

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/GI/CRV 2019. I wish to thank this year's co-chairs, Andrea Tagliasacchi and Rob Teather, 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.

A Message from the Program Co-chairs

Graphics Co-chair

Andrea Tagliasacchi
Google/Canada, Canada

HCI Co-chair

Robert J. Teather
Carleton University, Canada

Graphics Interface is the premier Canadian international conference devoted to research in computer graphics, visualization, and human-computer interaction. It is a dual-track, interdisciplinary conference featuring outstanding keynote speakers, high-quality papers presented by researchers from Canada and abroad, an invited speaker series, and an awards program celebrating the best in Canadian HCI and graphics. It is also the oldest continuously-scheduled conference in the field: it began in 1969 as the “Canadian Man-Computer Communications Seminar,” before taking on its modern name of “Graphics Interface” in 1982. This year is Graphics Interface’s 45th year, taking place at Queen’s University in Kingston, Ontario from May 28th to 31st, 2019.

The Graphics Interface 2019 program features 26 papers. We received 50 submissions and amongst these, the international program committee accepted a total of 26 papers (52% accept rate). The program committee consisted of 30 experts spanning various areas of Graphics and HCI. Each graphics paper was formally reviewed by a minimum of three committee members and an external reviewer. HCI papers were reviewed by two committee members plus at least two external reviewers. A double-blind reviewing process was used: the identity of the paper authors was known only to the program committee. We thank the program committee and external reviewers for ensuring quality, 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 NVIDIA has kindly sponsored Graphics Interface with prizes for best papers. Since 2012, authors of selected computer graphics papers have been invited to submit extended and revised manuscripts to be considered, with partial reviewer continuity, for journal publication in special sections 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.

The conference schedule includes talks given by two keynote speakers, two achievement award winners, and two dissertation award winners. The keynote speakers this year are Otmar Hilliges (ETH Zurich) and Wolfgang Stuerzlinger (Simon Fraser University), who are each well known for exemplary contributions to their respective disciplines. In 2019, the Graphics Interface awards committee chose two highly deserving recipients for the CHCCS/SCDHM Achievement Award; congratulations to Karan Singh (University of Toronto) and Carl Gutwin (University of Saskatchewan). This year the Service Award is presented to Pierre Poulin, congratulations to him for his long-term contributions to our research community as vice-president of CHCCS, and in his role coordinating the doctoral dissertation awards. Lastly, we extend our congratulations to the two dissertation award winners: Max Birk (University of Saskatchewan)— 2018 Bill Buxton Dissertation Award, and Olivier Mercier (Université de Montréal) — 2018 Alain Fournier Dissertation Award.

Further information about all the award winners can be found in the proceedings.

We are excited this year to once again continue the Graphics Interface Speaker Series. The 2018 lineup consists of seven outstanding speakers with diverse areas of expertise: Simon Clavet (Ubisoft Montreal), Audrey Girouard (Carleton University), David Levin (University of Toronto), Lennart Nacke (University of Waterloo), Matthew O’Toole (Carnegie Mellon University), Stacey Scott (University of Guelph), and Alex Tessier (Autodesk).

Finally, we would like to thank the many people who contributed time and effort to the behind-the-scenes conference organization, especially Christopher Batty, Paul Kry, Kelly Booth, Brian Wyvill, Pierre Poulin and Meghan Haley. Thanks also go out to Spencer Rose for the conference web design and maintenance, James Stewart and Precision Conference Solutions for handling the electronic submission and review system, our Poster Chair Mikhail Bessmeltsev, and the AI/GI/CRV General Chair Michael Greenspan. For further information about the Graphics Interface conference series you can visit the official web site, <http://www.graphicsinterface.org>.

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Shan Yang
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Service Award 2019



Canadian Human-Computer Communications Society /
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The 2019 CHCCS/SCDHM Service Award of the Canadian Human-Computer Communications Society is presented to Dr. Pierre Poulin for his long-term contributions to the Canadian computer graphics, visualization, and human-computer interaction community in his role coordinating the doctoral dissertation awards given annually for the best Canadian dissertation in computer graphics and the best Canadian dissertation in human-computer interaction.

Dr. Poulin initiated the first CHCCS dissertation award in 2005 to commemorate and honor his mentor and former graduate supervisor, Dr. Alain Fournier, who passed away in 2000. The Alain Fournier Dissertation Award was funded by donations from family, friends, and former colleagues of Dr. Fournier that are administered through the Vancouver Foundation on behalf of CHCCS. Initially the Fournier Award was open to any dissertation in the field of computer graphics, visualization, or human-computer interaction by a doctoral student at a Canadian university.

In 2010, a second dissertation award was introduced after an anonymous donor established the Bill Buxton Dissertation Award through the Vancouver Foundation for dissertations in human-computer interaction. Since then, the Fournier Award recognizes exceptional doctoral research in computer graphics or visualization and the Buxton Award recognizes exceptional doctoral research in human-computer interaction or visualization, with the understanding that visualization intersects computer graphics and HCI so the selection committee will determine the appropriate area for a particular dissertation.

In his role as Chair of the Dissertation Awards Committee, Dr. Poulin serves as the primary liaison with the Vancouver Foundation for the endowments that fund the dissertation awards. He also oversees the annual submission and review process for both awards by appointing the selection committees for each award and then coordinating the selection process and ensuring that any potential conflict-of-interest concerns are properly dealt with. It is a testament to Pierre's dedication to these and other tasks associated with the award process that the CHCCS Dissertation Awards are recognized as significant achievements for Canadian doctoral students and that the selection process has run smoothly for more than a decade under this leadership.

In addition to his many years almost single-handedly establishing and nurturing the CHCCS Dissertation Awards, Pierre has served as general co-chair and local arrangements organizer for the Graphics Interface 2000 conference in Montréal, as a member of the technical program committee for numerous Graphics Interface conferences starting in 1998, as the elected Vice-Chair of the CHCCS organization since 2002.



Pierre Poulin

Université de Montréal
CHCCS/SCDHM Service Award
Recipient 2019

Dr. Poulin earned his B.Sc. at Laval University in 1986 and his M.Sc. in 1989 at the University of Toronto. He earned his Ph.D. from The University of British Columbia in 1993 after which he was a postdoctoral fellow at Princeton University before joining the Department of Computer Science and Operations Research (Département d'informatique et de recherche opérationnelle) as a faculty member at the University of Montreal in 1994 where he is currently Professor and Chair of the department. Pierre's research focuses on topics in computer graphics including realism, image synthesis, local and global Illumination, image-based modeling and rendering, natural phenomena and physical simulation, procedural modeling, real-time rendering, and animation.

Michael A. J. Sweeney Award 2019



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

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 2019

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

Graphics 2019 Award Winner

“A Frequency Analysis and Dual Hierarchy for Efficient Rendering of Subsurface Scattering”, by David Milaenen (Université de Montréal), Laurent Belcour (Université de Montréal), Jean-Philippe Guertin (Université de Montréal), Toshiya Hachisuka (University of Tokyo), Derek Nowrouzezahrai (Université de Montréal).

BIOGRAPHIES

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HCI 2019 Award Winner

“WiseType: A Tablet Keyboard with Color-Coded Visualization and Various Editing Options for Error Correction”, by Ohoud Alharbi (Simon Fraser University), Ahmed Sabbir Arif (University of California, Merced), Wolfgang Stuerzlinger (Simon Fraser University), Mark Dunlop (University of Strathclyde), Andreas Komninos (University of Patras).

BIOGRAPHIES

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Alain Fournier Award 2018



Canadian Human-Computer Communications Society /
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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/>.



Olivier Mercier

Université de Montréal
CHCCS/SCDHM Alain Fournier
Award Recipient 2018

Olivier Mercier is the recipient of the 2018 Alain Fournier Ph.D. Dissertation Award. His dissertation, entitled “Iterative Solvers for Physics-based Simulations and Displays”, addressed several important problems in the areas of realistic physical simulation and efficient numerical methods, with diverse applications to scalable fluid dynamics and computational imaging.

The effectiveness of software tools in digital content creation and consumption for computer graphics, particularly in the areas of physics-based animation and image synthesis, relies on the development of numerical methods with predictable efficiency and reliable error bounds. Dr. Mercier’s thesis presents a body of works that address fundamental problems affecting the scalability of quality in interactive graphics applications. In every instance, Olivier’s solutions push the state-of-the-art in their respective application domains, starting with a method for decoupling coarse volumetric fluid simulations with fine scale surface-based dynamics. Here, Olivier proposed a stable wave-based dynamics simulation that marries seamlessly atop many existing underlying fluid simulators, allowing for the augmentation of the effective resolution of these base simulators with sub-linear growth in computation cost and memory. Continuing the trend of these works, Olivier devised another efficient numerical method to address an important problem in focal stack decomposition in virtual reality. His iterative algorithm efficiently computes multi-plane display outputs suitable for rendering in novel virtual reality displays. The crowning work in Olivier’s thesis marries the insights gained in his previous factorization and simulation solutions, devising a theory of semi-analytic subspace simulation for Eulerian fluid simulation. Olivier relates his subspace scheme to Fourier- and wavelet-based representations and, as with his previous work, he proposes an efficient numeri-

cal solver that leverages his multi-resolution subspace simulation theory: using a novel energy cascade-based advection scheme, Olivier developed a proof-of-concept digital content creation tool for fluid simulations with complex fluid-solid coupling.

Olivier’s contributions to the academic community are complemented by his contributions to the open source and industrial research communities. He released his surface-based fluid wave simulator in the widely-adopted open source Mantaflow fluid simulation research platform, and variants of his thesis works have been used in the digital content creation pipelines at Pixar Animation Studios and the rendering tools at Facebook Reality Labs.

Olivier obtained his B.Sc. in Pure and Applied Mathematics with Distinction from the Université de Montréal in 2011, his M.Sc. in Applied Mathematics under the supervision of Jean-Christophe Nave at McGill University in 2013, before returning to complete his Ph.D. at the Université de Montréal in the Département d’informatique et de recherche opérationnelle under the supervision of Derek Nowrouzezahrai. During his Ph.D. studies, he completed research internships at Autodesk Research under the supervision of Jos Stam, at Oculus Research (now Facebook Reality Labs) under the supervision of Douglas Lanman, and at Pixar Research under the supervision of Theodore Kim. Olivier was also a recipient of the prestigious Alexander Graham Bell NSERC Scholarship, the Fonds de recherche du Québec nature et technologies Doctoral Scholarship, and departmental and faculty excellence awards at the Université de Montréal. Olivier is currently a Research Scientist at Facebook Reality Labs, where he continues his work on advancing the state-of-the-art in interactive graphics simulations and virtual reality.

For more information, please visit: <http://www.olivier-mercier.com>

Bill Buxton Dissertation Award 2018



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. Andrea Bunt (University of Manitoba), Dr. Fanny Chevalier (University of Toronto), Dr. Jeremy Cooperstock (McGill University), and Dr. Kellogg Booth (University of British Columbia) who facilitated the process.



Max Birk

University of Saskatchewan
CHCCS/SCDHM Bill Buxton
Award Recipient 2018

The recipient of the 2018 award for the best doctoral dissertation completed at a Canadian university in the field of Human-Computer Interaction is Dr. Max Birk.

His dissertation, *Investigating Avatar Customization as a Motivational Design Strategy for Improving Engagement with Technology-Enabled Services for Health*, explores one of the biggest challenges in effective digital health solutions—attrition due to lack of long-term user engagement. Limited uptake thwarts the tremendous clinical potential of, interest in, and evidence for the efficacy of technology-enabled services. Drawing inspiration from game design, Birk conducted four studies: the effects of avatar customization on user experience and behaviour in a game setting, the effects of avatar customization on attrition in an intervention context using a breathing exercise, the immediate effects of avatar customization on the efficacy of an anxiety-reducing attentional retraining task, and the effects of financial rewards on self-reported motivation and performance in a gamified training task. Together, these provide evidence for a causal effect chain whereby avatar customization increases self-reported identification with an avatar, which in turn increases self-reported motivation that leads to increased behavioural engagement and focus, and those lead to heightened exposure over time or qualitatively higher exposure through increased focus in the moment of use, which in the end can increase the efficacy of the intervention.

Motivational design strategies to improve engagement are not well understood and thus are under-utilized. Birk deployed experiments both online and in-the-wild to investigate how compensation for participation and the timing of payments affects adherence. Noting clear differences between the relatively high adherence levels found in strict RCT (randomized controlled trials) versus the attrition rates often encountered with in-the-wild studies, he developed

new methods for studying adherence over time that have already been adopted by other researchers to help address a major limitation in current research—that participation rates in experimental contexts simply do not translate into actual use.

Max Birk completed his doctorate in computer science at the University of Saskatchewan under the supervision of Dr. Regan Mandryk. He had previously earned a Diplom in Psychology (equivalent to a master's degree) at the University of Trier (Germany) in 2012 on the topic “Provoking aggression in the laboratory: Physiological responses to violent video games.” He then studied computer science at the University of Saskatchewan before entering the doctoral program there. Papers he co-authored received honorable mention (top 5%) awards at both the CHI 2017 and CHI 2018 conferences, and at CHI Play 2015 one paper he co-authored received a best paper (top 1%) award and another received an honorable mention (top 5%) award. He is currently an assistant professor in the Department of Industrial Design at Eindhoven Technical University in the Netherlands.

Achievement Award 2019



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 2019 members of the Awards Committee are...

A 2019 CHCCS/SCDHM Achievement Award from the Canadian Human-Computer Communications Society is presented to Dr. Karan Singh. This award recognizes the significant and varied contributions he has made in interactive computer graphics, spanning geometric modeling, art and visual perception, facial and character animation, and sketch-based techniques and interfaces.

Of particular note is his innovative work on interactive methods for geometric modeling and animation. A persistent theme of his work is that it is human centered: he develops interactive tools for creative people to develop visual expressions. This includes the well known Wires deformers in Maya, which became the ubiquitous deformation tool in interactive geometric modelling, as well as blend-shape animation, which likewise became the fundamental tool of kinematic animation. In both inventions, the ability to easily draw, visualize, and interactively manipulate geometry and animation were a key to their success. Drawing and visualizing extended to sketching 3D shapes in the ILoveSketch system, which inspired many others to work on sketch-based graphics. He continued with a collection of other highly creative interfaces that leverage sketching, scaffolding-based construction, and guidance from images and 3D models. He has further developed systems that reflect the opportunities and constraints related to computational fabrication. Much of his work has been richly interdisciplinary, as seen in the publication venues for his work, which span SIGGRAPH, CHI, UIST, and more. His graduate students include talent from areas that span math, science, engineering, the arts, and the anatomical sciences, to mention a few.

He developed the ideas and implementations behind the cords that were a key feature of the 2004 animated short, Ryan, for which he was the software R&D director. The cords were developed as an intuitive representation for modeling and animating rope-like objects, including hair, in the film. Ryan went on to win over 60 awards, including the 2004 Academy Award for Animated Short Film and the 25th Genie Award for Best Animated Short.



Karan Singh

affiliation
CHCCS/SCDHM Achievement Award
Recipient 2019

Dr. Singh's work is further notable for its resulting technology transfer. It has led to commercial software offerings and startups, including MeshMixer, FlatFab, JanusVR and JALL. He has further led strong collaborative efforts with Autodesk Research.

Karan Singh is a Professor in the Department of Computer Science at the University of Toronto. He holds a B.Sc. in 1991 from IIT Madras, and a Ph.D. from Ohio State State University in 1995. From 1995-1999, he was an Engineer and Researcher at Autodesk Research (then Alias/wavefront) in Toronto.

Achievement Award 2019



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 2019 members of the Awards Committee are...

This year's CHCCS Achievement Award goes to Professor Carl Gutwin for his significant and sustained contributions to human-computer interaction research.



Carl Gutwin

University of Saskatchewan
CHCCS/SCDHM Achievement Award
Recipient 2019

Carl Gutwin is a full professor at the University of Saskatchewan, where he co-directs the Human-Computer Interaction (HCI) Lab. Over the past 25 years Carl Gutwin has really made his mark on the human-computer interaction research world. He has become one of the most respected researchers in human computer interaction (HCI). He is internationally renowned and has put the University of Saskatchewan on the HCI research map.

Gutwin has undergraduate degrees in computer science and in English literature. He received his PhD in 1997 from the University of Calgary, where he developed the ideas of workspace awareness and the mechanics of collaboration as a design factor for distributed groupware systems. Carl was the Canada Research Chair for Next-Generation Groupware, a co-theme leader in the SurfNet national research network, conference co-chair for Computer Supported Cooperative Work (CSCW) 2010, and papers co-chair at CHI 2011. Carl Gutwin's impact on the human computer interaction research community has been well recognized by his peers. For example, in 2012, he was inducted into the ACM CHI Academy and in 2015 he was recognized as an ACM Distinguished Researcher.

Gutwin is known for his contributions in HCI ranging from the technical aspects of systems architectures, to the design and implementation of interaction techniques, and to social theory as applied to design. The wide range of HCI topics he contributes to include computer-supported cooperative work, groupware usability, interaction techniques, collaboration support, modelling human performance, information visualization and interface design. In combination, he has published more than 230 papers. Carl Gutwin's research impact is apparent in terms of citations. His h-factor is 68. That means that 68 of his papers have been cited 68 times. For the last few years his yearly citation count has hovered around 1200 and his most cited paper – on workspace awareness – has been cited over 1000 times.

In his PhD, with Saul Greenberg as his supervisor,

Carl started out his research career with a bang when he developed the concepts of inter-personal awareness and the mechanics of collaboration as a significant design factors in the creation of collaborative computer software systems. He considers workspace awareness to be 'the up-to-the-moment understanding of another person's interaction with a shared workspace'. His research led to a framework that shows how work place awareness can help and improve the usability of digital groupware applications. This framework has helped educate designers about awareness in groupware and help to improve the quality of the systems that are built. Awareness in in real time groupware and mechanics of collaboration are both landmark research contributions that have changed the way we think about collaboration via computers.

To mention only a few other research contributions, another early career, high impact research contribution is KEA. With Witten, Paynter, Frank, and Nevill-Manning, Gutwin developed KEA – a key phrase extraction algorithm. Being able to extract appropriate and important keyphrases is a significant milestone in automation of the process of providing brief summaries of document contents. In 2008, Gutwin and his students Bateman and Nacenta, explored how different perceptual factors affect how people read tag clouds. Tag clouds grouping of salient words from a piece of text where the size of the word indicates its frequency in the text. Their studies showed that font size and font weight have stronger effects than intensity, number of characters in the word, or size of the tag area. A different study indicated the graphic embellishments on information visualization charts may not always be negative as had previously been assumed. Carl Gutwin has also been deeply involved and very influential in the study of touch-based interactions.

Carl has also been active and influential as a supervisor and a mentor. There many of us in the HCI research community that have benefited from his collegiality. His pleasure in doing research imparts his enthusiasm to those around him.

For more information, please visit: <http://hci.usask.ca/people/view.php?id=2>

Keynote Speaker

Information at your fingertips – towards an interactive future

Otmar Hilliges

ETH Zürich



ABSTRACT

Virtual and augmented reality (VR/AR) is seeing a lot of interest both in industry and academia. With VR/AR displays being actively developed by leading tech companies, we can assume that high quality headsets both in terms of rendering quality as well as the form factor will soon be available. However, if we have an always-on, always-available display right in front of our eyes then the question of how we interact with the world in both its digital as well as physical incarnation becomes an increasingly pressing question.

The requirements imposed on an AR/VR interaction paradigm are many-fold. Such a system should be non-intrusive, work under occlusion and in different lighting conditions, be amenable to mobile and outdoor scenarios, and obviously be highly accurate. Furthermore, we will see a transition from explicit interaction to implicit interaction. That means instead of issuing fine-grained step-by-step commands, as is the case with mouse and keyboard interfaces, we seek an interaction paradigm in which interacting agents, powered by artificial intelligence, can perceive and analyze our actions and reason about our intent. Such systems will then be able to pro-actively display information at opportune moments and locations or even act in the physical world itself.

From a technical perspective this brings new challenges since most work in computer vision assumes an external camera pointed at a human and many traditional approaches do not translate to an ego-centric perspective. While the recent trend of deep-learning powered vision systems has brought automated action understanding closer to reality, a core problem in analyzing human activity is that it is tedious, expensive and sometimes impossible to collect appropriate training data, especially once we look beyond simple discriminative approaches and begin to strive for understanding of more complex activities. I will talk about deep-learning approaches that leverage knowledge about spatio-temporal structure that underlies human activity. In particular, we are interested in incorporating such knowledge into end-to-end trainable architectures such that the explicit representation of domain knowledge can be exploited for meta-learning and self-supervised forms of

learning and in turn reduce the reliance on labelled training data. I will demonstrate how incorporation of such models can improve many tasks including human (hand) pose and eye gaze estimation, and how such approaches can be leveraged to build always available means of input in AR/VR. In the second half, the talk will explore challenges in interacting with virtual objects that live in the real-world including (lack of) haptic feedback and the danger of information overload.

BIOGRAPHY

Otmar Hilliges is currently an Associate Professor of computer science at ETH Zürich, where he leads the AIT lab. His research is at the intersection of machine learning, computer vision and human computer interaction (HCI). The main mission is to develop new ways for humans to interact with complex interactive systems (computers, wearables, robots), powered by advanced algorithms and technologies in machine perception, planning and data driven user modeling. Prior to joining ETH he was a Researcher at Microsoft Research Cambridge (2010-2013). His Diplom (equiv. MSc) in Computer Science is from Technische Universität München, Germany (2004) and his PhD in Computer Science from LMU München, Germany (2009). He spent two years as a postdoc at Microsoft Research Cambridge (2010-2012). He has published more than 70 peer-reviewed papers in the major venues on computer vision, HCI and computer graphics and received an ERC starting grant in 2017 for computational approaches to sensing based human-computer interfaces. Finally, 20+ patents have been filed in his name on a variety of subjects from surface reconstruction to AR/VR.

For more information, please visit: <https://ait.ethz.ch/people/hilliges/>

Keynote Speaker

Better User Interfaces for Occasionally Failing Technologies

Wolfgang Stuerzlinger

Simon Fraser University



ABSTRACT

Technology increasingly employs unreliable systems as a central means to interpret input. Common examples include voice and text input in mobile devices or lane departure detection in cars. This reliance exposes a fundamental problem – people do not generally understand the underlying systems, and seemingly small system or human errors can lead to potentially disastrous consequences. While technical improvements partially address this, recent research in my group pursues a complementary approach through a better understanding of human interaction with, and new user interface (UI) technologies for, unreliable systems. In this talk I first present work that analyzed human behaviours around occasionally failing systems in text entry and gesture recognition and the insights that we gathered from this work. Then, I present a new text entry method that reduces errors caused by auto-correction and prediction algorithms. Moreover, I present a system that uses a brain-computer interface to sense user reactions to incorrect auto-corrects, which we use to trigger better system responses by offering different corrections. Finally, I close with an outlook for future work in this area.

BIOGRAPHY

Building on his deep expertise in virtual reality and human-computer interaction, Dr. Stuerzlinger is a leading researcher in three-dimensional user interfaces. He got his Doctorate from the Vienna University of Technology, was a postdoctoral researcher at the University of Chapel Hill in North Carolina, and professor at York University in Toronto. Since 2014, he is a full professor at the School of Interactive Arts + Technology at Simon Fraser University in Vancouver, Canada. His work aims to find innovative solutions for real-world problems. Current research projects include better 3D interaction techniques for VR and AR applications, new human-in-the-loop systems for big data analysis (visual analytics and immersive analytics), the characterization of the effects of technology limitations on human performance, investigations of human behaviors with occasionally failing technologies, user interfaces for versions, scenarios and alternatives, and new virtual reality hardware and software.