

Origins

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Editor-in-Chief Torsten Möller introduces what is in store for IEEE CG&A in 2020, introduces the new issue and thanks those who are departing and introduces those coming aboard.

■ **OUR MAGAZINE HAS** seen a lot of new things this past year—from a new layout to a fantastic production staff to a new webpage with improved guidelines for authors, reviewers, editors, and special issue guest editors as well as improved author templates. I hope this makes it smoother to provide your contribution to our readers. Further, we much improved our online presence through more frequent Twitter messages, but also through additional material (not available in the magazine) that we are posting on Facebook. We would be grateful for feedback from our readers as to how better to serve you in this regard.

Looking ahead, I am proud to announce that we have many exciting issues coming up—from Visualization in Public Spaces to Art and Cultural Heritage to Graphics and Virtual Environments for Serious Games to Data Physicalization, we are covering again a broad spectrum of computer graphics applications. However, I am most excited about our issue for December 2020, which will focus on

Climate Change, of course, from a computer graphics, visualization, and HCI point of view.

But the name of the current issue, Origins, has been “stolen” from our brand new department, which we are introducing in this issue. It is called “Visual Computing: Origins” and details “personal accounts of the origins of techniques, software, and hardware in computer graphics.” I am especially pleased that Turner Whitted—the “father” of global illumination—will be the author of the inaugural issue. Turner’s article tells the story of his inspiration, development, and first public presentation of recursive ray tracing, a technique that was an important framework for later research in global illumination, a term Whitted coined. Whitted brackets his story with descriptions of the state-of-the art in shading in the late 1970s when he began his ray tracing work and the state-of-the art in global illumination in the mid 1980s, when the technology was starting to be mainstream. The team that is putting together the department consists of big names in the field themselves—Mary Whitton, Chris Johnson, Bill Lorensen, and David Kasik.

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The timing is, of course, perfect, as our magazine is turning 40 years old by the end of 2020. The first issue of the magazine appeared in 1981. Hence, it is a celebratory time and the right time to revisit some of the milestones, told by the people that were there and with details that cannot be found in any of the original articles.

IN THIS ISSUE

We had some great special issues this year, but once a year we like to highlight our regular submissions, which are articles that have been submitted (and accepted) without a specific focus theme. We selected six articles that highlight the breadth and diversity of the work in the general area of *computer graphics and its applications*. Two of the articles use virtual reality, one focusing on a medical application, (“Towards Placental Surface Vasculature Exploration in Virtual Reality”) whereas the other is detailing a cultural heritage application (“A Compelling Virtual Tour of the Dunhuang Cave With an Immersive Head-Mounted Display”).

A nice example for an effective parameter-space exploration in computational science is given by the article on “Aggregated Ensemble Views for Deep Water Asteroid Impact Simulations.” It is the contest winner of the 2018 Scientific Visualization contest. CG&A is proud to give the contest winners a space to present their work, as they are very application-driven scenarios. We will also publish the 2018 VAST contest winner in a subsequent issue.

The importance of the proper use of fonts doesn't become clear until a wrong font is used and the reading of an article, a set of slides, etc., is becoming hard. Generating fonts for different occasions is difficult, especially for some of the Asian languages that consist of thousands of characters. The article on “Automatic Generation of Typographic Font From Small Font Subset” is trying to simplify this process, by learning and applying the essence of a font from just a few characters.

Understanding more general sketches or drawings has been a well-researched topic in our community. “Deep Stroke-Based Sketched Symbol Reconstruction and Segmentation” is using a novel deep neural network to decompose a sketch into its components (strokes), allowing

researchers to better understand drawings and to possibly improve sketching programs.

In order to better manipulate videos with the same ease as we manipulate images in applications like Gimp or Photoshop is being pursued by the authors of “Interactive Video Completion.” They present novel algorithms for the seamless removal of objects from a video stream.

NEW EDITORIAL BOARD MEMBERS

As every year, there are a number of new additions to our editorial board and a number of retirements. I would like to take this opportunity to wholeheartedly thank all the editorial members (past, current, and future) to serve in this important role to put out six high-quality issues of our magazine each year. It takes a lot of time to find authors, articles, themes, as well as reviewers, and to provide feedback to the authors that ultimately improves their work. Without you, we could not do this! Thank you!

One of the people that served for six years and to which CG&A is much indebted to is our former AEiC for regular submissions, Kwan-Liu Ma. He dedicated his time week-after-week to assure a timely and high-quality review process for all of our authors. The only good news is that he can now finally submit his own prolific research articles to our magazine, and I hope he will make lots of use of it. Thank you Kwan-Liu for all your work! Kwan-Liu has been replaced with Richard Zhang, who was previously an Associate Editor of the magazine. Thank you, Richard, for stepping in!

Frank Steinicke has served as a co-Editor for the regular department on “Spatial Interfaces.” He has been with us in this role for four years and has been replaced by Kyle Johnson. Further, we would like to thank Martin Hatched as well as Jan Bender for serving as Associate Editors. Thank you for all your work.

I am also very happy to welcome a number of new members to the board. Besides our new department “Origins,” which is led by Mary Whitton, Chris Johnson, Bill Lorensen, and David Kasik, Dan Keefe has joined “People in Practice,” a department we launched last year.

Finally, I am happy to welcome Xin Tong and Kun Zhou to our editorial board. Xin and Kun

guest edited the wildly popular “Deep Learning” special issue last year, which we had to split into two special issues. Also, Maud Marchal joined last year, strengthening our capacities in the area of animation.

Lastly, I would like to thank all the reviewers and authors for their time to make this magazine great. We are looking forward to another exciting year—the 40th in our existence. And to our readers—we wish you a productive new year.



Kyle Johnsen (<http://www.engineering.uga.edu/people/profile/kyle-johnsen-ph.d>) is a faculty member of the University of Georgia where he is an Associate Professor with the School of Electrical and Computer Engineering

and is the Director of the Georgia Informatics Institutes for Research and Education. His research and instruction focus on the design of human-computer interfaces, with an emphasis on virtual reality technologies and spatial interaction techniques applied to the advancement of human health and education. He is currently general chair for the IEEE Virtual Reality 2020 conference, and has previously been program chair for the ACM Spatial User Interaction 2016–2018 conferences.



Chris Johnson (<https://www.cs.utah.edu/~crj/>) is a faculty member within the Scientific Computing and Imaging (SCI) Institute, University of Utah, where he is a Distinguished Professor of Computer Science and holds faculty appointments in the

Departments of Physics and Bioengineering. His research interests are scientific computing and scientific visualization. With professor Rob MacLeod, he founded the SCI research group in 1992, which has since grown to become the SCI Institute employing over 200 faculty, staff, and students. Prof. Johnson directed SCI until 2018. He is a Fellow of AIMBE (2004), AAAS (2005), SIAM (2009), and IEEE (2014). He has received a number of awards, including an NSF Presidential Faculty Fellow award from President Clinton, the

Governor’s Medal for Science, the IEEE Visualization Career Award, the IEEE IPDPS Charles Babbage Award, the IEEE Sidney Fernbach Award, and the Rosenblatt Prize.



Dave Kasik retired as Boeing’s Senior Technical Fellow in visualization and interactive techniques in 2016. In this role, he advanced Boeing’s use of digital twin 3-D design and digital thread processes. His work

with geometric data made him a pioneer in interactive 3-D computer graphics. He devoted his first 11 years at Boeing to research and development of computer-aided design software. The project led to pioneering work in interactive 3-D graphics, user interface management systems, and industrial use of nonuniform rational (NURBS) solids and surfaces. He has worked to make 3-D geometry available to the entire Boeing user community, e.g., IVT/Superviewer, which let users see an entire virtual Boeing aerospace product without using special hardware, low-end visualization, which give users access to the 3-D engineering drawings, parts lists, training material, etc. He pioneered Boeing’s use of visual analytics to help extract more information from complex nongeometric data. The visual analytics supplements more traditional analytic techniques (like statistics and data mining) with a human’s ability to use vision to find anomalies and detect trends. Emerging visual analytics tools are now in use throughout Boeing. He has worked with researchers worldwide on visual analytics, massive model visualization, and other topics. For example, he worked with Brazilian and Canadian researchers on use of visual analytics in a mobile environment, with Brazilian and U.S. researchers on visualization of dynamic simulations of dense crowds, with Hungarian researchers on multisided surface patches, and with Korean researchers on dynamic transparency for complex geometric models. He received the master’s degree in computer science from the University of Colorado in 1972 and the bachelor’s in quantitative studies from Johns Hopkins University in 1970. He participates in numerous professional organizations, including the Association for Computing Machinery (ACM),

which named him a Distinguished Scientist in 2007, a Fellow in 2013, and a Distinguished Speaker in 2018; ACM SIGGRAPH, where he started the annual pioneers student mentoring program and is the recipient of the Outstanding Service Award in 2012; and IEEE, where he is a past member of the editorial board and current member of the Advisory board of *IEEE Computer Graphics and Applications* and was recognized as a Senior Member in 2013. He holds 10 patents, and has authored more than 35 papers and coauthored two books.



Dan Keefe (<https://www.danielkeefe.net/>) is a Distinguished University Teaching Professor and Associate Professor with the Department of Computer Science and Engineering, University of Minnesota. His research

interests include virtual and augmented reality, data visualization, tangible user interfaces, and artistic 3-D modeling. He is the recipient of the best paper, panel, and poster awards at recent IEEE and ACM conferences, the Horace T. Morse-University of Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education, the National Science Foundation CAREER award, the University of Minnesota Guillermo E. Borja Award for research and scholarly accomplishments, the University of Minnesota McKnight Land-Grant Professorship, and the 3M Non-Tenured Faculty Award. His research has been funded by the National Science Foundation, the National Institutes of Health, the National Academies Keck Futures Initiative, and industry sponsors. In addition to his work in computer science, Prof. Keefe is also an accomplished artist and has published and exhibited work in international venues for digital art. Before joining the University of Minnesota, Prof. Keefe did postdoctoral work with Brown University jointly with the departments of Computer Science and Ecology and Evolutionary Biology, and with the Rhode Island School of Design. He received the Ph.D. degree in 2007 from the Department of Computer Science, Brown University and the B.S. degree in computer engineering *summa cum laude* from Tufts University in 1999.



Bill Lorensen (<http://marchingcubes.org>) retired from GE Research in January 2007. His career with GE started in 1978. He was a Graphics Engineer in the Visualization and Computer

Vision Laboratory, GE Research in Niskayuna, NY. He has more than 40 years of experience in computer graphics and software engineering. He recently worked on algorithms for medical image analysis and scientific visualization. He is a co-developer of the marching cubes and dividing cubes surface extraction algorithms, two popular isosurface extraction algorithms. The 1987 Marching Cubes ACM SIGGRAPH paper continues to be the top cited SIGGRAPH paper in the ACM Digital Library. He has authored/coauthored more than 80 technical articles on topics ranging from finite-element pre/postprocessing, 3-D medical imaging, computer animation, and object-oriented design. He is a coauthor of “Object-Oriented Modeling and Design” published by Prentice-Hall, 1991. He is also coauthor with Will Schroeder and Ken Martin of the book “The Visualization Toolkit: An Object-Oriented Approach to 3D Graphics,” published by Kitware in 2004.

Bill holds 31 U.S. Patents on medical and visualization algorithms. In 1991, he was named a Coolidge Fellow, the highest scientific honor at GE Research. In 2004, he became the recipient of the first IEEE Visualization Career Award. He was elected a Fellow of the American Institute of Medical and Biological Engineering in 2006.

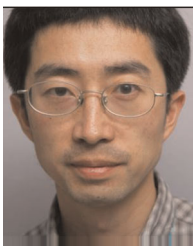
Before joining GE in 1978, he was a mathematician with the U.S. Army Benet Weapons Laboratory, where he worked on computer graphics software for structural analysis. He has a B.S. degree in mathematics and M.S. degree in computer science from Rensselaer Polytechnic Institute.

Bill and his wife Terri enjoy their new home in Aptos, California. Today, he remains an active contributor to the open source Visualization Toolkit, VTK*.

*At the time of the writing of this editorial, Bill Lorensen was very active in the launching of the “Visual Computing: Origins” department. I am sad to report that Bill has recently passed on and we plan to have a special tribute to him in a future issue of IEEE CG&A.



Maud Marchal (<http://people.rennes.inria.fr/Maud.Marchal/>) is an Associate Professor with Univ. Rennes, INSA, IRISA, Inria, France, since September 2008 and is also a junior member of the Institut Universitaire de France, since 2018. Her main research interests include physically-based simulation, haptic feedback, 3-D interactions, and virtual reality. Her research explores the design and evaluation of 3-D interaction techniques combining multimodal feedback and physics-based simulations in virtual environments. She received the Ph.D. degree in computer science in 2006 from University Joseph Fourier in Grenoble, France, and an “Habilitation à Diriger les Recherches” (tenure) in 2014. She has been a Conference Chair of ACM SIGGRAPH/Eurographics Symposium on Computer Animation in 2018. She is also a Program Chair of the IEEE Virtual Reality Journal track 2020.



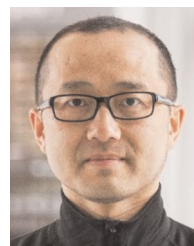
Xin Tong (<https://www.microsoft.com/en-us/research/people/xtong/>) is a Principal Researcher and leader of the graphics group in Microsoft Research Asia. His research interests include computer graphics and computer vision, including appearance modeling and rendering, computational light transport, texture synthesis, image based rendering, facial performance capturing and modeling, as well as data driven geometric analysis. He received the Ph.D. degree from Tsinghua University in 1999, and then joined Microsoft Research Asia. He is a member of IEEE and ACM.



Mary C. Whitton (<https://www.cs.unc.edu/~whitton/>) is a Research Professor (mostly-retired) of computer science with the University of North Carolina at Chapel Hill. She co-led the Effective Virtual Environments research group that investigated what technology is required to enable virtual reality

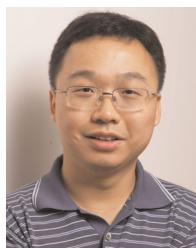
experiences to achieve their goals. She and her students used the knowledge of human perception to develop technologies and techniques that make virtual environments more effective for applications, such as simulation, training, and rehabilitation. Before joining UNC in 1994, she was a founder of Ikonas Graphics Systems in 1978 and Trancept Systems in 1987. Both Ikonas and Trancept designed and sold high-end user-programmable hardware and libraries of software for graphics, image processing, volume rendering, and visualization. The companies’ products were widely adopted in academic and industrial research laboratories for applications including seismic exploration, 3-D medical imaging, intelligence, computer animation, and scientific modeling and simulation. The Ikonas RDS-3000 is widely recognized as the precursor of today’s general purpose graphical programming units, GPUs.

Prof. Whitton is a Life Senior Member of IEEE and serves on the Steering Committee for the IEEE Virtual Reality Conference. She is a senior member of ACM and a member of ACM SIGGRAPH where she has held leadership roles including serving as Chair/President 1993–1995. She is currently the Chair of SIGGRAPH’s History Committee and a member of the ACM History Committee. She is the recipient of the ACM SIGGRAPH Outstanding Service Award in 2013. She received the B.A. degree from Duke University in 1970, and the M.S. degree in guidance and personnel services in 1974 and the M.S. degree in electrical and computer engineering in 1984 from North Carolina State University.



Hao (Richard) Zhang (<https://www.cs.sfu.ca/~haoz/>) is a Full Professor in the School of Computing Science, Simon Fraser University (SFU), Canada, where he directs the graphics (GrUVi) lab. He has also been a visiting professor with Stanford University from 2016 to 2017. He has authored/coauthored more than 120 papers on the topics of his research interests. His research interests include computer graphics with special interests in geometric modeling,

shape analysis, 3-D content creation, machine learning, and computational design and fabrication. He received the Ph.D. degree from the University of Toronto, and MMath and BMath degrees from the University of Waterloo, all in computer science. From 2014 to 2018, he served as an Editor-in-Chief for *Computer Graphics Forum* and as an associate editor for several other leading journals in the field. He has also worked for the program committees of all major computer graphics conferences and was SIGGRAPH Asia 2014 course chair, a paper co-chair for SGP 2013, GI 2015, and CGI 2018, and a program chair for the International Geometry Summit 2019 and SIAM GD 2019. Dr. Zhang is an IEEE Senior Member and is the recipient of the NSERC DAS (Discovery Accelerator Supplement) Award in 2014, Best Paper Awards from SGP 2008 and CAD/Graphics 2017, a Faculty of Applied Sciences Research Excellence Award at SFU in 2014, and a National Science Foundation of China (NSFC) Overseas Outstanding Young Researcher Award in 2015.



Kun Zhou (<http://www.kunzhou.net/>) is a Cheung Kong Professor and the Director of the State Key Lab of CAD&CG, Zhejiang University. He received the B.S. and Ph.D. degrees in computer science, both from Zhejiang

University. From 2002 to 2008, he was a Researcher with the graphic group, Microsoft Research Asia. His research interests span a broad range of topics in computer graphics, from shape modeling, avatar animation, image synthesis to 3-D printing.

Welcome aboard!