

# **IS&T International Symposium on Electronic Imaging Science and Technology 2019**

Human Vision and Electronic  
Imaging 2019

Burlingame, California, USA  
13-17 January 2019

## **Editors:**

**Damon Chandler  
Mark McCourt  
Jeffrey Mulligan**

ISBN: 978-1-7138-1338-5

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2019) by Society for Imaging Science & Technology  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact Society for Imaging Science & Technology  
at the address below.

Society for Imaging Science & Technology  
7003 Kilworth Lane  
Springfield, Virginia 22151  
USA

Phone: 703-642-9090

Fax: 703-642-9094

[info@imaging.org](mailto:info@imaging.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

---

# HUMAN VISION AND ELECTRONIC IMAGING 2019

Monday, January 14, 2019

---

## Human and Machine Perception 3D Shapes

10:40 – 11:40 am

Grand Peninsula Ballroom A

HVEI-200

**KEYNOTE: Human and machine perception of 3D shape from contour**, James Elder, York University (Canada)

James Elder is a professor and York research chair in human and computer vision at York University, Toronto, Canada. He is jointly appointed to the department of psychology and the department of electrical engineering & computer science at York, and is a member of York's Centre for Vision Research (CVR) and Vision: Science to Applications (VISTA) program. He is also director of the NSERC CREATE Training Program in Data Analytics & Visualization (NSERC CREATE DAV) and principal investigator of the Intelligent Systems for Sustainable Urban Mobility (ISSUM) project. His research seeks to improve machine vision systems through a better understanding of visual processing in biological systems. Elder's current research is focused on natural scene statistics, perceptual organization, contour processing, shape perception, single-view 3D reconstruction, attentive vision systems and machine vision systems for dynamic 3D urban awareness.

---

## Medical Imaging - Perception I

11:40 am – 12:00 pm

Grand Peninsula Ballroom A

This is the first of several medical imaging sessions throughout the week.

HVEI-225

**Do different radiologists perceive medical images the same way? Some insights from Representational Similarity Analysis (Invited)**, Jay Hegde, Augusta University (United States)...pg. 74

12:00 – 2:00 pm Lunch

---

## Monday Plenary

2:00 – 3:00 pm

Grand Peninsula Ballroom D

**Autonomous Driving Technology and the OrCam MyEye**, Amnon Shashua, President and CEO, Mobileye, an Intel Company, and senior vice president, Intel Corporation (United States)

The field of transportation is undergoing a seismic change with the coming introduction of autonomous driving. The technologies required to enable computer driven cars involves the latest cutting edge artificial intelligence algorithms along three major thrusts: Sensing, Planning and Mapping. Shashua will describe the challenges and the kind of computer vision and machine learning algorithms involved, but will do that through the perspective of Mobileye's activity in this domain. He will then describe how OrCam leverages computer vision, situation awareness and language processing to enable blind and visually impaired to interact with the world through a miniature wearable device.

Prof. Amnon Shashua holds the Sachs chair in computer science at the Hebrew University of Jerusalem. His field of expertise is computer vision and machine learning. Shashua has founded three startups in the computer vision and machine learning fields. In 1995 he founded CogniTens that specializes in the area of industrial metrology and is today a division of the Swedish Corporation Hexagon. In 1999 he cofounded Mobileye with his partner Ziv Aviram. Mobileye develops system-on-chips and computer vision algorithms for driving assistance systems and is developing a platform for autonomous driving to be launched in 2021. Today, approximately 32 million cars rely on Mobileye technology to make their vehicles safer to drive. In August 2014, Mobileye claimed the title for largest Israeli IPO ever, by raising \$1B at a market cap of \$5.3B. In August 2017, Mobileye became an Intel company in the largest Israeli acquisition deal ever of \$15.3B. Today, Shashua is the president and CEO of Mobileye and a senior vice president of Intel Corporation. In 2010 Shashua cofounded OrCam which harnesses computer vision and artificial intelligence to assist people who are visually impaired or blind.

3:00 – 3:30 pm Coffee Break

HVEI

**Symmetry in Vision and Image Processing**

**3:30 – 4:30 pm**

Grand Peninsula Ballroom A

HVEI-201

**KEYNOTE: The role of symmetry in vision and image processing,**  
Zygmunt Pizlo, University of California, Irvine (United States)

Professor Zygmunt Pizlo holds the Falmagne Endowed Chair in mathematical psychology in the department of cognitive sciences at University of California-Irvine. Pizlo received his MSc in electrical engineering (1978) from Politechnika, Warsaw, Poland, and PhD in electrical engineering (1982) from the Institute of Electron Technology, Warsaw, Poland. He then decided to pursue his interests in, and passion for, natural sciences. Having been already exposed to elements of AI, he became absolutely fascinated with the possibility of studying the human mind. In 1982, he started his research on human vision at the Nencki Institute of Experimental Biology in the Polish Academy of Sciences in Warsaw. Delving into visual psychophysics as the most mature branch of experimental psychology, Pizlo received his PhD in psychology from the University of Maryland at College Park. Bob Steinman and Azriel Rosenfeld were his advisers. In 1988, he moved to the University of Maryland in College Park, MD where he received his PhD in Psychology (1991). He was a professor of psychological sciences at Purdue University for 26 years. In 2017, he moved to UC Irvine. Pizlo's research focuses on psychophysics and computational modeling of 3D shape perception. He authored and co-authored two books on shape (MIT Press, 2008 and Oxford University Press, 2014) and co-edited a book on shape perception in human and computer vision (Springer, 2013). His interest in vision research extends to depth, motion, figure-ground, color, eye movement, as well as image and video processing. He has also done work on human problem solving where he adapted multiresolution/multiscale pyramids used in visual models to solve combinatorial optimization problems such as the Traveling Salesman Problem. Most recently, he has been exploring the role that symmetry and the least-action principle can play in a theoretical formalism that can explain perception and cognition.

**End of Day Discussion**

**4:30 – 5:00 pm**

Grand Peninsula Ballroom A

**Moderators:** Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); Jeffrey Mulligan, NASA Ames Research Center (United States)

Please join us for a lively discussion of today's presentations. Participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.

5:00 – 6:00 pm All-Conference Welcome Reception

HVEI

**Tuesday January 15, 2019**

7:15 – 8:45 am Women in Electronic Imaging Breakfast

**Material Appearance Perception**

JOINT SESSION

Session Chair: Ingeborg Tasfl, HP Labs, HP Inc. (United States)

**9:10 – 10:10 am**

Grand Peninsula Ballroom D

This session is jointly sponsored by: Human Vision and Electronic Imaging 2019, and Material Appearance 2019.

9:10

MAAP-202

**Material appearance: Ordering and clustering,** Davit Gigilashvili, Jean-Baptiste Thomas, Marius Pedersen, and Jon Yngve Hareberg, Norwegian University of Science and Technology (NTNU) (Norway) ...N/A

9:30

MAAP-203

**A novel translucency classification for computer graphics,** Morgane Gerardin<sup>1</sup>, Lionel Simonot<sup>2</sup>, Jean-Philippe Farrugia<sup>3</sup>, Jean-Claude Leh<sup>3</sup>, Thierry Fournel<sup>4</sup>, and Mathieu Hebert<sup>4</sup>; <sup>1</sup>Institut d'Optique Graduate School, <sup>2</sup>Université de Poitiers, <sup>3</sup>IRIS, and <sup>4</sup>Université Jean Monnet de Saint Etienne (France) ...N/A

9:50

MAAP-204

**Constructing glossiness perception model of computer graphics with sounds,** Takumi Nakamura, Keita Hirai, and Takahiko Horiuchi, Chiba University (Japan) ...N/A

10:00 am – 7:00 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

**Vision Potpourri: Eye Movements, Eyeballs & Colors**

**10:50 am – 12:10 pm**

Grand Peninsula Ballroom A

10:50

HVEI-205

**Object-based and multi-frame motion information predict human eye movement patterns during video viewing,** Zheng Ma<sup>1</sup>, Jiaxin Wu<sup>2</sup>, Sheng-hua Zhong<sup>2</sup>, and Stephen Heinen<sup>1</sup>; <sup>1</sup>Smith-Kettlewell Eye Research Institute (United States) and <sup>2</sup>Shenzhen University (China) ...pg. 1

11:10

HVEI-206

**Discovery of activities via statistical clustering of fixation patterns,** Jeffrey Mulligan, NASA Ames Research Center (United States) ...pg. 6

11:30

HVEI-207

**Investigation of the effect of pupil diameter on visual acuity using a neuro-physiological model of the human eye,** Csilla Timár-Fülep and Gábor Erdei, Budapest University of Technology and Economics (Hungary) ...pg. 13

11:50

HVEI-208

**What is the opposite of blue?: The language of colour wheels (JPI-pending),** Neil Dodgson, Victoria University of Wellington (New Zealand) ...pg. 91

12:30 – 2:00 pm Lunch

**Tuesday Plenary****2:00 – 3:00 pm**

Grand Peninsula Ballroom D

**The Quest for Vision Comfort: Head-Mounted Light Field Displays for Virtual and Augmented Reality**, Hong Hua, professor of optical sciences, University of Arizona (United States)

Hong Hua will discuss the high promises and the tremendous progress made recently toward the development of head-mounted displays (HMD) for both virtual and augmented reality displays, developing HMDs that offer uncompromised optical pathways to both digital and physical worlds without encumbrance and discomfort confronts many grand challenges, both from technological perspectives and human factors. She will particularly focus on the recent progress, challenges and opportunities for developing head-mounted light field displays (LF-HMD), which are capable of rendering true 3D synthetic scenes with proper focus cues to stimulate natural eye accommodation responses and address the well-known vergence-accommodation conflict in conventional stereoscopic displays.

*Dr. Hong Hua is a professor of optical sciences at the University of Arizona. With more than 25 years of experience, Hua is widely recognized through academia and industry as an expert in wearable display technologies and optical imaging and engineering in general. Hua's current research focuses on optical technologies enabling advanced 3D displays, especially head-mounted display technologies for virtual reality and augmented reality applications, and microscopic and endoscopic imaging systems for medicine. Hua has published more than 200 technical papers and filed a total of 23 patent applications in her specialty fields, and delivered numerous keynote addresses and invited talks at major conferences and events worldwide. She is an SPIE Fellow and OSA senior member. She was a recipient of NSF Career Award in 2006 and honored as UA Researchers @ Lead Edge in 2010. Hua and her students shared a total of 8 "Best Paper" awards in various IEEE, SPIE and SID conferences. Hua received her PhD in optical engineering from the Beijing Institute of Technology in China (1999). Prior to joining the UA faculty in 2003, Hua was an assistant professor with the University of Hawaii at Manoa in 2003, was a Beckman Research Fellow at the Beckman Institute of University of Illinois at Urbana-Champaign between 1999 and 2002, and was a post-doc at the University of Central Florida in 1999.*

3:00 – 3:30 pm Coffee Break

**Computational Models for Human Optics****JOINT SESSION**

Session Chair: Jennifer Gille, Oculus VR (United States)

**3:30 – 5:30 pm**

Grand Peninsula Ballroom D

*This session is jointly sponsored by the EI Steering Committee.*

3:30

EISS-704

**Eye model implementation (Invited)**, Andrew Watson, Apple Inc. (United States)

Dr. Andrew Watson is the chief vision scientist at Apple Inc., where he specializes in vision science, psychophysics display human factors, visual human factors, computation modeling of vision, and image and video compression. For thirty-four years prior to joining Apple, Dr. Watson was the senior scientist for vision research at NASA. Watson received his PhD in psychology from the University of Pennsylvania (1977) and followed that with post doc work in vision at the University of Cambridge.

3:50

EISS-700

**Wide field-of-view optical model of the human eye (Invited)**, James Polans, Verily Life Sciences (United States)

*Dr. James Polans is an engineer who works on surgical robotics at Verily Life Sciences in South San Francisco. Polans received his PhD in biomedical engineering from Duke University under the mentorship of Joseph Izatt. His doctoral work explored the design and development of wide field-of-view optical coherence tomography systems for retinal imaging. He also has a MS in electrical engineering from the University of Illinois at Urbana-Champaign.*

4:10

EISS-702

**Evolution of the Arizona Eye Model (Invited)**, Jim Schwiegerling, University of Arizona (United States)

Prof. Jim Schwiegerling is a professor in the College of Optical Sciences at the University of Arizona. His research interests include the design of ophthalmic systems such as corneal topographers, ocular wavefront sensors and retinal imaging systems. In addition to these systems, Schwiegerling has designed a variety of multifocal intraocular and contact lenses and has expertise in diffractive and extended depth of focus systems.

4:30

EISS-705

**Berkeley Eye Model (Invited)**, Brian Barsky, University of California, Berkeley (United States)

Prof. Brian Barsky is professor of computer science and affiliate professor of optometry and vision science at UC Berkeley. He attended McGill University, Montréal, received a DCS in engineering and a BSc in mathematics and computer science. He studied computer graphics and computer science at Cornell University, Ithaca, where he earned an MS. His PhD is in computer science from the University of Utah, Salt Lake City. He is a fellow of the American Academy of Optometry. His research interests include computer aided geometric design and modeling, interactive three-dimensional computer graphics, visualization in scientific computing, computer aided cornea modeling and visualization, medical imaging, and virtual environments for surgical simulation.

4:50

EISS-701

**Modeling retinal image formation for light field displays (Invited),** *Hekun Huang, Mohan Xu, and Hong Hua, University of Arizona (United States)*

Prof. Hong Hua is a professor of optical sciences at the University of Arizona. With more than 25 years of experience, Hua is widely recognized through academia and industry as an expert in wearable display technologies and optical imaging and engineering in general. Hua's current research focuses on optical technologies enabling advanced 3D displays, especially head-mounted display technologies for virtual reality and augmented reality applications, and microscopic and endoscopic imaging systems for medicine. Hua has published more than 200 technical papers and filed a total of 23 patent applications in her specialty fields, and delivered numerous keynote addresses and invited talks at major conferences and events worldwide. She is an SPIE Fellow and OSA senior member. She was a recipient of NSF Career Award in 2006 and honored as UA Researchers @ Lead Edge in 2010. Hua and her students shared a total of 8 "Best Paper" awards in various IEEE, SPIE and SID conferences. Hua received her PhD in optical engineering from the Beijing Institute of Technology in China (1999). Prior to joining the UA faculty in 2003, Hua was an assistant professor with the University of Hawaii at Manoa in 2003, was a Beckman research fellow at the Beckman Institute of University of Illinois at Urbana-Champaign between 1999 and 2002, and was a post-doc at the University of Central Florida in 1999.

5:10

EISS-703

**Ray-tracing 3D spectral scenes through human optics (Invited),** *Trisha Lian, Kevin MacKenzie, and Brian Wandell, Stanford University (United States)*

Trisha Lian is an electrical engineering PhD student at Stanford University. Before Stanford, she received her bachelor's in biomedical engineering from Duke University. She is currently advised by Professor Brian Wandell and works on interdisciplinary topics that involve image systems simulations. These range from novel camera designs to simulations of the human visual system.

**End of Day Discussion**

**5:30 – 6:00 pm**

Grand Peninsula Ballroom A

**Moderators:** Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); and Jeffrey Mulligan, NASA Ames Research Center (United States)

Please join us for a lively discussion of today's presentations. Participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.

5:30 – 7:00 pm Symposium Demonstration Session

HVEI

**Wednesday January 16, 2019**

**Models of Perception**

**9:10 – 10:10 am**

Grand Peninsula Ballroom A

9:10

HVEI-209

**On the role of edge orientation in stereo vision,** *Alfredo Restrepo and Julian Quiroga, Pontificia Universidad Javeriana (Colombia)...pg. 19*

9:30

HVEI-210

**Neurocomputational lightness model explains the perception of real surfaces viewed under Gelb illumination,** *Michael Rudd, University of Washington (United States) ...N/A*

9:50

HVEI-211

**Accelerated cue combination for multi-cue depth perception,** *Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States) ...N/A*

10:00 am – 3:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

**Perceived Image Quality**

**10:50 am – 12:10 pm**

Grand Peninsula Ballroom A

10:50

HVEI-212

**A visual model for predicting chromatic banding artifacts,** *Gyorgy Denes, George Ash, and Rafal Mantiuk, University of Cambridge (United Kingdom) ...pg. 24*

11:10

HVEI-213

**NARVAL: A no-reference video quality tool for real-time communications,** *Augustin Lemesle<sup>1,2</sup>, Alexis Marion<sup>1,3</sup>, Ludovic Roux<sup>1</sup>, and Alexandre Gouaillard<sup>1</sup>; <sup>1</sup>CoSMo Software (Singapore), <sup>2</sup>Centrale Supelec (France), and <sup>3</sup>Centrale Marseille (France) ...pg. 31*

11:30

HVEI-214

**An improved objective metric to predict image quality using deep neural networks,** *Pinar Akyazi and Touradj Ebrahimi, EPFL (Switzerland) ...pg. 37*

11:50

HVEI-215

**Analyze and predict the perceptibility of UHD video contents,** *Steve Göring, Julian Zebelein, Simon Wedel, Dominik Keller, and Alexander Raake, Technische University Ilmenau (Germany) ...pg. 42*

12:30 – 2:00 pm Lunch

**Wednesday Plenary****2:00 – 3:00 pm**

Grand Peninsula Ballroom D

**Light Fields and Light Stages for Photoreal Movies, Games, and Virtual Reality**, Paul Debevec, senior scientist, Google (United States)

Paul Debevec will discuss the technology and production processes behind “Welcome to Light Fields”, the first downloadable virtual reality experience based on light field capture techniques which allow the visual appearance of an explorable volume of space to be recorded and reprojected photorealistically in VR enabling full 6DOF head movement. The lightfields technique differs from conventional approaches such as 3D modelling and photogrammetry. Debevec will discuss the theory and application of the technique. Debevec will also discuss the Light Stage computational illumination and facial scanning systems which use geodesic spheres of inward-pointing LED lights as have been used to create digital actor effects in movies such as Avatar, Benjamin Button, and Gravity, and have recently been used to create photoreal digital actors based on real people in movies such as Furious 7, Blade Runner: 2049, and Ready Player One. The lighting reproduction process of light stages allows omnidirectional lighting environments captured from the real world to be accurately reproduced in a studio, and has recently be extended with multispectral capabilities to enable LED lighting to accurately mimic the color rendition properties of daylight, incandescent, and mixed lighting environments. They have also recently used their full-body light stage in conjunction with natural language processing and automultiscopic video projection to record and project interactive conversations with survivors of the World War II Holocaust.

*Paul Debevec is a senior scientist at Google VR, a member of Google VR’s Daydream team, and adjunct research professor of computer science in the Viterbi School of Engineering at the University of Southern California, working within the Vision and Graphics Laboratory at the USC Institute for Creative Technologies. Debevec’s computer graphics research has been recognized with ACM SIGGRAPH’s first Significant New Researcher Award (2001) for “Creative and Innovative Work in the Field of Image-Based Modeling and Rendering”, a Scientific and Engineering Academy Award (2010) for “the design and engineering of the Light Stage capture devices and the image-based facial rendering system developed for character relighting in motion pictures” with Tim Hawkins, John Monos, and Mark Sagar, and the SMPTE Progress Medal (2017) in recognition of his achievements and ongoing work in pioneering techniques for illuminating computer-generated objects based on measurement of real-world illumination and their effective commercial application in numerous Hollywood films. In 2014, he was profiled in The New Yorker magazine’s “Pixel Perfect: The Scientist Behind the Digital Cloning of Actors” article by Margaret Talbot.*

3:00 – 3:30 pm Coffee Break

**Immersive QoE****JOINT SESSION**

Session Chair: Stuart Perry, University of Technology Sydney (Australia)

**3:30 – 5:10 pm**

Grand Peninsula Ballroom A

*This session is jointly sponsored by: Human Vision and Electronic Imaging 2019, and Image Quality and System Performance XVI.*

3:30

HVEI-216

**Complexity measurement and characterization of 360-degree content**, Francesca De Simone<sup>1</sup>, Jesús Gutiérrez<sup>2</sup>, and Patrick Le Callet<sup>2</sup>; <sup>1</sup>CVVI (the Netherlands) and <sup>2</sup>Université de Nantes (France) ...pg. 48

3:50

HVEI-217

**Using 360 VR video to improve the learning experience in veterinary medicine university degree**, Esther Guervós<sup>1</sup>, Jaime Jesús Ruiz<sup>2</sup>, Pablo Perez<sup>2</sup>, Juan Alberto Muñoz<sup>1</sup>, César Díaz<sup>3</sup>, and Narciso García<sup>3</sup>; <sup>1</sup>Universidad Alfonso X El Sabio, <sup>2</sup>Nokia Bell Labs, and <sup>3</sup>Universidad Politécnica de Madrid (Spain) ...pg. 54

4:10

HVEI-218

**Quality of Experience of visual-haptic interaction in a virtual reality simulator**, Kjell Brunnstrom<sup>1,2</sup>, Elijs Dima<sup>2</sup>, Mattias Andersson<sup>2</sup>, Mårten Sjöström<sup>2</sup>, Tahir Qureshi<sup>3</sup>, and Mathias Johanson<sup>4</sup>; <sup>1</sup>RISE Acreo AB, <sup>2</sup>Mid Sweden University, <sup>3</sup>HIAB AB, and <sup>4</sup>Alkit Communications AB (Sweden) ...pg. 60

4:30

HVEI-219

**Impacts of internal HMD playback processing on subjective quality perception**, Frank Hofmeyer, Stephan Fremerey, Thaden Cohrs, and Alexander Raake, Technische Universität Ilmenau (Germany) ...pg. 68

4:50

IQSP-220

**Are people pixel-peeping 360° videos?**, Stephan Fremerey<sup>1</sup>, Rachel Huang<sup>2</sup>, and Alexander Raake<sup>1</sup>; <sup>1</sup>Technische Universität Ilmenau (Germany) and <sup>2</sup>Huawei Technologies Co., Ltd. (China) ...N/A

**End of Day Discussion****5:10 – 5:30 pm**

Grand Peninsula Ballroom A

**Moderators:** Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); and Jeffrey Mulligan, NASA Ames Research Center (United States)

*Please join us for a lively discussion of today’s presentations. Participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.*

5:30 – 7:00 pm Symposium Interactive Papers (Poster) Session



**HVEI Banquet and Speaker: Dr. Jacqueline C. Snow**

**7:00 – 10:00 pm**

Offsite - details provided on ticket

Join us for a wonderful evening of conversations, a banquet dinner, and an enlightening speaker. This banquet is associated with the Human Vision and Electronic Imaging Conference (HVEI), but everyone interested in research at the intersection of human perception/cognition, imaging technologies, and art is welcome. We'll convene over a family-style meal at a local Lebanese/Middle Eastern restaurant.

HVEI-221

**KEYNOTE: 'WonkaVision' and the need for a paradigm shift in vision research,** Jacqueline Snow, University of Nevada, Reno (United States)

Jacqueline Snow joined the cognitive and brain sciences group in the department of psychology at the University of Nevada, Reno in fall 2013. She completed her graduate training in clinical neuropsychology and cognitive neuroscience at the University of Melbourne, Australia, under the supervision of Professor Jason Mattingley. Snow completed two years of post-doctoral research in the United Kingdom working with Professor Glyn Humphreys of University of Birmingham. During this time, she developed a strong interest in functional magnetic resonance imaging (fMRI). She subsequently moved to Canada where she completed a further five years of post-doctoral research in the laboratories of Professors Jody Culham and Melvyn Goodale at the University of Western Ontario. During this time, she developed a range of special fMRI techniques to study how objects are represented in the human brain. Now an assistant professor at the University of Nevada, Reno, Snow teaches undergraduate psychology students about the theory and practice of science, and graduate student seminars in functional magnetic resonance imaging (fMRI) and clinical neuropsychology. She also heads a research laboratory that consists of four doctoral students and a group of Honors Program students and undergraduate trainees. Together, they examine how humans recognize and make decisions about objects. They are particularly interested in studying the behavioral significance of real-world 3-D objects that one can reach out and interact with, such as tools and snack foods, and how neural structures in the brain code and represent action-relevant information. Other research topics include how object information is integrated across sensory modalities, such as vision and touch. They use a range of methodological approaches, including fMRI, psychophysics and the study of neuropsychological patients with brain damage. The lab is supported by a pilot project grant from the Center of Biomedical Research Excellence (COBRE).



**Thursday January 17, 2019**

**Medical Imaging - Computational**

**JOINT SESSION**

**8:50 – 10:10 am**

Grand Peninsula Ballroom A

This medical imaging session is jointly sponsored by: Computational Imaging XVII, Human Vision and Electronic Imaging 2019, and Imaging and Multimedia Analytics in a Web and Mobile World 2019.

8:50

IMAWM-145

**Smart fetal care,** Jane You<sup>1</sup>, Qin Li<sup>2</sup>, Qiaozhu Chen<sup>3</sup>, Zhenhua Guo<sup>4</sup>, and Hongbo Yang<sup>5</sup>; <sup>1</sup>The Hong Kong Polytechnic University (Hong Kong), <sup>2</sup>Shenzhen Institute of Information Technology (China), <sup>3</sup>Guangzhou Women and Children Medical Center (China), <sup>4</sup>Tsinghua University (China), and <sup>5</sup>Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences (China)...N/A

9:10

COIMG-146

**Self-contained, passive, non-contact, photoplethysmography: Real-time extraction of heart rates from live view within a Canon Powershot,** Henry Dietz, Chadwick Parrish, and Kevin Donohue, University of Kentucky (United States) ...N/A

9:30

COIMG-147

**Edge-preserving total variation regularization for dual-energy CT images,** Sandamali Devadithya and David Castañón, Boston University (United States)...N/A

9:50

COIMG-148

**Fully automated dental panoramic radiograph by using internal mandible curves of dental volumetric CT,** Sanghun Lee<sup>1</sup>, Seongyoun Woo<sup>1</sup>, Joonwoo Lee<sup>2</sup>, Jaejun Seo<sup>2</sup>, and Chulhee Lee<sup>1</sup>; <sup>1</sup>Yonsei University and <sup>2</sup>Dio Implant (Republic of Korea) ...N/A

10:10 – 10:50 am Coffee Break

**Medical Imaging - Perception II**

**JOINT SESSION**

Session Chair: Sos Agaian, CUNY/ The College of Staten Island (United States)

**10:50 am – 12:10 pm**

Grand Peninsula Ballroom A

This medical imaging session is jointly sponsored by: Human Vision and Electronic Imaging 2019, and Image Processing: Algorithms and Systems XVII.

10:50

IPAS-222

**Specular reflection detection algorithm for endoscopic images,** Viacheslav Voronin<sup>1</sup>, Evgeny Semenishchev<sup>1</sup>, and Sos Agaian<sup>2</sup>; <sup>1</sup>Don State Technical University (Russian Federation) and <sup>2</sup>CUNY/ The College of Staten Island (United States) ...N/A

11:10

IPAS-223

**Feedback alpha-rooting algorithm for medical image enhancement,** Viacheslav Voronin<sup>1</sup>, Evgeny Semenishchev<sup>1</sup>, and Sos Agaian<sup>2</sup>; <sup>1</sup>Don State Technical University (Russian Federation) and <sup>2</sup>CUNY/ The College of Staten Island (United States)...N/A

11:30

HVEI-224

**Observer classification images and efficiency in 2D and 3D search tasks (Invited),** Craig Abbey, Miguel Lago, and Miguel Eckstein, University of California, Santa Barbara (United States) ...N/A



11:50 HVEI-226  
**Image recognition depends largely on variety (Invited)**, Tamara Haygood<sup>1</sup>, Christina Thomas<sup>2</sup>, Tara Sagebiel<sup>2</sup>, Diana Palacio<sup>2</sup>, Myrna Godoy<sup>2</sup>, and Karla Evans<sup>1</sup>; <sup>1</sup>University of York (United Kingdom) and <sup>2</sup>UT M.D. Anderson Cancer Center (United States)...N/A

12:10 – 1:30 pm Lunch

---

**The Art of Science: The ‘Magic Eyes’ of Christopher Tyler, Part 1**

Session Chairs: Lora Likova, Smith-Kettlewell Eye Research Institute (United States) and Jeffrey Mulligan, NASA Ames Research Center (United States)

**1:50 – 3:20 pm**  
 Grand Peninsula Ballroom A

While long-standing HVEI committee member, Christopher Tyler, shows no signs of retiring, his attainment of his 75th year, and his seminal contributions ranging from binocular vision and stereopsis through art and consciousness to brain mechanisms and brain imaging, are certainly deserving of recognition. With this Tylerfest session, we are honoring him, followed by a reception/discussion section (with refreshments), with a self-organized dinner outing afterwards. The focus for this session is on Bay Area collaborators and HVEI colleagues of the honoree, with each participant presenting exciting relevant work.

1:50 HVEI-227  
**Vision scientist Chris Tyler - An appreciation of his contributions**, Gerald Westheimer, University of California, Berkeley (United States)...N/A

2:05 HVEI-228  
**Paradoxical, quasi-ideal, spatial summation in the modelfest data**, Stanley Klein, University of California, Berkeley (United States)...N/A

2:20 HVEI-229  
**Modulate this! CWT measures the spatial sensitivity of higher-order quantities**, Jeffrey Mulligan, NASA Ames Research Center (United States) ...N/A

2:35 HVEI-230  
**“Trust the Psychophysics”. Applying Tyler’s precepts to computer vision**, Lauren Barghout, University of California, Berkeley (United States) ...N/A

2:50 HVEI-231  
**The notorious CWT: Adventures with Christopher Tyler**, Mark McCourt, North Dakota State University (United States) ...N/A

3:05 HVEI-232  
**A retrospective of our collaboration**, Leonid Kontsevich, entrepreneur (United States)...N/A

3:20 – 3:45 pm Coffee Break

**Additional Paper**

**Learning face perception without vision: Rebound learning effect and hemispheric differences in congenital vs late-onset blindness**, Lora T. Likova, Ming Mei, Kris N. Mineff and Spero C. Nicholas, The Smith-Kettlewell Eye Research Institute, San Francisco, CA...pg. 79

---

**The Art of Science: The ‘Magic Eyes’ of Christopher Tyler, Part 2**

Session Chairs: Lora Likova, Smith-Kettlewell Eye Research Institute (United States) and Jeffrey Mulligan, NASA Ames Research Center (United States)

**3:50 – 5:35 pm**  
 Grand Peninsula Ballroom A

While long-standing HVEI committee member, Christopher Tyler, shows no signs of retiring, his attainment of his 75th year, and his seminal contributions ranging from binocular vision and stereopsis through art and consciousness to brain mechanisms and brain imaging, are certainly deserving of recognition. With this Tylerfest session, we are honoring him, followed by a reception/discussion section (with refreshments), with a self-organized dinner outing afterwards. The focus for this session is on Bay Area collaborators and HVEI colleagues of the honoree, with each participant presenting exciting relevant work.

3:50 HVEI-233  
**Christopher Tyler through the looking glass...of HVEI**, Bernice Rogowitz, Visual Perspectives and Columbia University (United States) ...N/A

4:05 HVEI-234  
**The role of rigorous computer-aided image analysis in fine art authentication**, David Stork, Rambus Labs (United States) ...N/A

4:20 HVEI-235  
**Forty years of human stereopsis**, Anthony Norcia, Stanford University (United States) ...N/A

4:35 HVEI-236  
**Factors of the visual mind and brain: Normal individual differences in the spatiotemporal sensitivities of adults and infants**, David Peterzell, John F. Kennedy University (United States)...N/A

4:50 HVEI-237  
**Quantum jump into the brain**, Lora Likova, Smith-Kettlewell Eye Research Institute (United States) ...N/A

5:05 HVEI-238  
**Explorations into the light and dark sides of the visual system**, Hoover Chan, University of California, San Francisco (United States) ...N/A

5:20 HVEI-239  
**Light, quanta and vision: A metaphysical evolution**, Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States) ...N/A

---

**HVEI Conference Wrap-up Discussion**

**5:45 – 6:30 pm**  
 Grand Peninsula Ballroom A

**Moderators:** Damon Chandler, Shizuoka University (Japan); Mark McCourt, North Dakota State University (United States); and Jeffrey Mulligan, NASA Ames Research Center (United States)

Please join us for a lively discussion of today’s presentations. Participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.