LONDON imaging MEETING 2022

DISPLAY SCIENCE

JULY 7-8, 2022 LONDON, UK

Sponsored by the Society for Imaging Science and Technology

FINAL PROGRAM AND PROCEEDINGS

The papers in this volume represent the program of the London Imaging Meeting 2022
held July 7-8, 2022 in London, UK.

IS&T: Society for Imaging Science and Technology
7003 Kilworth Lane
Springfield, VA 22151 USA
703/642-9090; 703/642-9094 fax
info@imaging.org
www.imaging.org

ISBN: 978-0-89208-360-2
ISSN Online: 2694-118X
DOI: https://doi.org/10.2352/issn.2694-118X.2021.LIM-A
Contributions are reproduced from copy submitted by authors; no editorial changes have been made.

Funding for this meeting is supported by EPSRC.

WELCOME TO LIM 2022!

Thank you for joining us at the third London Imaging Meeting (LIM), which is organized for the first time as an in-person event at the Institute of Physics (IoP). We hope that you will find the meeting interesting, informative, and fun.

LIM's mandate is to bring together experts from a particular imaging-related topic every year. This year's theme—Display Science—is intended to convene communities working on or with different aspects of electronic display technology, from colour science to holography.

We have an exciting program ahead of us. On the first day, we organized for the first time a summer school, with courses on holography, colour perception, gamut mapping, and high dynamic range. Our plan is to hold a summer school as a recurring part of the program in future LIMs. The following two days are devoted to the technical program and include two keynote talks, an invited lecture, five focal talks, and 12 peer-reviewed papers, presented as a talk or interactive poster. The papers associated with talks are published open access in the IS&T library. This year we also welcomed work-in-progress posters, the abstracts of which are included in this proceedings.

The Technical Program includes state-of-the-art papers in the broad area of display science: perceptual metrics and perceptual optimization, colour, high dynamic range, geometric projection, and a range of display technologies: automotive, holographic, tensor, wide colour gamut, autostereoscopic, and AR displays.

We hope that this year LIM will give you an opportunity to network with like-minded researchers and practitioners, who may work in different disciplines, but on similar problems. We encourage you to interact with presenters during the poster session on Thursday and with the authors of the presented works during the breaks.

Finally, we want to thank all the people who have helped to make this conference possible. These include the Steering Committee, composed of Michael Brown (York University), Susan Farnand (RIT), Sophie Triantaphillidou (University of Westminster), and Javier Vazquez-Corral (Universitat Autònoma de Barcelona/Computer Vision Center), who served this year as both paper and poster chair; all the great colleagues and researchers who volunteered to serve on the Program Committee and/or as reviewers; and the staff at IS&T. I also want to thank the Institute of Physics who are co-hosting the meeting.

I hope you enjoy your time at LIM2022!

—Rafal Mantiuk and Özgür Yöntem, LIM 2022 Conference Chairs, and Graham Finlayson, LIM Series Chair

CONFERENCE SPONSOR

IOP Institute of Physics
Printing and Graphics Science Group

PROGRAM COMMITTEE

General Chair
Rafal Mantiuk*
University of Cambridge (UK)

General Co-chair
Özgur Yöntem*
University of Cambridge (UK)

Papers Chair
Javier Vázquez Corral*
Universitat Autònoma de Barcelona (Spain)

Program Committee
Tara Akhavan*
Irystec (Canada)
Kaan Aksit*
University College London (UK)
Scott Daly*
Dolby (US)
Kurt Debattista*
University of Warwick (UK)
George Alex Koulieris*
University of Durham (UK)
Douglas Lanman*
Meta Reality Labs (US)
Kenichiro Masaoka*
NHK Science & Technology Research Laboratories (Japan)
Michael Murdoch*
Rochester Institute of Technology (US)
Robert Pepperel*
Cardiff Metropolitan University (UK)
Erik Reinhard*
Interdigital (France)
Caterina (Katia) Ripamonti
Cambridge Research Systems Limited (UK)
Erdem Sahin*
Tampere University (Finland)
Andrew B. Watson
Apple (US)
Sophie Wuerger*
University of Liverpool (UK)
Hao Xie*
Rochester Institute of Technology (US)
Onur Kulce
Aselsan (Türkiye)
Lee Skrypchuk
Jaguar Land Rover (UK)
Hyunjin Yoo
Faurecia IRYStec (Canada)

Reviewers
*signifies paper reviewer +
Mojtaba Bemana
Max-Planck-Institut für Informatik (Germany)
Koray Kavaklı
Koç University (Türkiye)

Steering Committee
Michael Brown*
York University (Canada)
Susan Farnand
Rochester Institute of Technology (US)
Graham Finlayson*, series chair
University of East Anglia (UK)
Sophie Triantaphillidou*
University of Westminster (UK)

LIM 2022: SCHEDULE AND TECHNICAL PAPERS

WEDNESDAY 6 JULY 2022

SUMMER SCHOOL PROGRAM

09:00 – 17:30

The Reality of Augmented Reality Display and Optics
Instructor: Karl Guttag, Ravn (US)

Optimizing Holograms for Standard Holographic Displays
Instructor: Kaan Aksit, University College London (UK)

Colour Perception
Instructor: Sophie Wuerger, University of Liverpool (UK)

Gamut Mapping & High Dynamic Range
Instructor: Javier Vazquez Corral, Universitat Autònoma de Barcelona (Spain)

THURSDAY 7 JULY 2022

WELCOME AND OPENING KEYNOTE

Session Chair: Rafal Mantiuk, University of Cambridge (UK)
10:00 – 11:10

Foundations of Perception Engineering, *Steven M. LaValle, Center for Ubiquitous Computing, University of Oulu (Finland)*
Virtual reality (VR) technology has enormous potential to transform society by creating perceptual illusions that can uniquely enhance education, collaborative design, health care, and social interaction, all from a distance. Further benefits include highly immersive computer interfaces, data visualization, and storytelling. We propose in our research that VR and related fields can be reframed as perception engineering, in which the object being engineered is the perceptual illusion itself, and the physical devices that achieve it are auxiliary.

This talk reports on our progress toward developing mathematical foundations that attempt to bring the human-centered sciences of perceptual psychology, neuroscience, and physiology closer to core engineering principles by viewing the design and delivery of illusions as a coupled dynamical system. The system is composed of two interacting entities: The organism and its environment, in which the former may be biological or even an engineered robot. Our vision is that the research community will one day have principled engineering approaches to design, simulation, prediction, and analysis of sustained, targeted perceptual experiences. It is hoped that this direction of research will offer valuable guidance and deeper insights into VR, robotics, and possibly the sciences that study perception.

COFFEE BREAK
11:10 – 11:40

PERCEPTUAL METRICS AND OPTIMIZATION

Session Chair: Piotr Didyk, Università della Svizzera Italiana (Switzerland)
11:40 – 12:50

11:40 **FOCAL TALK Breaking the Limits of Display and Fabrication using Perception-aware Optimizations** *Piotr Didyk, Università della Svizzera Italiana (Switzerland)* **1**
Novel display devices and fabrication techniques enable highly tangible ways of creating, experiencing, and interacting with digital content. The capabilities offered by these new output devices, such as virtual and augmented reality head-mounted displays and new multi-material 3D printers, make them real game-changers in many fields. At the same time, the new possibilities offered by these devices impose many challenges for content creation techniques regarding quality and computational efficiency. This paper discusses the concept of perception-aware optimizations, which incorporate insights from human perception into computational methods to optimize content according to the capabilities of different output devices, e.g., displays, 3D printers, and requirements of the human sensory system. As demonstrated in this paper, the key advantage of such strategies is that tailoring computation to perceptually-relevant aspects of the content often reduces the computational cost related to the content creation or overcomes certain limitations of output devices. Besides discussing the general concept, the paper presents several specific applications where perception-aware optimization has been proven beneficial. The examples include methods for optimizing visual content for novel display devices that focus on perceived quality and new computational fabrication techniques for manufacturing objects that look and feel like real ones.

12:10 **The Effect of Peripheral Contrast Sensitivity Functions on the Performance of the Foveated Wavelet Image Quality Index,** *Aliakabar Bozorgian, Marius Pedersen, and Jean-Baptiste Thomas, Norwegian University of Science and Technology (Norway)* . . . **6**
The Contrast Sensitivity Function (CSF) is an integral part of objective foveated image/video quality assessment metrics. In this paper, we investigate the effect of a new eccentricity-dependent CSF model on the performance of the foveated wavelet image quality index (FWQI). Our results do not show a considerable change in FWQI performance when it is evaluated against the LIVE-FBT-FCVR 2D dataset. We argue that the resolution of the head-mounted display used in the subjective experiment limits our ability to reveal the anticipated effect of the new CSF on FWQI performance.

12:30 **A Comparative Study on the Loss Functions for Image Enhancement Networks,** *Aamir Mustafa[1], Hongjie You[2], and Rafal Mantiuk[1]; [1]University of Cambridge (UK) and [2]Huawei Technologies Duesseldorf (Germany)* **11**
Image enhancement and image retouching processes are often dominated by global (shift-invariant) change of colour and tones. Most "deep learning" based methods proposed for image enhancement are trained to enforce similarity in pixel values and/or in the high-level feature space. We hypothesise that for tasks, such as image enhancement and retouching, which involve a significant shift in colour statistics, training the model to restore the overall colour distribution can be of vital importance. To address this, we study the effect of a Histogram Matching loss function on a state-of-the art colour enhancement network—HDRNet. The

loss enforces similarity of the RGB histograms of the predicted and the target images. By providing detailed qualitative and quantitative comparison of different loss functions on varied datasets, we conclude that enforcing similarity in the colour distribution achieves substantial improvement in performance and can play a significant role while choosing loss functions for image enhancement networks.

LUNCH BREAK
12:50 – 14:00

PERCEPTUAL AND AUTOMOTIVE DISPLAYS

Session Chair:Tara Akhavan, Faurecia IRYStec Inc. (Canada)
14:00 – 15:10

14:00 **FOCAL TALK Perceptual Displays Today & Tomorrow – Evangelism, Productization, and Evaluation,** *Tara Akhavan, Faurecia IRYStec Inc. (Canada)* **16**
Evolution of displays in various industries such as consumer electronics, aerospace, automotive, gaming and digital signage has been a key factor to engage and satisfy consumers. In this talk, I focus on Automotive market as one of the fastest growing display markets, but most discussed matters are applicable to other display verticals. Perceptual and Immersive display user experience are attracting more manufacturers these days to build products matching the end user's expectation and needs while interacting with displays such as: perfect visibility in all conditions, personalization, less eye fatigue, seamless interaction - in one word "mimic real world" experience. Hardware and software advancements are critical but not enough to fulfil today's knowledgeable consumer demands. The User Experience has become one of the highest priorities leading companies to develop dedicated user experience or UX teams to study the need of the end user. Multi-disciplinary teams of experts are built to tackle the UX optimization challenge.

In this talk I share our experience evangelizing the benefits of Perceptual displays, challenges of such evangelism, productization of it and most importantly measuring the performance of perceptual displays in a comparable way to traditional displays.

14:30 **Does External Illumination Affect Color Acceptability Threshold for a Mixed Display Technology Cockpit?,** *Pooshpanjan Roy Biswas[1, 2], Dominique Dumortier[2], Sophie Jost[2],Herve Drezet[1], and Marie-Laure Avenel[1]; [1]Technocentre Renault, and [2]ENTPE, l'école de l'aménagement durable des territoires (France)* **20**
Color Acceptability is a complex phenomenon. Contrary to perceptibility, color acceptability is defined as the level of color difference that is considered under the limit of preferred color reproduction on two media. A system comprising two automotive OLED and LCD displays was used in this experiment. A previous study by the authors had identified this limit for a daylight scenario where an external illumination of 3000 Lux at 5300K was illuminating the surface of the displays. In this study a night-time driving scenario was simulated with a projector light source illuminating the displays at 50 lux and 1318K. Statistical analysis is used to quantify statistically significant differences between various conditions.

14:50 **The Influence of Mismatches between Ambient Illumination and Display Colors on Video Viewers' Subjective Experiences,** *Yunyang Shi and Anya Hurlbert, Newcastle University (UK)* . . **26**
Mismatches between ambient illumination levels and display luminance can cause poor viewing experiences. This paper explores the influence of chromaticity differences between illumination and display on viewers' subjective evaluations of color appearance, preference, and visual comfort when watching videos. Results show that when the chromaticity biases of display and illumination are incongruent, viewers like the video less than when the biases are congruent, and find its colors abnormal.

TWO-MINUTE INTERACTIVE PAPER (POSTER) PREVIEWS FOLLOWED BY POSTER SESSION

Session Chair: Javier Vázquez Corral, Universitat Autònoma de Barcelona (Spain)
15:10 – 16:30

The Art and Science of Displaying Visual Space, *Robert Pepperell and Alistair Burleigh, Fovotec and Cardiff Metropolitan University (UK)* . . . **31**
This paper considers the problem of how to display visual space naturalistically in image media. A long-standing solution is linear perspective projection, which is currently used in imaging technologies from cameras to 3D graphics renderers. Linear perspective has many strengths but also some significant weaknesses and over the centuries alternative techniques have been developed for creating more naturalistic images. Here we discuss the problem, its scientific background, and some of the approaches taken by artists and computer graphics researchers to find solutions. We briefly introduce our own approach, which is a form of nonlinear 3D geometry modelled on the perceptual structure of visual space and designed to work on standard displays. We conclude that perceptually modelled nonlinear approaches can make 3D imaging technology more naturalistic than methods based on linear perspective.

Effect of Bit-depth in Stochastic Gradient Descent Performance for Phase-only Computer-generated Holography Displays, *Andrew C. Kadis, Benjamin Wetherfield, Jinze Sha, Fan Yang, Youchao Wang, and Timothy Wilkinson, University of Cambridge (UK)* **36**
SGD (Stochastic gradient descent) is an emerging technique for achieving high-fidelity projected images in CGH (computer-generated holography) display systems. For real-world applications, the devices to display the corresponding holographic fringes have limited bit-depth depending on the specific display technology employed. SGD performance is adversely affected by this limitation and in this piece of work we quantitatively com-pare the impact on algorithmic performance based on different bit-depths by developing our own algorithm, Q-SGD (Quantised-SGD). The choice of modulation device is a key decision in the design of a given holographic display systems and the research goal here is to better inform the selection and application of individual display technologies.

Work In Progress: **An Exposure Invariant Neural Network for Colour Correction,** *Abdullah Kucuk[1], Graham Finlayson[1], Rafal Mantiuk[2], and Maliha Ashraf[3]; [1]University of East Anglia, [2]University of Cambridge, and [3]University of Liverpool (UK)* **A-1**

DISPLAYS AND HDR

Session Chair: Özgur Yöntem, University of Cambridge (UK)
16:30 – 17:30

INVITED TALK High Dynamic Range Imaging—Technologies, Applications, and Perceptual Considerations, *Timo Kunkel, Dolby Laboratories (US)*

High-Dynamic Range imaging, better known by its acronym "HDR", has established itself as a foundational component when looking at the aspects defining today's image fidelity. HDR technology is widely supported by millions of devices from cameras to post-production tools, deployment systems, and displays and is embraced by content creators and providers. HDR imaging is based on several key concepts that facilitate perceptually meaningful, artistically compelling, and technologically effective delivery of movies, TV shows, and video games that are more immersive and realistic than previously possible. This lecture provides an overview of these concepts enabling today's HDR ecosystem, including perceptual and technological aspects, as well as industry standards, formats, and approaches.

FRIDAY 8 JULY 2022

HOLOGRAPHIC, TENSOR, AND WIDE COLOUR GAMUT DISPLAYS

Session Chairs: Özgur Yöntem, University of Cambridge (UK) and Kaan Aksit, University College London (UK)
09:15 – 10:40

9:15 **Welcome and IS&T Awards**

9:30 **FOCAL TALK Perceptually Guided Computer-generated Holography,** *Kaan Aksit, University College London (UK)* **41**

Inventing immersive displays that can attain realism in visuals is a long standing quest in the optics, graphics and perception fields. As holographic displays can simultaneously address various depth levels, experts from industry and academia often pitch these holographic displays as the next-generation display technology that could lead to such realism in visuals. However, holographic displays demand high computational complexity in image generation pipelines and suffer from visual quality-related issues.

This talk will describe our research efforts to combine visual perception related findings with Computer-Generated Holography (CGH) to achieve realism in visuals and derive CGH pipelines that can run at interactive rates (above 30 Hz). Specifically, I will explain how holographic displays could effectively generate three-dimensional images with good image quality and how these images could be generated to match the needs of human visual perception in resolution and statistics. Furthermore, I will demonstrate our CGH methods running at interactive rates with the help of learning strategies. As a result, we provide a glimpse into a potentialfuture where CGH helps to replace two-dimensional images generated on today's displays with authentic three-dimensional visuals that are perceptually realistic

10:00 **Towards Non-Lambertian Scenes for Tensor Displays,** *Eline Soetens, Armand Losfeld, Daniele Bonatto, Sarah Fachada, Laurie Van Bogaert, Gauthier Lafruit, and Mehrdad Teratani, Université Libre de Bruxelles (Belgium)* **44**

Tensor displays are screens able to render a light field with correct depth perception without wearing glasses. Such devices have already been shown to be able to accurately render a scene composed of Lambertian objects. This paper presents the model and prototyping of a tensor display with three layers, using repurposed computer monitors, and extends the light field factorization method to non-Lambertian objects. Furthermore, we examine the relation and limitations between the depth-of-field and the depth range with Lambertian and non-Lambertian scenes. Non-Lambertian scenes contain out-of-range disparities that can not be properly rendered with the usual optimization method. We propose to artificially compress the disparity range of the scene by using two light fields focused on different depths, effectively solving the problem and allowing to render the scene clearly on both simulated and prototyped tensor display.

10:20 **Probing Perceptual Phenomena for Color Management,** *Trevor Canham and Marcelo Bertalmío, Spanish National Research Council - CSIC (Spain)* **49**

Advancement of color management techniques is required to accommodate for emerging formats and devices. To address this, experiments were conducted by the authors in order to characterize and account for

the effect of metamerism error, chromatic adaptation to the surround, contrast adaptation to display dynamic range, and viewing size dependent effects of retinal signal pooling. These topics were assembled to address perceptual representation inconsistencies which are becoming more common with the popularity of mobile, High Dynamic Range (HDR), and Wide Color Gamut (WCG) displays. In this paper, we briefly summarize the findings of these efforts and compile a series of takeaways which are key to the problem of perceptual color management. Furthermore, we discuss the implications of these take-aways on the advancement of the field.

COFFEE BREAK
10:40 – 11:10

VR/AR AND VOLUMETRIC CONTENT

Session Chair: Aljosa Smolic, Lucerne University of Applied Sciences and Arts (Switzerland) and Trinity College Dublin (Ireland)
11:10 – 12:20

11:10 **FOCAL TALK Volumetric Video Content Creation for Immersive XR Experiencesn,** *Aljosa Smolic[1,3], Konstantinos Amplianitis[2,3], Matthew Moynihan[3], Neill O'Dwyer[3], Jan Ondrej[2,3], Rafael Pagés[2,3] Gareth W. Young[3], and Emin Zerman[3]; [1]Lucerne University of Applied Sciences and Arts (Switzerland), [2]Vologrames Limited (Ireland), and [3]Trinity College Dublin (Ireland)* **54**

Volumetric video (VV) is an emergent digital media that enables novel forms of interaction and immersion within eXtended Reality (XR) applications. VV supports 3D representation of real-world scenes and objects to be visualized from any viewpoint or viewing direction; an interaction paradigm that is commonly seen in computer games. This allows for instance to bring real people into XR. Based on this innovative media format, it is possible to design new forms of immersive and interactive experiences that can be visualized via head-mounted displays (HMDs) in virtual reality (VR) or augmented reality (AR). This paper highlights technology for VV content creation developed by the V-SENSE lab and the startup company Vologrames. It further showcases a variety of creative experiments applying VV for immersive storytelling in XR.

11:40 **A Hybrid Multi-view and Eye-tracked Transparent Autostereoscopic Display for Augmented Reality,** *Charlie Schlick[1,2], Thomas Crespel[1,3], Xavier Granier[3,4], and Patrick Reuter[1,2]; [1]University of Bordeaux, Inria, [2]Bordeaux INP, [3]Institut d'Optique Graduate School, and [4]Archéosciences Bordeaux (France)* **60**

We put forward the use of transparent 3D displays for augmented reality. For a glasses-free experience with autostereoscopy and a large viewing area, we study the use of a recent transparent display with multiple discrete and horizontally adjacent viewing zones. Although promising, this display cannot directly be used for augmented reality due to inconsistencies within and between the discrete viewing zones. In this work, we propose to overcome this limitation by tracking the user's eyes for ensuring continuous transitions, thus making the display feasible for augmented reality. In particular, we compensate the intensity variations, we ensure a consistent horizontal parallax within and between the adjacent viewing zones, and we add vertical parallax. In this way, the display becomes a transparent augmented window that can be used for various augmented reality applications. We present results on a display with 5 viewing zones for three different use cases, evaluate the appropriateness, discuss the limitations, and show future directions.

12:00 **Augmented Reality for Automatically Generating Robust Manufacturing and Maintenance Logs,** *Tim Schoonbeek[1], Pierluigi Frisco[2], Hans Onvlee[2], Peter H.N. de With[1], and Fons van der Sommen[1]; [1]Eindhoven University of Technology and [2]ASML (the Netherlands))* **65**

Logs describing the execution of procedural steps during manufacturing and maintenance tasks are important for quality control and configuration management. Such logs are currently hand-written or typed during a procedure, which requires engineers to frequently step away from their work and results in difficulties for searching and optimizing logs. In this paper, we propose to automatically generate standardized, searchable logs, by visually perceiving and monitoring the progress of the procedure in real-time, and comparing this to the expected procedure. Unlike related work, we propose an approach which does not restrict the engineers to rigid, sequential sequences and instead allows them to execute procedures in a variety of different sequences where possible. The proposed framework is experimentally validated on the task of (dis)assembling a Duplo block model and operates properly when occlusions are absent.

LUNCH BREAK
12:20 – 13:50

COLOUR

Session Chair: Hao Xie, Munsell Color Science Laboratory, Rochester Institute of Technology (US)
13:50 – 15:00

13:50 **FOCAL TALK Point and Line to Surface: The Geometric Elements of Display Color Modeling,** *Hao Xie, Rochester Institute of Technology (US)* **70**

Color appearance is multidimensional, and color space has been a useful geometric representation for display modeling and optimization. However, the three fundamental attributes of color, i.e., brightness, saturation, and hue, have not found their singly corresponding physical correlates. Changes along one physical dimension interfere with other color attributes, which has been a deficiency of the existing color spaces, particularly prevalent for high-dynamic-range and wide-color-gamut displays. This paper describes how we set out to develop independent color scales for each attribute. Based on both psychophysical experiments and computational modeling, the surfaces/lines of equal brightness/saturation, as well as the boundaries between surface versus illumination color modes, have been characterized. Furthermore, the independent relations between those new scales have been quantitatively evaluated. Those results promise a new color representation that is more intuitive and efficient for color controls in displays.

14:20 **Comparison of Regression Methods and Neural Networks for Colour Corrections,** *Abdullah Kucuk and Graham Finlayson, University of East Anglia; Rafal Mantiuk, University of Cambridge; and Maliha Ashraf; University of Liverpool (UK)* **74**

Colour correction is the problem of mapping the sensor responses measured by a camera to the display-encoded RGBs or to a standard colour space such as CIE XYZ. In regression-based colour correction, camera

RAW RGBs are mapped according to a simple formula (e.g. a linear mapping). Regression methods include least squares, polynomial and root-polynomial approaches. More recently, researchers have begun to investigate how neural networks can be used to solve the colour correction problem.

In this paper, we investigate the relative performance of regression versus a neural network approach. While we find that the latter approach performs better than simple least-squares the performance is not as good as that delivered by either root-polynomial or polynomial regression. The root-polynomial approach has the advantage that it is also exposure invariant. In contrast, the Neural Network approach delivers poor colour correction when the exposure changes.

14:40 **Colour Difference Formula for Photopic and Mesopic Vision Incorporating Cone and Rod Responses,** *Maliha Ashraf[1], Rafal Mantiuk[2], Graham Finlayson[3], Abdullah Kucuk[3], and Sophie Wuerger[1]; [1]University of Liverpool, [2]University of Cambridge, and [3]University of East Anglia (UK)* **79**

The standard colour difference formulas, such as CIEDE2000, operate on colours defined by cone-fundamentals, which ignore the influence of rods on colour perception. In this work, we combine the rod intrusion model by Cao et al. with the popular CIEDE2000 colour difference formula and validate the accuracy of the new formula on three contrast sensitivity datasets. When compared with the standard CIEDE2000 formula, the new colour difference formula improves the perceptual uniformity of the space at low luminance levels.

COFFEE BREAK
15:00 – 15:30

CLOSING KEYNOTE AND BEST PAPER PRESENTATION

Session Chair: Özgur Yöntem, University of Cambridge (UK)
15:30 – 16:40

The Display of Perception and the Perception of Displays,
Robert Pepperell, Fovotec Ltd/Cardiff Metropolitan University (UK)

In this talk I consider the problem of how to display visual space naturalistically in image media. We can think of visual space—the 3D space we experience—as a kind of internal display in the head that shows us the world outside. Artists and technologists have long been interested in how to emulate visual space on external displays such as paintings, photographs, and electronic screens in a way that looks as natural as possible. A long-standing solution is linear perspective projection, which is currently used in imaging technologies from cameras to 3D renderers. Linear perspective has many advantages but also some significant limitations. Over the centuries alternative techniques have been developed for creating more naturalistic image media. I discuss the problem of how best to emulate the internal display on an external display, some of the historical solutions to the problem, and introduce a new solution. This is a form of nonlinear 3D rendering modelled on the structure of human visual space. I conclude that nonlinear human-centred approaches to 3D imaging can create more naturalistic image media than methods based on techniques such as linear perspective.

16:30 **Best Paper Award Presentation and Closing Remarks**
Rafal Mantiuk, University of Cambridge, and Graham Finlayson, University of East Anglia (UK)

SATURDAY 9 JULY 2022

POST-LIM 2022 NETWORKING EVENT + DEMOS IN CAMBRIDGE
10:00 – 13:00

IS&T CORPORATE MEMBERS

STRATEGIC PARTNERS

Adobe

Google

Meta

SUSTAINING

hp

Qualcomm

xerox

SUPPORTING

Dolby

RICOH

DONOR

Felix Schoeller Group
Best Performing Papers. Worldwide.

FUJIFILM

Image Engineering

NTNU
Norwegian University of Science and Technology

OmniVision

AUTHOR INDEX

Society for Imaging Science and Technology
7003 Kilworth Lane
Springfield, VA 22151 USA
*1 703 642 9090