ETRA 2022

June 8 - 11, 2022

ACM Symposium on Eye Tracking Research & Applications
Seattle Children's Building Cure
Seattle, Washington, USA

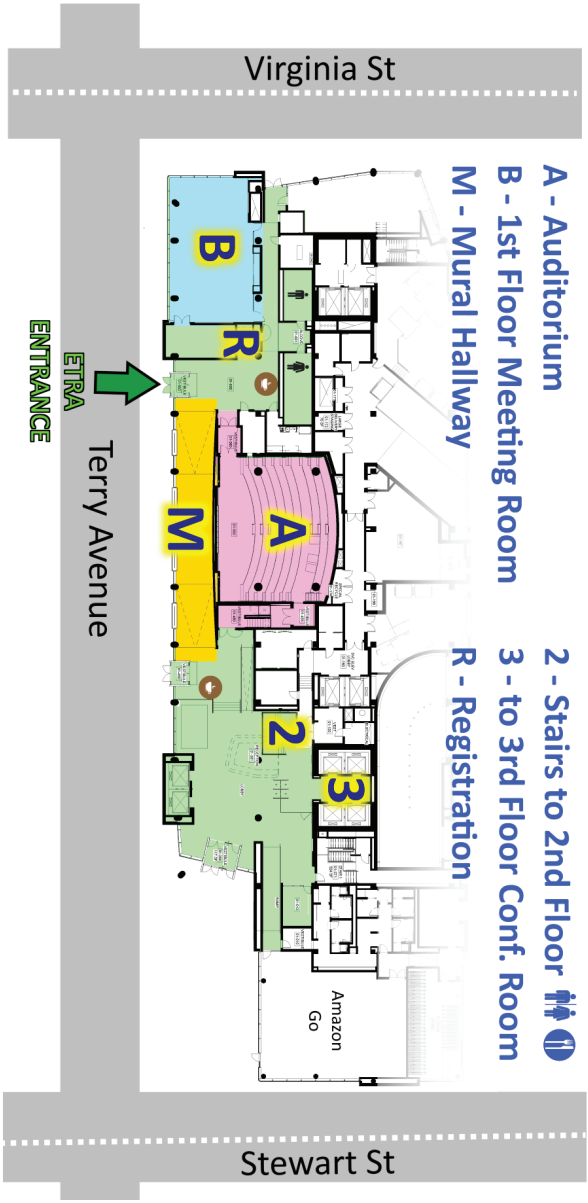
Seattle Children's HOSPITAL • RESEARCH • FOUNDATION

Association for Computing Machinery

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

Map of Venue

Building Cure:
1920 Terry Ave
Seattle, WA
98101



Welcome Note

We would like to give you all a warm welcome to ETRA 2022!

After two years of fully virtual or even cancelled conferences and an ongoing pandemic, we are delighted to host this hybrid event -- the first ETRA to combine in-person and digitized participation. We are grateful to serve as the General Chairs of this pioneering ETRA milestone, which we hope will pave the way towards even more productive and accessible future ETRA meetings. We believe this hybrid approach will have a positive influence on the future of ETRA beyond the current year and will serve as a demonstration of how conference technologies can help connect us to one another beyond borders and beyond local restrictions, allowing us to address the most pressing and fundamental challenges of our field and of our professions -- together.

The in-person component of event this year is located at the Seattle's Children Hospital's Research Institute's Building Cure. Its selection as a site for ETRA reflects the growing multidisciplinary character of our community, the multifaceted impacts and potential of our science, and the growing visibility, prominence, and ubiquity of eye tracking as a technology. Being here in Seattle, we are also surrounded by one of the strongest technology hubs in the world. We are confident that this meeting will not only strengthen interactions within our research community, but also expand it -- fostering knowledge transfer in collaborations with key local tech players that have a presence. We are further joined by representatives from six continents attending both in-person and virtually, making ETRA a truly global event and a unique melting pot of ideas and perspectives.

ETRA 2022 features a rich program including two keynotes by our distinguished speakers Katarzyna Chawarska (Yale School of Medicine) and Sophie Stellmach (Microsoft Mixed Reality), workshops (Chairs: Kamram Binaee, Michael Burch and Peter Kiefer), tutorials (Chairs: Diako Mardanbegi & Roman Bednarik), demos and videos (Chairs: Christopher Clarke, Rakshit Kothari, and Vijay Rajanna), a doctoral symposium (Chairs: Sampath Jayarathna and Arantxa Villanueva), and posters & technical abstract (Chairs: Adham Atyabi & Shahram Eivazi).

For the first time this year, full papers accepted for ETRA are published through Proceedings of the ACM. Reflecting the interdisciplinary nature of the community, authors were given a choice of having their work published in either the Proceedings of the ACM on Computer Graphics and Interactive Techniques (PACMCGIT) or the Proceedings of the ACM on Human-Computer Interaction (PACMHCI). We are very grateful to our full paper chairs (Hans Gellersen, Enkelejda Kasneci, Krzysztof Krejtz and Daniel Weiskopf) for ensuring high quality publications and to the editors and editorial offices of both journals for their support.

We also thank our Short Paper Chairs Tanja Blaschek, Jessica Bradshaw, and Hana Vrzakova for their oversight in enriching our program with various short papers, published together with Technical Abstracts and Workshop Contributions in the ACM ETRA Conference Proceedings.

We also thank our Short Paper Chairs Tanja Blaschek, Jessica Bradshaw, and Hana Vrzakova for their oversight in enriching our program with various short papers, published together with Technical Abstracts and Workshop Contributions in the ACM ETRA Conference Proceedings.

We are very grateful for all the support of our colleagues who contributed as chairs, in addition to those mentioned before: Mohamed Khamis as Technical Program Chair for weaving the tracks together and setting up an amazing program; Brendan M David-John, Thomas Kübler and Xi Wang for their phenomenal job attracting sponsoring; Wolfgang Fuhl and Sanket Kumar Thakur for setting up and maintaining the conference website; Nora Castner and Benedikt Hosp for publicizing the conference and its various events; Kelsey Dommer for organizing student volunteers; Stephen Spencer for all concerns regarding the proceedings; Beibin Li, Jenny Skytta, and Hsiaoying Annie Shic for handling the local side of the conference; Hana Vrzakova and Yao Rong for advising us on accessability, diversity, and inclusion; and last but not least Sarah Fakhoury, Ludwig Sidenmark, and Shreshth Saxena for mastering the challenges of virtualization in a hybrid setting.

Last, but certainly the opposite of least: ETRA is made possible by its amazing contributors – all of you. We want to thank all authors, keynote speakers, attendees, and sponsors for the value they bring to this conference. All of their work has resulted in a comprehensive and high-quality conference program.

It is thus with our greatest enthusiasm and pleasure that we greet you all - face-to-face on the ground or in the cloud - in thisyear's foundational hybrid ETRA event.

Enkelejda Kasneci
ETRA 2022 General Chair
University of Tübingen, Germany

Frederick Shic
ETRA 2022 General Chair
Seattle Children's Institute / University of Washington,USA

Event Notes

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Event Notes

Room Abbreviations

A	**AUDITORIUM**
B	**1st FLOOR MEETING ROOM**
M	**MURAL HALLWAY**
2	**STAIRS to 2nd FLOOR**
3	**3rd FLOOR CONFERENCE ROOM**
R	**REGISTRATION**

Wednesday, June 8, 2022

Schedule

Time	Track I	Track II	Track III	Virtual	Virtual
07:45	Continental Breakfast 2				
08:00 - 10:00	Doctoral Symposium 3 p. 14	Tutorial 1 A p. 18	Tutorial 3 B p. 25	PLEY Workshop p. 29	ETVIS Workshop p. 30
10:00 - 10:30	Coffee Break				
10:30 - 12:30	Doctoral Symposium 3 p. 14	Tutorial 1 A p. 18	Tutorial 3 B p. 25	PLEY Workshop p. 29	ETVIS Workshop p. 30
12:30 - 13:30	Lunch 2				
13:30 - 15:30		Tutorial 2 A p. 20	Tutorial 4 B p. 27		
15:30 - 16:00	Coffee Break				
16:00 - 18:00		Tutorial 2 A p. 20	Tutorial 4 B p. 27		

Time	Track I	Track II	Track III	Virtual
0:00 - 04:00				EDUEye Workshop p. 34
07:45	Continental Breakfast 2			
08:15 - 08:30	Opening Session A			
08:30 - 09:30	Keynote 1 A p. 32			
09:30 - 09:45	Coffee Break			
09:45 - 10:45	Posters 1 M p. 36	PrEthics Workshop B p. 41	VPS Webinar A p. 38	
10:45 - 11:00	Coffee Break			
11:00 - 12:00	Session 1 A p. 39	PrEthics Workshop B p. 41		
12:00 - 13:00	Lunch 2			
13:00 - 15:00	Session 2 A p. 39	PrEthics Workshop B p. 41		
15:00 - 15:30	Coffee Break			
15:30 - 16:30	Session 3 A p. 42			
16:30 - 17:30	Posters 2 M p. 42			
18:00 - 20:30	Reception 2			

Friday, June 10, 2022

Schedule

Time	Track I	Track II	Track III	Virtual
07:45	Continental Breakfast [2]			
08:15 - 08:30	Opening Session [A]			
08:30 - 09:30	Keynote 2 [A] p. 44			
09:30 - 09:45	Coffee Break			
09:45 - 10:45	Session 4 [A] p. 46			
10:45 - 11:00	Coffee Break			
11:00 - 12:00	Posters 3 [M] p. 46			
12:00 - 13:00	Lunch [2]			
13:00 - 15:00	Session 5 [A] p. 48			
15:00 - 15:30	Coffee Break			
15:30 - 16:30	Session 6 [A] p. 49			
16:30 - 17:30	Posters 4 [M] p. 50			
18:00 -20:30	Banquet [B] (18:30 - 19:00 Awards Program)			

Time	Track I	Track II	Track III	Virtual
07:45	Hot Breakfast 2			
08:15 - 08:30	Opening Session A			
08:30 - 09:30	Panel Discussion A p.52			
09:30 - 10:00	Coffee Break			
10:00 - 12:00	Session 7 A p. 59	COGAIN Workshop B p. 61		
12:00 - 13:00	Lunch 2 / Town Hall B (starts 12:10)			
13:00 - 14:00	OpenEDS Workshop A p. 60			
14:00 - 14:30	Coffee Break			
13:30 - 16:00	OpenEDS Workshop A p. 60			
16:00 - 18:00	OpenEDS Workshop A p. 60			

Doctoral Symposium

TRACK I 3

08:15-08:30 Welcome note. Sampath Jayaratna & Arantxa Villanueva (Doctoral Symposium Chairs)

08:30-09:30 Keynote (45 min talk +15 min questions)

Vidhya Navalpakkam,
https://sites.google.com/site/vidhyanavalpakkam/home

Keynote Title: Accelerating eye movement research via ML-based smartphone gaze technology

Eye movements are thought to be a window to the mind, and have been extensively studied across Neuroscience, Psychology and HCI. However, progress in this area has been severely limited as the underlying eye tracking technology relies on specialized hardware that is expensive (upto $30,000) and hard to scale.
In this talk, I will present our recent work from Google, which shows that ML applied to smartphone selfie cameras can enable accurate gaze estimation, comparable to state-of-the-art hardware based mobile eye trackers, at 1/100th the cost and without any additional hardware. Via extensive experiments, we show that our smartphone gaze tech can successfully replicate key findings from prior eye movement research in Neuroscience and Psychology, across a variety of tasks including traditional oculomotor tasks, saliency analyses on natural images and reading comprehension. We also show that smartphone gaze could serve as a potential digital biomarker for detecting mental fatigue.

Doctoral Symposium

Taken together, these results show that ML-based smartphone gaze tech has the potential to unlock advances by scaling fundamental eye movement research, and enabling new applications for improved wellness and accessibility (e.g., gaze-based interaction for patients with ALS, stroke that cannot otherwise interact with devices). I'll end the talk by briefly discussing the importance of privacy and responsible AI principles for gaze research.

Bio: Vidhya Navalpakkam is a Principal research scientist and leads an interdisciplinary team in Google research, focused on modeling human attention and behavior at scale. Her work is at the intersection of Computer Science, Neuroscience and Psychology. Prior to joining the industry, she was in academia, modeling attention mechanisms in the brain during her postdoc at Caltech, and PhD at USC. She has a Bachelors in Computer Science from IIT Kharagpur.

09:30-10:00 Student presentations (10 min talk + 5min questions)

1. Using Eye Tracking Data for Enhancing Adaptive Learning Systems
   Kathrin Kennel (TU Kaiserslautern, Kaiserslautern, Germany)

2. Introducing a Real-Time Advanced Eye Movements Analysis Pipeline
   Gavindya Jayawardena (Old Dominion University, Norfolk, United States)

3. Introducing a Real-Time Advanced Eye Movements Analysis Pipeline
   Gavindya Jayawardena (Old Dominion University, Norfolk, United States)

Doctoral Symposium

TRACK I | 3

10:00 Group photo
10:00-10:30 Coffee break

10:30:11:15 Student presentations (10 min talk + 5min questions)

4. Mobile Device Eye Tracking on Dynamic Visual Contents using Edge Computing and Deep Learning
   Nishan Gunawardenam, Anupama Ginige, Bahman Javadi (School of Computer, Data and Mathematical Sciences, Western Sydney University, Penrith South, NSW, Australia), Dr Gough Yi,i Lui (The MARCS Institute for Brain, Behaviour and Development, WesternSydney University, Penrith South, NSW, Australia)

5. Characterizing the expertise of Aircraft Maintenance Technicians using eye-tracking.
   Florence Paris, Remy Casanova, Daniel Mestre (Aix-Marseille Univ, CNRS, ISM, Marseille, Airbus Helicopters, Marignane, France), Marie-Line Bergeonneau (Airbus Helicopters, Marignane, France)

6. Multi-user Eye-tracking
   Bhanuka Mahanama (Computer Science, Old Dominion University, Norfolk, Virginia, United States)

11:15-12:15 Mentor panel

11:15-12:00 Meetings with mentors

12:00-12:15 Sharing & Comments. Closing remarks

Tutorials

A TRACK II

Tutorial 1

Gaze Analytics Pipeline: Designing, Planning, and Analyzing an Eye-Tracking Study

This tutorial gives a short introduction to experimental design in general and with regard to eye tracking studies in particular. The tutorial presents details of a PsychoPy and Python-based gaze analytics pipeline used to extract raw eye movement data, detect fixations via velocity-based filtering, collate data for statistical evaluation, analyze and visualize results using R. Attendees of the tutorial will have the opportunity to run the scripts of an analysis of gaze data collected from a simple example mock study. The tutorial covers basic eye movement analytics, e.g., fixation count and dwell time within AOIs, as well as advanced analysis using gaze transition entropy. The tutorial welcomes attendees at all levels of experience and expertise, from those just beginning to study eye movements and interested in the basics of experimental design to those well practiced in the profession who might wish to consider adopting use of Python and R scripts, possibly wishing to contribute to, expand on, and improve the pipeline.

Presenters:

Andrew Duchowski
Nina Gehrer
Krzysztof Krejtz

Tutorial 1

TRACK II

Andrew Duchowski

Clemson University, duchowski@clemson.edu

Dr. Duchowski is a professor of Computer Science at Clemson University. He received his baccalaureate (1990) from Simon Fraser University, Canada, and doctorate (1997) from Texas A&M University, TX, USA, both in Computer Science. His research and teaching interests include visual attention and perception, eye track ing, computer vision, and computer graphics. He is a noted research leader in the field of eye tracking, having produced a corpus of papers and a monograph related to eye tracking research, and has delivered courses and seminars on the subject at international conferences. He maintains Clemson's eye tracking laboratory, and teaches a regular course on eye tracking methodology attracting students from a variety of disciplines across campus.

Nina Gehrer

University of Tubingen, nina.gehrer@uni-tuebingen.de

Dr. Gehrer is a clinical psychologist who completed her PhD (summa cum laude, 2020) at the University of Tübingen, Germany. Her main research interest lies in studying biases in (social) information processing using eye tracking and a preferably wide range of analytic methods. As a clinical psychologist, she is particularly interested in possible alterations related to psychological disorders and attentional biases that could play a role in their development and maintenance.

Krzysztof Krejtz

SWPS University of Social Sciences and Humanities, Poland, kkrejtz@swps.edu.pl

Dr. Krejtz is an assistant professor of Psychology at SWPS University of Social Sciences and Humanities in Warsaw, Poland, where he runs the Eye Tracking Research Center. He has delivered several invited talks at various institutions, e.g., Max-Planck Institute (Germany), Bergen University (Norway), and Lincoln University Nebraska (USA). He has extensive experience in social and cognitive psychology research methods and statistics. In his research he focuses on the use of eye tracking methods and developing novel metrics capturing the dynamics of attention and information processing processes, in the context of Human Computer Interaction, multimedia learning, media user experience, and accessibility. He holds a Ph.D. in Psychology from the University of Warsaw, Poland.

Tutorial 2

TRACK II A

Tutorial 2

Spatial Cognition and Artificial Intelligence:
Methods for In-The-Wild Behavioural Research in Visual Perception

The tutorial on "Spatial Cognition and Artficial Intelligence" addresses the confluence of empirically based behavioural research in the cognitive and psychological sciences with computationally driven analytical methods rooted in artficial intelligence and machine learning. This confluence is addressed in the backdrop of human behavioural research concerned with "in-the-wild" naturalistic embodied multimodal interaction. The tutorial presents: 1. an interdisciplinary perspective on conducting evidence-based (possibly large-scale) human behaviour research from the viewpoints of visual perception, environmental psychology, and spatial cognition. 2. artificial intelligence methods for the semantic interpretation of embodied multimodal interaction (e.g., rooted in behavioural data), and the (empirically driven) synthesis of interactive embodied cognitive experiences in real-world settings relevant to both everyday life as well to professional creative-technical spatial thinking. 3. the relevance and impact of research in cognitive human-factors (e.g., in spatial cognition) for the design and implementation of next-generation human-centred AI technologies. Keeping in mind an interdisciplinary audience, the focus of the tutorial is to provide a high-level demonstration of the potential of general AI-based computational methods and tools that can be used for multimodal human behavioral studies concerned with visuospatial, visuo-locomotive, and visuo-auditory cognition in everyday and specialized visu

ospatial problem solving. Presented methods are rooted in foundational research in artificial intelligence, spatial cognition and computation, spatial informatics, human- computer interaction, and design science. We highlight practical examples involving the analysis and synthesis of human cognitive experiences in the context of application areas such as (evidence-based) architecture and built environment design, narrative media design, product design, and visual sensemaking in autonomous cognitive systems (e.g., social robotics, autonomous vehicles).

Presenters:

Mehul Bhatt
Jakob Suchan
Vasiliki Kondyli
Vipul Nair

Tutorial 2

TRACK II B

Mehul Bhatt

Örebro University, Sweden

Mehul Bhatt is Professor within the School of Science and Technology at Orebro University (Sweden), and a Guest Professor at the University of Skövde (Sweden). His basic research focusses on formal, cognitive, and computational foundations for AI technologies with a principal emphasis on knowledge representation, semantics, integration of commonsense reasoning & learning, explainability, and spatial representation and reasoning. Mehul Bhatt steers CoDesign Lab (www.codesign-lab.org), an initiative aimed at addressing the confluence of Cognition, Artificial Intelligence, Interaction, and Design Science for the development of human-centred cognitive assistive technologies and interaction systems. Since 2014, he directs the research and consulting group DesignSpace (www.design-space.org) and pursues ongoing research in Cognitive Vision (www.codesign-lab.org/cognitive-vision) and Spatial Reasoning (www.spatial-reasoning.com). Mehul Bhatt obtained a bachelors in economics (India), masters in information technology (Australia), and a PhD in computer science (Australia). He has been a recipient of an Alexander von Humboldt Fellowship, a German Academic Exchange Service award (DAAD), and an Australian Post-graduate Award (APA). He was the University of Bremen nominee for the German Research Foundation (DFG) Award: Heinz Maier-Leibnitz-Preis 2014. Prior to moving to Sweden, Mehul Bhatt was Professor at the University of Bremen (Germany). Further details are available via: www.mehulbhatt.org, and a detailed research statement at: htttp://codesign-lab.org/hcc/agenda.html

Jakob Suchan

German Aerospace Center, Germany

Jakob Suchan is researcher based at the German Aerospace Center (DLR); previously, Jakob was based as doctoral researcher at the Human-Centred Cognitive Assistance Lab at the Faculty of Mathematics and Informatics, University of Bremen, Germany. His research is in the area of Cognitive Vision (https://codesign-lab.org/cognitive-vision/), particularly focussing on the integration of Vision and AI (specifically, KR) from the viewpoint of computational cognitive systems where integrated (embodied) perception and interaction are involved.

Vasiliki Kondyli

Örebro University, Sweden

Vasiliki Kondyli is a Ph.D. researcher at the Center for Applied Autonomous Sensor Systems (AASS) as part of the Newbreed-Successful Ageing interdisciplinary program by Marie Skłodowska Curie Action and Örebro University (Sweden). Her research work is at the interface of visual perception, spatial cognition, and environmental psychology. Her Ph.D. project focusses on multimodal human behavioural studies with an emphasis on the vi-

Tutorial 2

TRACK II B

suo-locomotive perception of humans, aiming to establish behavioural precedents that can be embedded within assistive technologies in a range of applications such as autonomous driving, HRI design, user experience design, etc. Within architecture design, her research interest involve human perception and cognition in the built environment, inclusive design principles, as well as the development of a cognitive technological framework for people-centred parametric design. Vasiliki obtained a diploma in Architecture Engraining from the University of Patras (Greece) and also participates in the DesignSpace Group (www.design-space.org).

Vipul Nair

University of Skövde, Sweden

Vipul Nair is a Ph.D. researcher at the Interaction Lab at the School of Informatics, University of Skövde (Sweden). His research focusses on multimodal event perception, visual perception, and biological motion in naturalistic settings in diverse contexts such as moving images, and embodied activities as relevant to human-robot interaction. Previously, Vipul studied cognitive science at IIT Gandhinagar (India), and Computer Science at NIT Silchar (India).

TRACK III B

Tutorial 3

Using Intelligible Models to Analyze and interpret the Pupil Dilation Time Course

Cognitive scientists often link changes in pupil size to cognitive processing shifts. This tutorial will introduce a new method to discover the triggers that elicited the pupil response. We have made our new method available in the papss R package. Because the method involves using additive mixed models (GAMMs), the tutorial consists of two parts: In the first part of the interactive tutorial, we show how the mgcv R package (see Wood, 2017) can be used to fit intelligible GAMMs (see van Rij et al., 2019) that capture how pupil size changes over time and how it depends on predictors (e.g., aspects of experimental stimuli, gaze location). This permits for model-based aggregation of the pupil dilation time course: instead of calculating the average pupil dilation time course over multiple trials, GAMMs can be used to obtain estimated changes in pupil dilation over time for any combination of continuous and categorical predictors. In the second part, we explain how GAMMs can be used to find out which events triggered the changes in pupil size. We show how our method – in combination with the model-based aggregates discussed in the first part – provides more information about changes in processing demand than earlier deconvolution attempts (e.g., Wierda et al., 2012) and allows to estimate the effect of experimental manipulations on processing demand. Together, this two-part tutorial covers a complete analysis of the pupillometry time course. Demo scripts will be made available to all participants.

Presenters:
Joshua Krause, Dr. Simone Sprenger, Dr. Jacolien van Rij

Tutorial 3

Using Intelligible Models to Analyze and interpret the Pupil Dilation Time Course

TRACK III B

Joshua Krause

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TRACK III B

Tutorial 4

Overview and Analysis of Eye Movement Detection Evaluation Methods

Dozens of eye movement detectors exist to date, though the respectively retorted evaluation results are not always directly comparable and easily interpretable. Part of the blame lies with the potentially confusing multitude of employed evaluation methods. The number of reported metrics alone is impressive, while the details of their application and implementation lead to fundamental dissimilarities even when the same metric is used on paper. This second iteration of the tutorial, which, in addition to an extensive overview of existing evaluation approaches, includes new empirical analysis of different aspects of the event-level evaluation process, as well as a demonstration of a software package enabling it.

Presenters:

Mikhail Startsev
Raimondas Zemblys

Tutorial 4

Overview and Analysis of Eye Movement Detection Evaluation Methods

TRACK III B

Mikhail Startsev

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Dr. Mikhail Startsev has completed his PhD in 2020 at the Technical University of Munich (TUM), Germany after receiving a Diplom degree in Computational Mathematics and Informatics from the Lomonosov Moscow State University (LMSU), Russia, in 2015. During his PhD, Mikhail's research centred around the human visual system, with a particular emphasis on eye movements and saliency modelling. He is currently working as an AI developer for medical imaging systems at a Brainlab AG subsidiary while continuing independent research in the eye movement field.

Raimondas Zemblys

raimondas.zemblys@gmail.com

Dr. Raimondas Zemblys received his PhD from Kaunas University of Technology, Lithuania in 2013 and worked as a postdoc researcher at Lund University, Sweden in 2013-2015 and Michigan State University, US in 2017-2018. He is currently a Senior Research Scientist at Smart Eye AB, Sweden while also continuing independent research in the field of eye movements. His main research interests are eye-tracking methodology and data quality, event detection and applications of deep learning for behavioral data analysis.

Workshop - PLEY

Virtual

PLEY - Eye Tracking in Games and Play Workshop in Programming

Among the many application areas of eye tracking, games have become an increasingly popular domain for leveraging this technology to 1) build new and novel experiences for players and 2) to gain a better understanding of players' cognitive processes during gameplay. Games, however, pose unique challenges for using gaze technology due to their complex, dynamic, and sometimes very fast-paced environments.

This workshop specifically targets the unique challenges of using, gathering, and analyzing eye tracking data faced in gaming. The workshop is of particular interest for researchers in game design, human-computer interaction, eye tracking, data science, and visualization. We want to establish a shared venue for this diverse community to enhance the current state-of-the-art and help develop the community further.

https://tinyurl.com/pleyws

Organizers:
Günter Wallner, Michael Burch, Bastian Pfleging,
Regina Bernhaupt, Michael Lankes

Workshop - ETVIS

Virtual

ETVIS - Workshop on Eye Tracking and Visualization

Broadly, this workshop considers the intersection of eye tracking research with visualization, whether the contributions relate to eye tracking studies of visualizations, or vice versa, visualization techniques for eye tracking. Technological advances in computer vision algorithms and sensor hardware have greatly reduced the implementational and financial costs of eye tracking. Thus, it is unsurprising to witness a significant increase in its use as a research tool in fields beyond the traditional domains of biological vision, psychology, and neuroscience, in particular, in visualization and human-computer interaction research. One of the key challenges lies in the analysis, interaction, and visualization of complex spatio-temporal datasets of gaze behavior, which is further complicated by complementary datasets such as semantic labels, user interactions and/or accompanying physiological sensor recordings. Ultimately, the research objective is to allow eye tracking data to be effectively interpreted in terms of the observer's decision-making and cognitive processes. To achieve this, it is necessary to draw upon our current understanding of gaze-behavior across various and related fields, from vision and cognition to visualization. All together eye tracking is an important field to be understood, be it in the sense of data analysis and visualization, interaction, or user-based evaluation of visualization.

https://tinyurl.com/etvis2022

Organizers:
Zoya Bylinskii, Benedict Fehringer, Kuno Kurzhals

Event Notes

Keynote 1

TRACK I TRACK II TRACK III A

Sophie Stellmach

Interaction Design & Science Lead, Microsoft Mixed Reality

Bio: Dr. Sophie Stellmach is an Interaction Design & Science Lead at Microsoft's Mixed Reality team where she explores entirely new ways to engage with and blend our virtual and physical realities in products such as Microsoft HoloLens. Having been an avid eye tracking researcher for over a decade, she was heavily involved in the development of gaze-based interaction techniques for HoloLens 2. With her PhD from the Technical University of Dresden, Germany, and a strong research background in Human-Computer Interaction, she bridges the gap between Software and Hardware Development to innovative User Interface, Human-centered and Multimodal Interaction Design.

Topic: More than a look: Multimodal Gaze-supported Interaction in Mixed Reality

Sophie Stellmach

Abstract: Mixed Reality glasses allow us to blend our virtual and physical realities and enable entirely new ways to engage not just with digital content, but with each other and our environments. The ability to augment human capabilities using a combination of various input modalities is an exciting yet also challenging area of exploration. How to move from an initial interaction exploration to something that fluently integrates with a rich holistic interaction model – one that feels satisfying to diverse users with unique needs and goals across various applications? In my talk, I will take you on a journey – a personal one. It will take you from my early fascination for eye tracking more than 15 years ago, the immense opportunity to combine eye targeting with diverse input modalities for a flexible and empowering interaction model to eventually shipping multimodal gaze-supported interactions for Microsoft's HoloLens 2. However, it is only the beginning of a long journey – an exciting one!

Workshop - EduEye

Virtual

EduEye: Workshop on Eye Tracking in Learning and Education

With its duality of being an active input technology and a passive sensor, eye tracking provides unique opportunities for education and learning. Actively, the technology can serve as an input strategy for interactive learning environments. Passively, it can be applied to observe learning states and gain a better understanding of learners' cognitive processes. Given its scalability, it can, or instance, help to improve collaborative learning, e.g., by establishing connections between learners during online lectures. Teachers or lecturers can also gain feedback about their learning material by analyzing students' eye gazes. However, many open challenges remain for the application of mobile eye tracking in learning and educational scenarios, including technical constraints and privacy concerns. This workshop specifically targets researchers and practitioners who are interested in using eye tracking in education and learning. This includes researchers from all areas of psychology, human-computer interaction, computer science, eye tracking methodology, and other related fields.

Topic: Domain-Specific Learning

- Scanpath Comparison using ScanGraph for Education and Learning Purposes
- Predicting Decision-Making during an Intelligence Test via Semantic Scanpath Comparisons
- Gaze Control and Visual Attention in Police Firearms Training - A Study in Progress
- Tracking a vocal group: A pilot study on multiple and simultaneous Eye-Tracking

https://tinyurl.com/edueye2022

Topic: Higher Education

- Mind Wandering Trait-level Tendencies During Lecture Viewing: A Pilot Study
- Can Eye Movement Synchronicity Predict Test Performance With Unreliably-Sampled Data in an Online Learning Context?
- Visualizing Instructor's Gaze Information for Online Video-based Learning: Preliminary Study
- Examining readers' eye movements, on-task attention, metacomprehension, and text comprehension between reading easy and difficult texts in print and on screen

Topic: Language Learning and Reading Comprehension

- Breaking the Ice between Idioms Processing and Population with Deafness.
- Can teachers use gaze displays to provide adaptive reading comprehension instruction?
- Instant messaging multitasking while reading: a pilot eye-tracking study Analogical Transfer Despite Misleading Information in Toddlerhood and Beyond: An Eye Tracking Study

Topic: Teachers

- The Benefits and Drawbacks of Eye Tracking for Improving Educational Systems
- (Eye) Tracking professional learning in language teacher education (work in progress)
- Eye tracking and think-aloud – promising methods for analyzing mathematics teachers' assessment competencies?
- Quality of teacher-student relationship in association with teachers' visual focus of attention across Grade 1 using mobile eye-tracking

Organizers: Teresa Hirzle, Marian Sauter, Ellen Kok, Michael Burch

Posters I

TRACK I M

1. LSTMs can distinguish dental expert saccade behavior with high "plaque-urracy"
   Nora Castner, Jonas Frankemölle, Enkelejda Kasneci, Constanze Keutel, Fabian Hüttig

2. "The more you explore, the less you remember": unraveling the effects of scene clutter on learning and memory for targets
   Christos Gkoumas, Andria Shimi

3. A holographic single-pixel stereo camera eye-tracking sensor for calibration-free eye-tracking in retinal projection augmented reality glasses
   Johannes Meyer, Tobias Wilm, Thomas Schlebusch, Reinhold Fiess, Wilhelm Stork, Enkelejda Kasneci

4. Classification of flight phases based on pilots' visual scanning strategies
   Vsevolod Peysakhovich, Wietse D. Ledegang, Mark M.J. Houben, Eric L. Groen

5. The trans-saccadic extrafoveal preview effect is modulated by object visibility
   Xiaoyi Liu, Christoph Huber-Huber, David Melcher

6. Using Eye Tracking Data for Enhancing Adaptive Learning Systems
   Kathrin Kennel

7. Can Gaze Inform Egocentric Action Recognition?
   Zehua Zhang, David Crandall, Michael J. Proulx, Sachin S. Talathi, Abhishek Sharma

8. HPCGen: Hierarchical K-Means Clustering and Level Based Principal Components for Scan Path Genaration
   Wolfgang Fuhl, Enkelejda Kasneci

9. For Your Eyes Only: Privacy-preserving eye-tracking datasets
   Brendan David-John, Kevin Butler, Eakta Jain

10. On the Use of Distribution-based Metrics for the Evaluation of Drivers' Fixation Maps Against Spatial Baselines
    Jaime Maldonado, Lino Antoni Giefer

11. FreezEye Tracker - fast and precise retinal eye-tracking system for psycho-physical experiments
    Szymon Tamborski, Michal Meina, Joanna Gorgol, Maciej M. Bartuzel, Krystian Wrobel, Anna Szkulmowska, Maciej Szkulmowski

Webinar VPS

Track III A

View point system: Robust eye tracking for the real world Interaction in Mixed Reality

In recent years, the need for robust, accurate and reasonably priced eye tracking solutions has increased tremendously. With new applications in areas such as security and military, transportation and healthcare, eye tracking ceased to be exclusive to research laboratories and hit the streets. With the outbreak of the COVID-19 pandemic and the restrictions on traveling, the use of mobile eye tracking glasses and practical solutions for remote support and distance trainings continued to increase. Although robustness, accuracy, precision, sufficient temporal resolution and reliability are always required for eye tracking, real-world applications are more demanding and require the handling of changing lighting conditions and slippage due to rapid head movements, for example. At the same time, the simplest and most practical handling is required by the users.

These are the topics that will be addressed in this webinar in relation to the solutions from Viewpointsystem:

- Eye tracking algorithms: dark pupil detection with robust algorithmic implementation, autocalibration, slippage compensation
- Ergonomic and robust mechanical design, certified safety glasses
- Streaming functionality: remote support and real time guidance
- Usability: suitable for industrial and harsh environments, easy to use
- AR/VR glasses: Integrating eye tracking via pre-configured modules

Organizers: Alejandro H. Gloriani, Roman Schmied

Session 1 & 2

A TRACK I

Session 1: AR / VR / MR / XR

1. Exploring Gaze for Assisting Freehand Selection-based Text Entry in AR
   Mathias N. Lystbæk, Ken Pfeuffer, Jens Emil Sloth Grønbæk, Hans Gellersen

   Long paper (20 + 5 minutes)

2. Eye Tracking-Based Stress Classification of Athletes in Virtual Reality
   Maike Stoeve, Markus Wirth, Rosanna Farlock, André Antunovic, Victoria Mueller, Bjoern M. Eskofier

   Long paper (20 + 5 minutes)

Session 2: AR / VR / MR / XR & Improving Gaze Estimation

1. Pupillary Light Reflex Correction for Robust Pupillometry in Virtual Reality
   Marie Eckert, Thomas Robotham, Emanuël A. P. Habets, Olli S. Rummukainen

   Long paper (20 + 5 minutes)

2. Real-time head-based deep-learning model for gaze probability regions in collaborative VR
   Maike Stoeve, Markus Wirth, Rosanna Farlock, André Antunovic, Victoria Mueller, Bjoern M. Eskofier

   Short paper (10 + 5 minutes)

Session 2

TRACK I A

3. A Holographic Single-Pixel Stereo Camera Sensor for Calibration-free Eye-Tracking in Retinal Projection Augmented Reality Glasses
   Johannes Meyer, Tobias Wilm, Thomas Schlebusch, Reinhold Fiess, Wilhelm Stork, Enkelejda Kasneci

   Short paper (10 + 5 minutes)

2. Model-based Gaze Estimation with Transparent Markers on Large Screens
   Koki Koshikawa, Takashi Nagamatsu, Kentaro Takemura

   Long paper (20 + 5 minutes)

3. HPCGen: Hierarchical K-Means Clustering and Level Based Principal Components for Scan Path Genaration
   Wolfgang Fuhl, Enkelejda Kasneci

   Short paper (10 + 5 minutes)

Workshop - PrEthics

B TRACK II

09:45 - 10:00	Welcome
10:00 - 10:30	Expert presentations: Introduction to privacy, ethical, and legal aspects of pervasive eye tracking (10 min each)
10:30 - 11:10	Breakout groups 1: Selection of eye tracking applications and use cases
11:10 - 11:45	Expert presentations: Key privacy, ethical, and legal dimensions
11:45 - 12:15	Coffee break / Lunch
12:15 - 12:55	Breakout groups 2: Discussion of dimensions for selected applications
12:55 - 13:15	Expert presentations: Possible solutions to privacy, ethical, and legal issues
13:15 - 13:55	Breakout groups 3: Development of solutions for selected applications
13:55 - 14:15	Summary discussion and closing

Sessions 3 / Posters 2

TRACK I A / M

Session 3: Improving Gaze Estimation 2

1. Rethinking Model-Based Gaze Estimation
   Harsimran Kaur, Swati Jindal, Roberto Manduchiv
   Long paper (20 + 5 minutes)

2. EllSeg-Gen, towards Domain Generalization for Head-Mounted Eyetracking
   Rakshit Sunil Kothari, Reynold Bailey, Christopher Kanan, Jeff B Pelz, Gabriel Jacob Diaz
   Long paper (20 + 5 minutes)

Posters 2

1. Consider the Head Movements! Saccadic Computation in Mobile Eye-Tracking
   Negar Alinaghi, Ioannis Giannopoulos

2. Mobile Device Eye Tracking on Dynamic Visual Contents using Edge Computing and Deep Learning
   Nishan Gunawardena, Jeewani Anupama Ginige, Bahman Javadi, Gough Lui

3. Fairness in Oculomotoric Biometric Identification
   Paul Prasse, David R. Reich, Silvia Makowski, Lena A. Jäger, Tobias Scheffer

4. Towards efficient calibration for webcam eye-tracking in online experiments
   Shreshth Saxena, Elke B. Lange, Lauren K. Fink

5. A gaze-based study design to explore how competency evolves during a photo manipulation task
   Nora Castner, Béla Umlauf, Ard Kastrati, Martyna Plomecka, William Schaefer, Enkelejda Kasneci, Zoya Bylinskii

6. Gaze Estimation with Imperceptible Marker Displayed Dynamically using Polarization
   Yutaro Inoue, Koki Koshikawa, Kentaro Takemura

7. Visualising Spatio-Temporal Gaze Characteristics for Exploratory Data Analysis in Clinical Fetal Ultrasound Scans
   Clare Teng, Harshita Sharma, Lior Drukker, Aris T. Papageorghiou, Alison J. Noble

8. Multi-user Eye-tracking

9. Calibration Error Prediction: Ensuring High-Quality Mobile Eye-Tracking
   Beibin Li, James C. Snider, Quan Wang, Sachin Mehta, Claire Foster, Erin Barney, Linda Shapiro, Pamela Ventola, Frederick Shic

10. Introducing a Real-Time Advanced Eye Movements Analysis Pipeline
    Gavindya Jayawardena

11. Tracker/Camera Calibration for Accurate Automatic Gaze Annotation of Images and Videos
    Swati Jindal, Harsimran Kaur, Roberto Manduchi

12. VR Cognitive Load Dashboard for Flight Simulator
    Somnath Arjun, Archana Hebbar, Sanjana Vinod, Pradipta Biswas

Keynote 2

TRACK I TRACK II TRACK III A

Katarzyna Chawarska

Emily Fraser Beede Professor of Child Psychiatry
Director, Social and Affective Neuroscience of Autism Program, Child Study Center
Director, Yale Toddler Developmental Disabilities Clinic

Bio: Dr. Chawarska is the E. Frazer Beede Professor of Child Study, Pediatrics, and Statistics and Data Science at Yale School of Medicine and the Director of the Social and Affective Neuroscience of Autism (SANA) Program at the Child Study Center and the director of the Yale Autism Center of Excellence. She has been the principal investigator on numerous NIH-funded studies of infants at risk for ASD, as well as toddlers and preschoolers with neurodevelopmental disorders.Her research has been focused on improving the understanding of processes that give rise to core and comorbid features of autism. Much of this work has been implemented using eye-tracking methodology. Work from her lab identified some of the earliest attentional markers of autism in infancy, demonstrated continuity of the attentional vulnerabilities from prodromal into early syndromic stages of the disorder, and identified specific conditions under which attentional patterns of young children with autism diverge from those observed in control groups.

Topic: Early Attentional Biomarkers In Autism

Katarzyna Chawarska

Abstract: This keynote focuses on the search for early attentional biomarkers in autism. Limited social attention constitutes one of the core features of autism that is apparent even before the frank behavioral symptoms of autism become evident. This talk will provide first a brief outline of autism, with a particular focus on symptoms of the disorder in infants and toddlers. Next, we will embark on a brief survey of attentional features that characterize children with autism during prodromal and early syndromal stages of the disorder. We will then discuss studies on processes that may contribute to attentional challenges observed in autism, including reflexive orienting, selective attention, and value learning, as assessed through psychophysical, behavioral, and both traditional and gaze-contingent eye tracking. Finally, we discuss the issue of the ecological validity of screen-based eye-tracking studies and work that link between atypical attention in autism and brain development in infancy.

Session 4 / Posters 3

TRACK I A / M

Session 4: Gaze Interaction, Errors and Visualization

1. Gaze as an Indicator of Input Recognition Errors
   Candace E Peacock, Ben Lafreniere, Ting Zhang, Stephanie Santosa, Hrvoje Benko, Tanya R. Jonker

   Long paper (20 + 5 minutes)

2. A Spiral into the Mind – Gaze Spiral Visualization for Mobile Eye Tracking
   Maurice Koch, Daniel Weiskopf, Kuno Kurzhals

   Long paper (20 + 5 minutes)

Posters 3

1. Inferring Native and Non-Native Human Reading Comprehension and Subjective Text Difficulty from Scanpaths in Reading
   David R. Reich, Paul Prasse, Chiara Tschirner, Patrick Haller, Frank Goldhammer, Lena A. Jäger

2. Characterizing the expertise of Aircraft Maintenance Technicians using eye-tracking.
   Florence Paris, Remy Casanova, Marie-Line Bergeonneau, Daniel Mestre

3. Comparison of Webcam and Remote Eye Tracking
   Katarzyna Wisiecka, Krzysztof Krejtz, Izabela Krejtz, Damian Sromek, Adam Cellary, Beata Lewandowska, Andrew T. Duchowski

4. Eye Movements in Extended Tasks: Analyses of Ambient/Focal Attention with Coefficient K
   Yuxuan Guo, Sebastian Pannasch, Jens R. Helmert

5. Skill Characterisation of Sonographer Gaze Patterns during Second Trimester Clinical Fetal Ultrasounds using Time Curves
   Clare Teng, Lok Hin Lee, Jayne Lander, Lior Drukker, Aris T. Papageorghiou, Alison J. Noble

6. Distance between gaze and laser pointer predicts performance in video-based e-learning independent of the presence of an on-screen instructor
   Marian Sauter, Tobias Wagner, Anke Huckauf

7. The Benefits of Depth Information for Head-Mounted Gaze Estimation
   Stefan Stojanov, Sachin Talathi, Abhishek Sharma

8. Regressive Saccadic Eye Movements on Fake News
   Efe Bozkir, Gjergji Kasneci, Sonja Utz, Enkelejda Kasneci

9. An Assessment of the Eye Tracking Signal Quality Captured in the HoloLens 2
   Samantha Aziz, Oleg Komogortsev

10. Saliency Methods Analysis for Paintings
    Kristina Miklosova, Zuzana Cernekova, Elena Sikudova

Session 5

TRACK I A

Session 5: Building better eye trackers & Understanding People through their gaze

1. Feasibility of Longitudinal Eye-Gaze Tracking in the Workplace
   Stephen Hutt, Angela E.B. Stewart, Julie Gregg, Stephen M Mattingly, SidneyD'Mello
   Long paper (20 + 5 minutes)

2. Measuring Cognitive Effort with Pupillary Activity and Fixational Eye Movements When Reading: Longitudinal Comparison of Children With and Without Primary Music Education
   Agata Cybulska, Krzysztof Krejtz, Andrew T. Duchowski, Izabela Krejtz
   Short paper (10 + 5 minutes)

3. Using a test battery to compare three remote, video-based eye-trackers
   Lisa Spitzer, Stefanie Mueller
   Short paper (10 + 5 minutes)

4. Fairness in Oculomotoric Biometric Identification
   Paul Prasse, David R. Reich, Silvia Makowski, Lena A. Jäger, Tobias Scheffer
   Short paper (10 + 5 minutes)

Session 6

A TRACK I

Session 6: Gaze and AR

1. A Highly Integrated Ambient Light Robust Eye-Tracking Sensor for Retinal Projection AR Glasses Based on Laser Feedback Interferometry
   Johannes Meyer, Thomas Schlebusch, Enkelejda Kasneci
   Long paper (20 + 5 minutes)

2. Gaze-Hand Alignment: Combining Eye Gaze and Mid-Air Pointing for Interacting with Menus in Augmented Reality
   Mathias N. Lystbæk, Peter Rosenberg, Ken Pfeuffer, Jens Emil Sloth Grønbæk, Hans Gellersen
   Short paper (10 + 5 minutes)

Posters 4

TRACK I A

1. Real-time head-based deep-learning model for gaze probability regions in collaborative VR
   Riccardo Bovo, Daniele Giunchi, Ludwig Sidenmark, Enrico Costanza, Hans Gellersen, Thomas Heinis

2. Using a test battery to compare three remote, video-based eye-trackers
   Lisa Spitzer, Stefanie Mueller

3. Interaction Design of Dwell Selection Toward Gaze-based AR/VR Interaction
   Toshiya Isomoto, Shota Yamanaka, Buntarou Shizuki

4. Measuring Cognitive Effort with Pupillary Activity When Reading. Comparison of Children With and Without Primary Music Education
   Agata Cybulska, Krzysztof Krejtz, Andrew T. Duchowski, Izabela Krejtz

5. A Preliminary Investigation on Eye Gaze-based Concentration Recognition during Silent Reading of Text
   Saki Tanaka, Airi Tsuji, Kaori Fujinami

6. When do Saccades begin? Prediction of Saccades as a Time-to-Event Problem
   Tim Rolff, Frank Steinicke, Simone Frintrop

7. An Eye Opener on the Use of Machine Learning in Eye Movement Based Authentication
   Siyuan Peng, Naser Al Madi

8. Estimating Perceptual Depth Changes with Eye Vergence and Interpupillary Distance using an Eye Tracker in Virtual Reality
   Mohammed Safayet Arefin, J. Edward Swan II, Russell A. Cohen Hoffing, Steven M. Thurman

9. Multidisciplinary Reading Patterns of Digital Documents
   Bhanuka Mahanama, Gavindya Jayawardena, Yasasi Abeysinghe, Vikas Ashok, Sampath Jayarathna

10. Game Audio Impacts on Player's Visual Attention Maps in Cloud Gaming
    Morva Saaty, Mahmoud Reza Hashemi

11. EyeLikert: Eye-based Interactions for Answering Surveys
    Moritz Langner, Nico Aßfalg, Peyman Toreini, Alexander Maedche

Panel Discussion

TRACK I TRACK II TRACK III A

Moderator

Dimitri A. Christakis - Director, Center for Child Health, Behavior and Development

A pediatrician, researcher, and parent, Dimitri Christakis, is the George Adkins Professor of Pediatrics at the University of Washington, Director of the Center for Child Health, Behavior and Development at Seattle Children's Research Institute, an attending pediatrician at Seattle Children's Hospital, and editor in chief, JAMA Pediatrics. Professor Christakis graduated from Yale University and the University of Pennsylvania School of Medicine. He is the author of over 230 original research articles (h Index 93), a textbook of pediatrics and The Elephant in the Living Room: Make Television work for your kids. (September 2006; Rodale). In 2010 he was awarded the Academic Pediatric Association Research Award for outstanding contributions to pediatric research over his career. His passion is developing actionable strategies to optimize the cognitive, emotional, and social development of preschool children. The pursuit of that passion has taken him from the exam room, to the community and most recently to cages of newborn mice. Christakis' laboratory focuses on the effects of early environmental influences on child health and development and his work has been featured on all major international news outlets as well as all major national and international newspapers. He speaks frequently to international audiences of pediatricians, parents, educators and policy makers about the impact of early learning on brain development. His eyes are exceedingly difficult to track.

Panelist

Roman Bednarik - Associate Professor at the School of Computing and Adjunct Professor of Interactive Technologies at University of Eastern Finland

My interests lie in developing and applying robust eye tracking technologies and other sensors to create truly intelligent interactions and valid user state monitoring tools. Recently we applied these sensors in medical domains such as microsurgery, laparoscopy, and neurodegenerative disease diagnostics. Me and my research team built the first eye-tracker for surgical microscopes. Longterm, we are researching and developing sensorimotor technologies for clinical and professional users. I am also involved in commercialising of these technologies.

Eye-Tracking in Healthcare

TRACK I TRACK II TRACK III A

Panelist

Amanda Bentley - Senior Director of Sales and Business Development for Tobii's Healthcare Solutions

Amanda is currently the Senior Director of Sales and Business Development for Tobii's Healthcare solutions. For the past decade, Amanda has worked with some of the world's top research institutes, leading companies, and most inventive start-ups using eye tracking innovations to make the world a better place. With her extensive experience in visual behavior research and technical expertise of eye tracking solutions, she helps companies incorporate Tobii's eye tracking technology into medical devices and healthcare applications. Amanda has advanced degrees in Research Psychology, where much of her work focused on advancing motivational theories for improving personal health.

Panelist

Katarzyna Chawarska - Emily Fraser Beede Professor of Child Psychiatry Director, Social and Affective Neuroscience of Autism Program, Child Study Center Director, Yale Toddler Developmental Disabilities Clinic

Dr. Chawarska is the E. Frazer Beede Professor of Child Study, Pediatrics, and Statistics and Data Science at Yale School of Medicine and the Director of the Social and Affective Neuroscience of Autism (SANA) Program at the Child Study Center and the director of the Yale Autism Center of Excellence. She has been the principal investigator on numerous NIH-funded studies of infants at risk for ASD, as well as toddlers and preschoolers with neurodevelopmental disorders.Her research has been focused on improving the understanding of processes that give rise to core and comorbid features of autism. Much of this work has been implemented using eye-tracking methodology. Work from her lab identified some of the earliest attentional markers of autism in infancy, demonstrated continuity of the attentional vulnerabilities from prodromal into early syndromic stages of the disorder, and identified specific conditions under which attentional patterns of young children with autism diverge from those observed in control groups.

Eye-Tracking in Healthcare

TRACK I TRACK II TRACK III A

Panelist

Eakta Jain - Associate Professor of Computer and Information Science and Engineering at the University of Florida

Eakta Jain is an Associate Professor of Computer and Information Science and Engineering at the University of Florida. She received her PhD and MS degrees in Robotics from Carnegie Mellon University and her B.Tech. degree from IIT Kanpur. She has industry experience at Texas Instruments R&D labs, Disney Research Pittsburgh, and the Walt Disney Animation Studios. Dr. Jain served as the Technical Program Chair for ACM Symposium on Eye Tracking Research (2020) and Applications and ACM/Eurographics Symposium on Applied Perception (2021). She currently leads the human factors group at the University of Florida Transportation Institute. Her research at the University of Florida has been funded through faculty research awards from Facebook/Oculus and Google/YouTube, the National Science Foundation, National Institutes of Health, and the Florida Department of Transportation. Dr. Jain is interested in user modeling and avatar generation, with particular interest and expertise in visual attention and eye tracking. Her recent publications on privacy risks created by large scale eye tracking have been presented at ETRA and IEEE VR, including a Best Paper nomination in 2021.

Panelist

Oleg Komogortsev - Center for Child Health, Behavior and Development Seattle Children's , Associate Professor Computer Science & Engineering & Psychology University of Washington

Dr. Komogortsev is currently a Professor of Computer Science at Texas State University and an advisor for Bulbitech. Dr. Komogortsev has received his B.S. in Applied Mathematics from Volgograd State University, and M.S./Ph.D. degree in Computer Science from Kent State University. He was previously a faculty or a scientist at such institutions as Johns Hopkins University, Notre Dame University, Michigan State University, and Meta. Dr. Komogortsev conducts research in eye tracking with a focus on health assessment, cyber security (biometrics), bioengineering, human computer interaction, and usability.

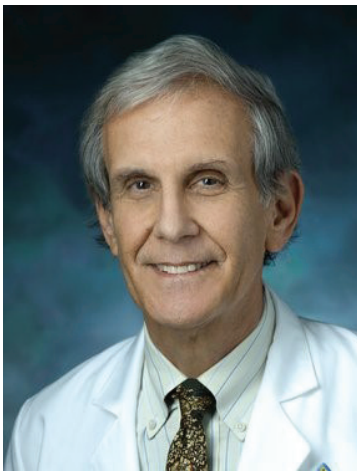
Dr. Komogortsev's research was covered by the national media including NBC News, Discovery, Yahoo, Livesience and others. Dr. Komogortsev is a recipient of four Google and four Meta Faculty Research Awards. Dr. Komogortsev has also won National Science Foundation CAREER award and Presidential Early Career Award for Scientists and Engineers (PECASE) from President Barack Obama on the topic of cybersecurity with the emphasis on eye movement-driven biometrics and health assessment. In addition, his research was supported by the National Science Foundation, National Institute of Health, National Institute of Standards, Sigma Xi the Scientific Research Society, and various industrial sources. Dr. Komogortsev's current grand vision is to push forward eye movement-driven user understanding with a very strong privacy backbone in the future virtual and augmented reality platforms.

Eye-Tracking in Healthcare

TRACK I TRACK II TRACK III A

Panelist

David Zee - Center for Child Health, Behavior and Development Seattle Children's , Associate Professor Computer Science & Engineering & Psychology
University of Washington



Dr. David Zee specializes in vertigo, dizziness and imbalance (including ataxia) and in disorders of eye movements (including nystagmus and strabismus). He is a Professor of Neurology at Johns Hopkins Medicine with secondary appointments in Otolaryngology-Head and Neck Surgery, Ophthalmology and Neuroscience. Dr. Zee's many research interests include: applications of biomedical engineering to recording and analysis of eye movements both in normal subjects and in patients with neuro-ophthalmologic or vestibular disorders; the immediate visual and vestibular influences on eye movements and the more long-term adaptive processes that permit compensation for disease; and the use of eye movement recordings as diagnostic aids (for example, early diagnosis of stroke, multiple sclerosis, myasthenia gravis).

Session 7

A TRACK I

Session 7: Understanding People through their Gaze 2

1. Gaze-enhanced Crossmodal Embeddings for Emotion Recognition
   Ahmed Abdou, Ekta Sood, Philipp Müller, Andreas Bulling
   Long paper (20 + 5 minutes)

2. U-HAR: A Convolutional Approach to Human Activity Recognition Combining Head and Eye Movements for Context-Aware Smart Glasses
   Johannes Meyer, Adrian Frank, Thomas Schlebusch, Enkelejda Kasneci
   Long paper (20 + 5 minutes)

3. Automatic Generation of Customized Areas of Interest and Evaluation of Observers' Gaze in Portrait Videos
   Leslie Woehler, Moritz von Estorff, Susana Castillo, Marcus Magnor
   Long paper (20 + 5 minutes)

4. Where and What: Driver Attention-based Object Detection
   Yao Rong, Naemi-Rebecca Kassautzki, Wolfgang Fuhl, Enkelejda Kasneci
   Long paper (20 + 5 minutes)

Workshop - OpenEDS

TRACK I A

OpenEDS Workshop

1:00-1:15 Welcome

1:15-2:00 **Invited speaker 1:** Dorothea: "Information Integration: Of Mice, Men and Machines"

2:00-2:15 Coffee Break

2:15-3:00 **Invited speaker 2:** Dorothea: "Gaze for Interaction Analysis"

3:00-3:45 **Selected paper presentations**

3:00-3:15 Geometry-Aware Eye Image-To-Image Translation

3:15-3:30 A study on the generalizability of Oculomotor Plant Mathe maticalModel

3:30-3:45 SynchronEyes: A Novel, Paired Data Set of Eye Movements Recorded Simultaneously with Remote and Wearable Eye-Tracking Devices

3:45-4:00 Coffee Break

4:00-4:45 **Invited speaker 3:** Melissa: "Dream on! The Jock, the Geek, and the Pragmatist..."

4:45-5:00 Coffee Break

5:00-5:45 **Invited speaker 4:** David: "Eye movements and the Neurologist: An update on pathophysiology and applications for diagnosis and treat ment"

5:45-6:00 Closing Remarks and Panel Discussion

Workshop - COGAIN

B TRACK II

COGAIN Workshop

10:00-10:05: Introduction

10:05-10:45: **Session 1** (Chair: Augusto)

Paper 1: A Research on Time Series Evaluation of Cognitive Load Fac tors using Features of Eye Movement
(nakayama@ict.e.titech.ac.jp, In Person)

Paper 2: Feasibility of a Device for Gaze Interaction by Visually-Evoked Brain Signals (bhou126.university@gmail.com, Remotely, UTC+1)

Paper 3: Usability of the super-vowel for gaze-based text entry

10:45 - 10:50 Break

10:50 - 11:30: **Session 2** (Chair: Joshua)

Paper 4: User Perception of Smooth Pursuit Target Speed
(sophia.sakel@ifi.lmu.de, In Person)

Paper 5: Attention of Many Observers Visualized by Eye Movements
(tehi@di.ku.dk, Remotely, UTC+2)

Paper 6: Look & Turn: One-handed and Expressive Menu Interaction by Gaze and Arm Turns in VR (ken@cs.au.dk, In Person)

11:30 - 11:35 Break

11:35 - 11:55: Keynote or Panel (tba)

11:55 - 12:00: Conclusion

ETRA Credits

General Chairs	Frederick Shic	University of Washington, USA
	Enkelejda Kasneci	University of Tübingen, Germany
Technical Program Chair	Mohamed Khamis	University of Glasgow, Scotland
Full Papers Chairs	Hans Gellersen	Aarhus Univeristy, Denmark
	Daniel Weiskopf	University of Stuttgart, Germany
	Krzysztof Krejtz	SWPS University of Social Sciences and Humanities, Poland
	Enkelejda Kasneci	University of Tübingen, Germany
Short Paper Chairs	Tanja Blaschek	Stuttgart University, Germany
	Jessica Bradshaw	University of South Carolina, USA
	Hana Vrzakova	University of Eastern Finland, Finland
Workshop Chairs	Michael Burch	University of Applied Sciences, Switzerland
	Peter Kiefer	ETH Zurich, Switzerland
	Kamran Binaee	University of Nevada, USA
Tutorial Chair	Diakok Mardanbegi	AdHawk Microsystems, Canada
Demo and Video Chair	Vijay Rajanna	Senior Research Engineer at Sensel, USA
	Christopher Clarke	University of Bath, Chur, England
	Rakshit Kothari	Rochester Institute of Technology, USA
Doctoral Symposium Chairs	Sampath Jayarathna	Old Dominion University, USA
	Arantxa Villanueva	Public University of Navarra, Spain

Poster Chairs	Adham Atyabi	University of Colorado, USA
	Shahram Eivazi	University of Tübingen, Germany
Sponsors Chairs	Thomas Kübler	University of Tübingen, Germany
	Xi Wang	Advanced Interactive Technologies, ETH Zurich
	Brendan M. David-John	University of Florida, USA
Web Chairs	Sanket Kumar Thakur	Italian Institute of Technology, Italy
	Wolfgang Fuhl	University of Tübingen, Germany
Diversity & Inclusion Chair	Yao Rong	University of Tübingen, Germany
Student Volunteer Chair	Kelsey Dommer	Seattle Children's Hospital, USA
Proceedings Chair	Stephen N. Spencer	University of Washington, USA
Communication Chairs	Nora Castner	University of Tübingen, Germany
	Benedikt Hosp	University of Tübingen, Germany
Accessibility Chair	Hana Vrzakova	University of Eastern Finland, Finland
Virtualization Chairs	Sarah Fakhoury	Washington State University, USA
	Ludwig Sidenmark	Lancaster University, UK
	Shreshth Saxena	Max-Planck-Institute, Germany
Local Chairs	Jenny Skytta	Seattle Children's Hospital, USA
	Beibin Li	University of Washington, USA
	Hsiaoying Annie Shic	Seattle Children's Hospital, USA

Sponsor Descriptions

ERGONEERS
FROM SCIENCE TO INNOVATION

Ergoneers was founded in 2005 out of research at the Technical University of Munich's Ergonomics department. Our founders had a need for an easy-to-use eye tracker that provided access to all the underlying data collected. Since that time, we have grown becoming a company with global reach while expanding data collection capabilities, all while maintaining a focused, customer centric environment. We currently offer hundreds of sensors including numerous eye trackers, biometric sensors, audio and video collection devices, motion capture, and much more. All sensors Ergoneers provides are already integrated into D-Lab, our behavioral analysis platform, with many more data sets available from preconfigured sources. D-Lab makes synchronization of all your data sources easy, getting you to the core analysis without the hassle of manual synching of data. Our Dikablis Glasses 3 present an eye tracking solution unique in the industry with the ability to work over all types of glasses, adjustable cameras, and high adaptability in dynamic lighting conditions.

RealEye

RealEye is an online research platform with webcam eye tracking. The company was established in 2017, and the software was already used in research universities worldwide, including Warsaw SWPS and Stanford US. With RealEye, you can easily prepare a study in your web browser. Use images, videos, or an online website as a stimulus. You can connect with any panel, survey, tool, or system when fielding. All the data is also being collected from a web browser using the participants' webcams or smartphones. After fielding, you can either use an online dashboard to analyze the data or export the data to any other tool for further analysis. RealEye algorithms can detect single fixations and saccadic eye movements; therefore, you can do the research based on any of them. Also, the recently implemented K-coefficient can quickly help understand the attention dimension (focal vs. ambient). We'll be happy to talk over the internet and answer your biggest concerns. Visit us at www.realeye.io and learn more.

We Power Human Insight

Founded in 2005 and headquartered in Copenhagen, iMotions, a SaaS company, has developed the world's leading human behavior analysis platform. More than 1,300 organizations around the world - from leading academic institutions to global brands to highly-respected healthcare organizations - use iMotions to access real-time and nonconscious emotional, cognitive and behavioral data. By integrating and synchronizing all types of sensors into a single platform, iMotions powers researchers with deeper and richer data insights - and the most complete picture of human behavior. iMotions works by integration of multiple biosensors that each measure different physiological and psychological reactions. The software works with 50+ different hardware brands, integrating Eye Tracking, Facial Expression Analysis, EEG, Galvanic skin response, EMG, ECG and it includes a complimentary survey tool. All in one unified platform. This provides the flexibility to extend your research at different levels. Data are seamlessly synchronized and presented in real time and are accompanied by analysis and export tools. With our modular platform and suite of support and services, iMotions facilitates a smarter and faster way to achieve results for business and scientific advancement in human innovation.

Tobii is the global leader in eye tracking and pioneer of attention computing. We are on a mission to improve the world with technology that understands human attention and intent. Creating tech for a better future, our technologies and solutions apply to areas such as behavioral studies and research, healthcare, education and training, gaming, extended reality (VR, AR & MR), automotive, and many more. We believe research is the foundation for innovation and our products and services bring our partners closer to their next revolutionary creation. Tobii's eye tracking is used by thousands of enterprises, universities, and research institutes around the globe. For more information: www.tobii.com.

Sponsor Descriptions

VIEW POINT SYSTEM
MAKING FUTURE REALITY

Viewpointsystem combines pioneering technology development with scientific expertise in vision research. Originally founded as a research and consulting spin-off of the University of Natural Resources and Life Sciences, Vienna, Viewpointsystem conducted scientific eye tracking studies for more than two decades, mainly for accident prevention in the field of traffic and mobility. Since 2016, Viewpointsystem develops and produces internationally awarded eye tracking glasses that are used in many different sectors for a wide range of applications such as streaming, remote support, trainings, video documentation, gaze and behavior analysis. Viewpointsystem stands for robust mobile eye tracking, which is suitable for real world conditions. The glasses are extremely easy to operate. They offer unprecedented wearing comfort, streaming and full functionality even in changing light conditions. The VPS 19 glasses are simply ideal for applications of any kind from the factory floor to mobile eye tracking studies. As the pioneer of the awarded "Digital Iris" technology, it is Viewpointsystem's goal to deepen the interaction between people and the digital world and to make augmented and mixed reality more intuitive.

visual camp

VisualCamp is an AI-based eye tracking technology development company that supplies eye tracking software applicable to various industries such as education, digital healthcare, and media.

Sponsor Descriptions

SR Research welcomes you to ETRA 2022!
Our company has been at the cutting edge of high-performance eye-tracking technology for over 25 years, and our eye trackers have now been cited in over 10,000 peer-reviewed publications. We continue to set the performance bar on every dimension in video-based eye-tracking, from high sampling rates and outstanding levels of accuracy and precision, to our unparalleled customer support. The EyeLink 1000 Plus has exceptionally low levels of spatial noise, and a wide range of mounting options allow it to be used in the laboratory and in EEG/MEG/MRI environments. The EyeLink Portable Duo offers the same high levels of data quality in a small, portable package. SR Research also provides sophisticated experiment delivery and data analysis software, which together have made eye tracking research accessible to thousands of researchers. Our latest software product, WebLink, is a screen recording / data streaming solution that allows EyeLink users to record eye movements while participants view and interact with websites, computer software, live events, gaming consoles, tablets and mobile phones, and other dynamic media such as videos and pdf documents. Find out more at www.sr-research.com.

NVIDIA's invention of the GPU sparked the PC gaming market. The company's pioneering work in accelerated computing—a supercharged form of computing at the intersection of computer graphics, high performance computing and AI—is reshaping trillion-dollar industries, such as transportation, healthcare and manufacturing, and fueling the growth of many others.

Sponsor Descriptions

Adobe

With a team of world-class research scientists, engineers, artists, and designers, Adobe Research combines cutting-edge academic discovery with industry impact. Our researchers shape early-stage ideas into innovative technologies. Many of Adobe Research's breakthroughs are incorporated into Adobe's products, building the company's reputation as a leader in fostering new forms of creativity and in advancing document and content intelligence. Our team collaborates with interns and faculty from universities across the globe. Our research areas include: Artificial Intelligence & Machine Learning; AR, VR & 360 Photography; Audio; Computer Vision, Imaging & Video; Content Intelligence; Data Intelligence; Document Intelligence; Graphics (2D & 3D); Human Computer Interaction; Intelligent Agents & Assistants; Natural Language Processing; Systems & Languages. We are looking for researchers, engineers, and interns to take our technologies to the next level. We're recruiting, and we would love to hear from you!

https://research.adobe.com

//blickshift

With Blickshift Analytics we offer an advanced software for the analysis of gaze data sets together with other data streams. It is both designed for researchers, who have just begun their work with eye tracking and professionals who are analyzing eye movements in complex scenarios. Besides standard visualizations and statistical tools, it provides modern visualizations for many participants and long data sets plus automatic search features for eye movement patterns. Blickshift Analytics works together with exported raw data from all main hardware manufacturers. It is being used for analyzing questions in psychology, cognitive sciences, virtual reality & augmented reality, automotive, aviation, usability, med tech and market research. Besides Blickshift Analytics we also offer Blickshift Recorder, an easy-to-use tool for recording eye movement data and further data streams within the same application.

Sponsor Descriptions

Gazepoint produces premium eye tracking and biometric systems for use in both user experience/ neuro-marketing settings and in scientific research. Our mission is to enable fast-paced, independently-led innovations and large-scale research that will bring biometric signals such as eye tracking, pupil dilation, heart rate, skin response and more to the forefront of natural human-computer interactions. We achieve our goal by providing high-performance, consumer-priced eye-tracker and biometric sensors to clients in all fields of applications from academic researchers to video game developers and more. We envision a world with eye trackers on every desk, phone, tablet, car and cockpit, helping users achieve optimal interaction in a natural environment. Gazepoint has been developing eye trackers for over a decade and brings both experience and expertise to every system we produce. Gazepoint's flagship product, the GP3, is the most affordable, research-grade eye tracking system on the market. Visit us today at www.gazept.com.

Smart Eye is the global leader in Human Insight AI, technology that understands, supports and predicts human behavior in complex environments. Bridging the gap between humans and machines for a safe and sustainable future. Smart Eye was founded in 1999, is publicly traded and headquartered in Sweden with offices in the US, UK, Germany, Denmark, Egypt, Japan, Singapore and China. Through our Research Instruments, Smart Eye offers the world's most advanced eye tracking systems for analyzing human behavior. Offering unparalleled performance in complex environments, our carefully crafted instruments enable unparalleled insights into human behavior and human-machine interaction in automotive, aviation, assistive technology, media & marketing, behavioral science and many more fields. Today, our technology is used by NASA, Airbus, Boeing, Toyota, Daimler, Audi, GM, Harvard University and hundreds of research organizations and universities around the world.

Sponsor Descriptions

EyeLogic is home to a young and dynamic team of international professionals who enjoy developing cutting-edge technology. As a manufacturer, we are dedicated to developing high-performance eye tracking hardware and software solutions for academic and applied application areas of behavioral research, including, but not limited to, psychology, linguistics, neuro and cognitive sciences, and market research. Due to high accuracy across available framerates, our products can precisely and with minimal latencies measure eye movements and analyze responses to visual information and external stimuli to understand better human perception, attention, and cognitive processes. An integral part of our company's DNA is to strive for innovation and always look for ways to make our products even better. We aim to become part of the life-changing scientific research results by enabling researcher and companies to get insights into human behavior using our non-invasive and powerful method to explain the attentional focus and cognitive strategies of perception. Visit www.eyelogicsolutions.com for more information or reach out for scientific consultation or collaboration. We are always happy to hear customers' projects and ideas.

FOVE

People are bound by various constraints.

Distance. Physical Handicaps.
Communication gaps. Human bias.
And the limitations we put on ourselves.

With the aid of XR,
the things that used to confine us fade away,
and one's true potential can be realized.

Together, let's change "Can't" into "Can".

Event Notes

Schedule at a Glance

Wed Jun 08

08:00-12:30	Doctoral Symposium [3]
	PLEY Workshop (virtual)
	ETVIS Workshop (virtual)
08:30-18:00	Tutorial 1 - [A] Gaze Analytics Pipeline (Duchowski, Gehrer, Kreijtz)
	Tutorial 2 - [B] Spatial Cognition & AI (Bhatt, Suchan, Kondyli, Nair)
	Tutorial 3 - [A] Pupil Dilation (Krause, Sprenger, van Rij)
	Tutorial 4 - [B] Eye Movement detection (Startsev, Zemblys)
07:00-17:30	Registration [R]
07:45-08:00	Continental Breakfast [2]
10:00-10:30	Coffee Break
12:30-13:30	Lunch [2]
15:30-16:00	Coffee Break

Thu Jun 09

00:00-04:00	EDUEye Workshop (Virtual)
08:15-08:30	Opening Session [A]
08:30-09:30	Keynote - [A] Mixed Reality (Stellmach)
09:45-10:45	Posters 1 [M]
	Viewpoint Systems Webinar [A]
11:00-12:00	Session 1 - [A] AR/VR/MR/XR
13:00-15:00	Session 2 - [A] AR/VR/MR/XR 2 & Improving Gaze Estimation
09:45-15:00	PrEThics Workshop [B]
15:30-16:30	Session 3 - [A] Improving Gaze Estimation 2
16:30-17:30	Posters 2 [M]
07:00-17:30	Registration
07:45-08:15	Continental Breakfast
09:30-09:45	Coffee Break
10:45-11:00	Coffee Break
12:00-13:00	Lunch
15:00-15:30	Coffee Break
18:00-20:30	Reception [2]

MAIN ETRA PROGRAM
WORKSHOPS
TUTORIALS

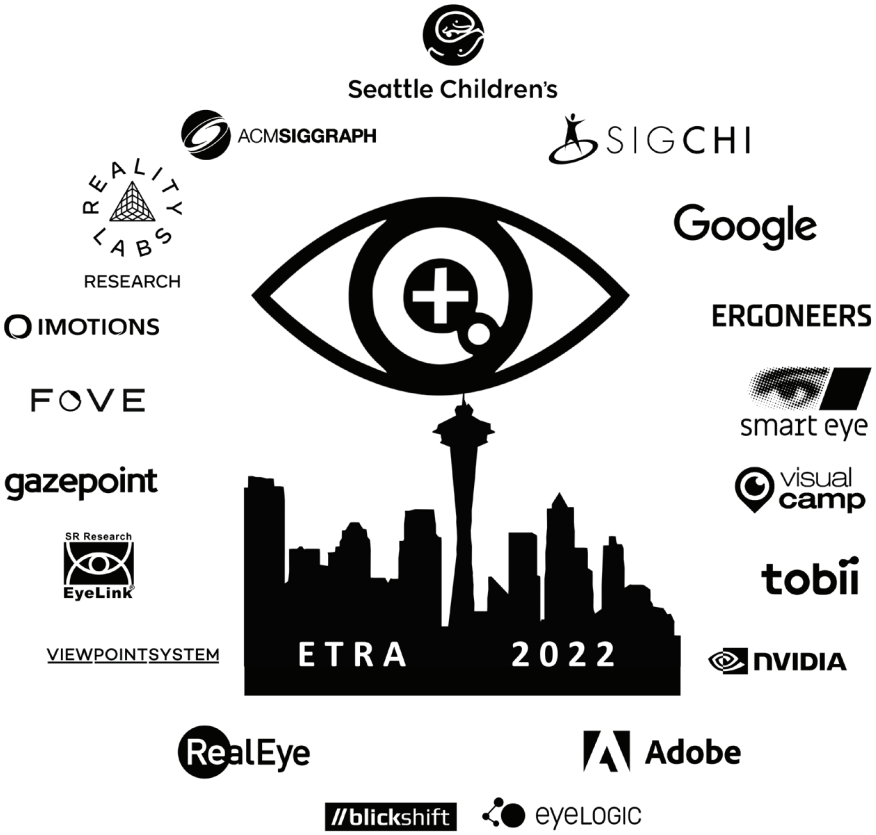
OPEN TO ALL
KEYNOTES (MAIN PROGRAM)
SPECIAL IN-PERSON EVENTS

Fri Jun 10

08:15-08:30	Opening Session [A]
08:30-09:30	Keynote - [A] Autism Biomarkers (Chawarska)
09:45-10:45	Session 4-[A] Errors & Visualization
11:00-12:00	Posters 3 [M]
13:00-15:00	Session 5-[A] Building Better ETs & Understanding People
15:30-16:30	Session 6-[A] Gaze & AR
16:30-17:30	Posters 4 [M]
07:00-17:30	Registration [R]
07:45-08:15	Continental Breakfast [2]
09:30-09:45	Coffee Break
10:45-11:00	Coffee Break
12:00-13:00	Lunch [2]
15:00-15:30	Coffee Break
18:00-20:30	Dinner Banquet [B]
18:30-19:00	Awards Ceremony [B]

Sat Jun 11

08:15-08:30	Opening Session [A]
08:30-09:30	Panel Discussion [A]
10:00-12:00	Session 7-[A] Understanding People 2
10:00-12:00	COGAIN Workshop [B]
12:10-13:00	Town Hall [A]
13:00-18:00	OpenEDS Workshop [A]
07:00-12:00	Registration
07:30-08:15	Hot Breakfast
09:30-10:00	Coffee Break
12:00-13:00	Lunch
14:00-14:15	Coffee Break
15:45-16:00	Coffee Break
16:45-17:00	Coffee Break



https://tinyurl.com/socio-ETRA2022

Wifi: SCH-GUEST-SECURE
PW: Childrens2022