Monday 8/17 Tuesday 8/18 back to program

Schedule for Wednesday, August 19

All Times are PDT = Pacific Time, West Coast USA

Time	**Room**	**Plenary Session 3**
9:00 - 9:15	AVAR Keynotes	Opening Remarks, AVAR Conference Organizing Committee
9:15 - 10:05	AVAR Keynotes	Keynote: Poppy Crum, *Dolby* *Empathetic Technology and Embodied User Experience*
10:10 - 11:00	AVAR Panels	Panel Discussion: *Reflections on Empathetic Technology and Embodied User Experience*
11:00 - 11:30	AVAR Lobby	Coffee Break
Time	**Room**	**Parallel Sessions**
11:30 - 1:30	AVAR Papers	Paper Session 5: XR Audio Reproduction/Perception
11:30 - 1:30	AVAR Workshops	Workshop Session 5: AR Audio
1:30 - 2:00	AVAR Lobby	Coffee Break
2:00 - 3:30	AVAR Papers	Paper Session 6: Room and Ear Acoustics for Mixed Reality
2:00 - 3:00	AVAR Workshops	Workshop Session 6: UI/UX and Binaural Audio
4:00 - 5:00	AVAR Lobby	Open Chat

Emerald Sponsors:

facebook Reality Labs

VALVE

Silver Sponsors:

GAME SOUND CON
THE ART, TECHNOLOGY AND BUSINESS OF GAME AUDIO

CORE

MAKER OF
OctoMic &
TetraMic

World's Finest Ambisonic Microphones

Plenary Session for Wednesday, August 19

back to top

9:00 - 9:15 Opening Remarks, AVAR Conference Organizing Committee

9:15 - 10:15 Keynote Speaker: Poppy Crum, Dolby

Empathetic technology and embodied user experience

ABSTRACT

Poppy Crum, *Dolby*

Dr. Poppy Crum is Chief Scientist at Dolby Laboratories. She is also an Adjunct Professor at Stanford University in the Center for Computer Research in Music and Acoustics and the Program in Symbolic Systems. At Dolby, Poppy directs the growth of internal science. She is responsible for integrating neuroscience and sensory data science into algorithm design, technological development, and technology strategy. At Stanford, her work focuses on the impact and feedback potential of new technologies including gaming and immersive environments such as Augmented and Virtual Reality on neuroplasticity and learning. Poppy is a U.S. vice-chair to the International Telecommunication Union (ITU) member of the Stanford Research Institute Technical Council, and Consumer Technology Association Board of Industry Leaders. Prior to joining Dolby Laboratories Poppy was Research Faculty in the Department of Biomedical Engineering at Johns Hopkins School of Medicine where her neurophysiological research focused on understanding the neural correlates of how we hear in a complex acoustic environment and the functional circuitry of the auditory cortex. Poppy is a Fellow of the Audio Engineering Society. She is a: 2018 recipient of the Advanced Imaging Societys Distinguished Leadership Award, a 2017 recipient of the Consumer Technology Associations Technology and Standards Achievement Award for work towards the introduction of over-the-counter hearing-aid devices, and has been named to Billboard Magazines 100 most influential female executives in the music industry. She is a frequent speaker including, TED, SXSW, IEEE, TNW, WIRED, on topics related to the intersection of: human experience, artificial intelligence, sensory data-science, and immersive technologies.

10:15 - 11:00 Panel Discussion:

Reflections on Empathetic technology and embodied user experience

ABSTRACT

Panel Members:

- **Poppy Crum,** *Chief Scientist, Dolby*
- **Sally Kellaway, (Moderator)** *Senior Audio Designer, Microsoft Mixed Reality at Work*
- **Brian Schmidt,** *Executive Director, GameSoundCon, Senior Lecturer, DigiPen*
- **Stefania Serafin,** *Aalborg University, Copenhagen*
- **Varun, Nair** *Facebook*

About the Panelists:

back to top

Sally Kellaway, (Moderator) *Senior Audio Designer, Microsoft Mixed Reality at Work*

Sally Kellaway is the Senior Audio Designer at Microsoft Mixed Reality at Work, where she is exploring the future of Spatial Audio in Mixed Reality, Artificial Intelligence and Machine Learning for Enterprise applications. This intersection of technologies allows Sal to build new workflows and technology pipelines that leverage interactive and immersive audio technologies from audio post production, psychoacoustics and game audio with the mission to discover how humans hear, experience and use audio as signals in Mixed Reality. Sal has a deep passion for communicating about the power of audio, and has spoken at conferences across the globe about her experience working across Game Audio, VR and Audio Hardware Development.

Stefania Serafin, *Aalborg University, Copenhagen*

Stefania Serafin is Professor in Sonic Interaction Design at Aalborg University in Copenhagen and head of the Multisensory Experience Lab. She completed her master's degree in acoustics, computer science and signal processing applied to music, from IRCAM (Paris) in 1997. Following this, she received her PhD in computer-based music theory and acoustics from Stanford University in 2004. She is the President of the Sound and Music Computing Association and principal investigator of the Nordic Sound and Music University Hub supported by Nordforsk. Her main research interests include sound models for interactive systems, multimodal interfaces and virtual reality, and sonic interaction design. She has been extensively published in these fields.

Brian Schmidt, *Executive Director, GameSoundCon, Senior Lecturer, DigiPen*

Brian Schmidt has been creating music, sound, and audio technology for games since 1987. As the 2008 recipient of the Game Audio Network Guild's Lifetime Achievement Award, Brian has a credits list of over 130 games for companies such as Sony, Electronic Arts, Capcom, Sega, Microsoft, Zynga, Namco, and many others. Apart from his work as one of the industry's first freelance game composers, Brian spent 10 years at Microsoft as the primary audio architect for the Xbox team, where he was responsible for technologies such as XMA and XACT. He also created the boot sound for the original Xbox. Brian's work has been featured in the "Legends of Game Music" CD set and received Sega's "Best Sound" award. His theme from the 1988 video game NARC was covered and recorded by The Pixies. In 1985, Brian received undergraduate degrees in music and computer science from Northwestern University, where he created the dual degree program between the School of Music and the Technological Institute. He went on to complete his master's degree in computer applications in music in 1987, and portions of his thesis work appeared in Computer Music Journal. Brian also presented his thesis work, by invitation, to the Audio Engineering Society (AES) special conference on audio technology. Brian is a frequent and in-demand speaker, as well as the founder and executive director of GameSoundCon, the largest professional conference on game music and sound design. Brian sits on the advisory board of the Game Developer Conference and is a founding board member of the Game Audio Network Guild (G.A.N.G.). He is also a former steering committee member of the Interactive Audio Special Interest Group (ia-sig) of the MIDI Manufacturers Association (MMA) and has presented as a keynote speaker at The Game Developers Conference and Project BBQ. Brian also belonged to a select group of 10 game audio professionals who successfully lobbied the National Academy of Recording Arts and Sciences (NARAS) into making video game soundtracks eligible for the Grammy Award in 1999.

Paper Session 5: **XR Audio Reproduction/Perception** back to top

Room: AVAR Papers Session Chair: Nils Meyer-Kahlen

11:30 - 11:55 Wednesday, August 19

AUTHORS: **Lior Madmoni, Jacob Donley, Vladimir Tourbabin, and Boaz Rafaely**

TITLE: **Beamforming-based Binaural Reproduction by Matching of Binaural Signals**

The capture and reproduction of spatial audio is becoming increasingly popular, with applications in teleconferencing, entertainment and virtual reality. Hence, many works aim to improve the quality of binaural reproduction with headphones. Recently, beamforming-based binaural reproduction (BFBR) was formally developed and studied with spherical arrays. However, the complete design of a BFBR system for arrays with a less regular configuration, including the selection of the number of beamformers and steering directions, has yet to be formulated and studied. This work presents a method for BFBR design, by defining conditions for appropriate sound field capture, which are then formulated in a sparse-recovery framework. The accuracy of the proposed method is studied objectively with computer simulations, and subjectively with a listening experiment.

12:00 - 12:25 Wednesday, August 19

AUTHORS: **Itai Neoran, Matan Ben-Asher, and Gal Alchanati**

TITLE: **Virtual Reality Music in the Real World**

Virtual sound localization techniques are becoming increasingly popular when listening to music over headphones. These methods involve binaural audio rendering, which requires adaptation to movements of the listeners head and body, for example when listening to music in a train or in a car. Proposed solutions use virtual loudspeakers controlled by head-tracking devices, where the directional cues in a musical track relate to a reference direction in the real-world coordinate system. This paper also discusses the question: Which is the ideal reference direction for head tracking, and how should head tracking adapt to a listener in motion? We propose the NX-tracker algorithm, addressing a wide-range of music-listening and movie-watching use cases, with solutions for one and two tracking sensors.

12:30 - 12:55 Wednesday, August 19

AUTHORS: **Tristan-Gael Bara, Alma Guilbert, and Tifanie Bouchara**

TITLE: **A new step to optimize sound localization adaptation through the use of vision**

In continuation of a previous experiment, this paper presents an improved multisensory training method to enhance the adaptation to new auditory localization cues and investigates deeper the influence of vision in this adaptation. The methodology consists of three consecutive daily sessions of a game-like training that uses each participants best-rated HRTFs. The localization performance improvement is assessed thanks to localization tests. Two experimental groups, one performing a bimodal training, while the other performs a trimodal training, are tested along with a control group. We hypothesize that adding a third modality, vision, to the training will lead to a greater improvement of the localization performance. Data for the two experimental groups are yet to be collected.

1:00 - 1:25 Wednesday, August 19

AUTHORS: **Stefan A. Wirler, Nils Meyer-Kahlen, and Sebastian J. Schlecht**

TITLE: **Towards Transfer-Plausibility for Evaluating Mixed Reality Audio in Complex Scenes**

The evaluation of mixed reality audio is typically approached under the paradigms of either authenticity or plausibility. While the first refers to the identity of a real and a virtualized sound source, the latter measures the degree of belief in cases where no direct reference is available. We refer to transfer-plausibility as the ability of a virtualized source to stand alongside multiple real sound sources. We present a perceptual experiment where listeners detect and identify a sound source as being virtualized using dynamic non-individualized binaural rendering under varying scene complexity. Scene Complexity is controlled by a varying number of loudspeakers. We demonstrate that the presented methodology mitigates ceiling effects, typically encountered in authenticity and plausibility tests.

Paper Session 6: **Room and Ear Acoustics for Mixed Reality**

back to top

Room: AVAR Papers

Session Chair: Keith Godin

2:00 - 2:25 Wednesday, August 19

AUTHORS: **Michael Chemistruck, Kyle Storck and Nikunj Raghuvanshi**

TITLE: **Cloud-enabled physical sound propagation in untethered mixed reality**

We describe the first system for physically-based wave acoustics including diffraction effects within a holographic experience shared by multiple untethered devices. Our system scales across standalone mobile-class devices. Audio propagation in real-world scenes exhibits perceptually salient effects that complement visuals. These include diffraction losses from obstruction, re-direction (portaling) of sounds around physical doorways and corners, and reverberation in complex geometries with multiple connected spaces. Such effects are necessary in mixed reality to achieve a sense of presence for virtual people and things within the real world, but have so far been computationally infeasible on mobile devices. We propose a novel cloud-enabled system that enables such immersive audio-visual scenarios on untethered mixed reality devices for the first time.

2:30 - 2:55 Wednesday, August 19

AUTHORS: **Keith Godin and Nikunj Raghuvanshi**

TITLE: **Fast acoustic obstruction with proximity cost differencing (PCD)**

We propose a fast heuristic for geometry-based acoustic obstruction in virtual reality and games. Our method is designed to produce the qualitative, smooth spatial variations in obstruction provided by ground-truth wave simulation at an orders-of-magnitude speedup. In particular, we are able to model the smooth dependence of obstruction on the size of both obstructing objects and apertures (like doors). Our technique remains robust to high scene complexity, making it suitable for application in interactive applications. While initial study is limited to 2D, generalization to 3D is possible.

3:00 - 3:25 Wednesday, August 19

AUTHORS: **Rishabh Gupta, Rishabh Ranjan, Jianjun He, and Woon-Seng Gan**

TITLE: **Acoustic transparency in hearables for augmented reality audio: Hear-through techniques review and challenges**

Augmented Reality Audio enables fusion of real and virtual sound contents in a way to make it perceptually indistinguishable and to create an immersive experience for the listener. Hearables, because of their different form factors modify natural open ear listening and therefore, real sound must be processed to make them acoustically transparent. The goal of reproducing real sounds perceptually similar to open ear response is known as acoustic transparency, and techniques for achieving this are called hear-through. The major components of hear-through, along with challenges and possible solutions from past studies are described. The relevant perceptual test paradigms for evaluation are also listed.

Workshop Session 5: **AR Audio** back to top

Room: AVAR Workshops

11:30 - 12:25 Wednesday, August 20

Thomas Aichinger, *Scopeaudio, Austria*

TITLE: **SONIC TRACES: AR audio at the Viennese Heldenplatz**

My workshop shall give people a hands-on approach on how to create immersive 3D audio landscapes for AR audio applications. Furthermore I will talk about the technical possibilities that are out there - like Unity, Wwise, binaural decoders, spatializers... But I will not limit my workshop to technical stuff. How do you guide your audience? You always have to deal with all kinds of user interaction as there is no 'path', only a free to explore mode - very similar to game audio. But, different to game audio, you deal with a very unexperienced audience. After the workshop audio professionals shall be able to evaluate AR audio apps and furthermore be aware of the necessities of good immersive audio storytelling.

12:30 - 1:30 Wednesday, August 20

Shauny Jang, *Microsoft*

TITLE: **Minecraft Through a New Lens: Recontextualizing Audio for Mobile AR**

With the rising popularity of VR/AR/MR, the audio community is alive with the possibilities of new perspectives and bleeding edge tech, but are these new possibilities incongruous with the straightforward aesthetics of Minecraft? Where does Minecraft Earth fit in in a world of ambisonics and head tracking? Do creepers need HRTF? The challenges of recontextualizing Minecraft for mobile AR might not be what you expect. Its easy to get lost in the allure of VR/AR/MR, but the most important problems to solve often have very little to do with the emerging technologies. Sometimes bringing existing IP into the future necessarily confines you to the constraints of the past, and thats not necessarily a bad thing.

Workshop Session 6: **UI/UX and Binaural Audio**

back to top

Room: AVAR Workshops

2:00 - 3:00 Wednesday, August 20

Andrew Champlin, *HTC Creative Labs, Seattle*

TITLE: **UI and UX across realities: Creating the sound design of Vive Lens**

HTC's Vive Lens is a ground-up re-envisioning of Vives VR interface, and required an entirely new sound design to match. Join sound designer Andrew Champlin, of HTCs Creative Labs, as he talks through the additive process of creating a cohesive, human-centered sound design for VR user experience, with lessons for your products and teams along the way.

3:00 - 4:00 Wednesday, August 20

Tom Ammermann, *New Audio Technology GmbH*

TITLE: **Creation and reproduction of high quality binaural audio for VR applications.**

After 360 introduced binaural audio with first order ambisonic sources, VR bears the advantage to go forward with regular interactive object-based audio, rendered in game engines, which are mandatory for VR applications. The first part of the presentation is to show, how to create extraordinary binaural audio in digital audio workstations for head locked score music. The second part is to show, how to use binaural real-time rendering tools, feed by a straight forward, interactive 7.1 output of a VR application.