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Schedule for Monday, August 20

Time	Room	Plenary Session 1
9:00 - 9:10	Plato	Opening Remarks, AVAR Conference Organizing Committee
9:10 - 10:10	Plato	Keynote Speaker: Jean-Marc Jot, Magic Leap *Unleashing Wearable 3D Audio*
10:15 - 11:00	Plato	Panel Discussion: *The state of VR/AR audio content development tools and workflows*
11:00 - 11:25	Cafe	Coffee Break

Time	Room	Paper Sessions	Time	Room	Workshop Sessions
11:30 - 1:00	Michelangelo	Production & Tools	11:30 - 1:30	Plato	Audio Production & Design for VR/AR I
1:00 - 2:00	Cafe	Lunch 1	1:30 - 2:30	Cafe	Lunch 2
2:00 - 4:30	Michelangelo	Perception & Evaluation	2:30 - 4:30	Plato	Audio Production & Design for VR/AR II
4:30 - 5:00	Cafe	Coffee Break			
5:00 - 7:00	Edison	Posters	5:00 - 6:30	Plato	Immersive Audio & Education

Special thanks to our sponsors!

Plenary Session for Monday, August 20

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9:00 - 9:10 Opening Remarks, AVAR Conference Organizing Committee

9:10 - 10:10 Keynote Speaker: Jean-Marc Jot, Magic Leap (speaker bio)

Unleashing Wearable 3D Audio

New virtual and augmented reality experiences must render multiple digital objects and support navigation though complex scenes for a physically mobile user wearing a head-mounted audio-visual display device. These applications challenge the state of the art in binaural interactive audio rendering technology. Fortunately, practical algorithmic solutions can be designed by exploiting and expanding our knowledge of human perception and its properties. Faithful 6-degree-of-freedom interactive graphics and audio is becoming possible with modern mobile hardware architectures and rendering algorithms optimized to retain the perceptually relevant cues necessary for audio/visual and real/virtual congruence. In this talk, we survey practical approaches for computationally efficient interactive binaural audio spatialization of multiple virtual sound sources, including near-field localization and spatially extended objects. We address the effects of acoustic reverberation, reflectors and obstacles in the virtual and physical environments, driven by combinations of pre-computed and real-time propagation models. We approach some additional challenges and opportunities brought about by the concurrent experience of physical and digital audio objects in mixed-reality applications.

10:15 - 11:00 Panel Discussion:

The state of VR/AR audio content development tools and workflows

This panel will discuss how audio engines and middleware, originally designed for console and PC games, have adapted to serve AR/VR content authoring. Sound designers and developers of middleware and audio engines will consider the practical workflow and toolset challenges, as well as critical 3D audio rendering performance criteria in audio for AR and VR. How do the current tools stand up to these challenges, from mobile to the latest VR platforms? With the help of our audience of AVAR attendees, we will take up this and other questions.

Panel Members: (panelist bios)

- **Jean-Marc Jot,** *Distinguished Fellow, Magic Leap*
- **Scott Selfon (Moderator),** *Audio Experiences Lead, Facebook Reality Labs*
- **Nathan Harris,** *Software Developer, Audio-Kinetic*
- **Sally Kellaway,** *Senior Audio Designer, Microsoft Mixed Reality at Work*
- **Aaron McLeran,** *Lead Audio Programmer, Epic Software*
- **Brian Schmidt,** *Executive Director, GameSoundCon, Senior Lecturer, DigiPen*

About the Keynote Speaker:

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Jean-Marc Jot, *Distinguished Fellow, Magic Leap*

Dr. Jean-Marc Jot is a Distinguished Fellow at Magic Leap, where he is responsible for audio processing technology innovation. Prior to Magic Leap, he led audio processing R&D at DTS. Previously, with Creative Labs, he led the design and development of SoundBlaster audio processing algorithms and architectures, including OpenAL and EAX technologies for game 3D audio authoring and rendering. Before relocating to California in the late nineties, he conducted research at IRCAM in Paris, where he designed the original IRCAM Spat software suite for spatial audio creation, performance, and virtual reality. Jean-Marc Jot holds a doctorate in audio and acoustics signal processing, from Telecom ParisTech, where he worked on the design and implementation of a spatial sound processor based on physical and perceptual models with advisor: professor Antoine Chaigne. Additionally, he pioneered a general method for the design of natural-sounding artificial reverberators using multi-channel Feedback Delay Networks (FDN), which have since been widely employed and referenced.

About the Panelists:

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Scott Selfon (Moderator), *Audio Experiences Lead, Facebook Reality Labs*

Scott Selfon is the Audio Experiences Lead at Facebook Reality Labs (formerly Oculus Research), exploring and inventing the technical, creative, and design languages of sound for virtual and augmented reality. Prior to that, he was engaged in developer consultancy, education, and support efforts across three generations of the Xbox game console and broader Windows audio efforts at Microsoft. Scott has composed music for a wide range of media, including film, television, games and live performance, and is a violist with the Puget Sound Symphony in Seattle. A member of the Game Audio Network Guild (G.A.N.G.) advisory board, Scott has been a faculty member of both the Pacific Northwest Film Scoring Program and the University of Southern California, has coordinated and lectured at the Game Developers Conference Audio Boot Camp tutorial sessions for more than fifteen years, and has spoken at the conferences worldwide on audio, interactive entertainment, and real-time sound implementation techniques and technologies. Scott is an alumnus of the University of Southern California, where he obtained dual degrees in music composition (film scoring emphasis) and computer engineering/computer science.

Nathan Harris, *Software Developer, Audio-Kinetic*

Nathan Harris graduated with a degree in computer science from the University of British Columbia, and with no delay launched into a career that combined his passion for music and his aptitude as a programmer - developing audio in the video game industry. Seeking a greater challenge, Nathan shifted focus from game development to middleware and moved to Montreal to work at Audiokinetic - a company at the forefront of the industry whose technology is deployed in hundreds of games across the globe. As part of the research and development team, Nathan is one of the masterminds behind the latest generation of 3D audio products including Wwise Spatial Audio and Wwise Reflect. Nathan has a black belt in Brazilian jiu jitsu, and when not on the mats or solving problems for tomorrow's most immersive video games, he enjoys building gadgets for brewing beer and roasting coffee.

Sally Kellaway, *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.

Aaron McLeran, *Lead Audio Programmer, Epic Software*

Aaron studied physics and music in undergrad with serious studies in jazz improvisation and composition. He later received a masters in physics from Notre Dame and a second masters in media arts and technology from University of California, Santa Barbara. His interests have always been at the boundary of the technical and artistic. After spending a couple years teaching high school physics and calculus, his first game job was writing procedural music for Spore, where he collaborated with Maxis audio director, Kent Jolly, and producer/composer/performer Brian Eno. Later, he was a sound designer on Dead Space 2. His first programming gig was working on Call of Duty at Sledgehammer Games, where he wrote features for Modern Warfare 3 and Advanced Warfare. He later worked at ArenaNet on interesting audio features for MMOs. He now works at Epic as the lead audio programmer, working on a new multiplatform audio renderer.

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 1

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Production & Tools

Room: Michelangelo

Session Chair: Edgar Choueiri

11:30 - 11:55 Monday, August 20

AUTHORS: **Michael Costagliola,** *Yale University*

TITLE: **Multi-user shared augmented audio spaces using motion capture systems**

This paper describes a method for creating multi-user shared augmented reality audio spaces. By using a system of infrared cameras and motion capture software, it is possible to provide accurate low-latency head tracking for many users simultaneously, and stream binaural audio representing a realistic, shared virtual environment to each user. Participants can thus occupy and navigate a shared virtual aural space without the use of head-mounted displays, only headphones (with passive markers affixed) connected to lightweight in-ear monitor beltpacks. Potential applications include installation work, classroom use, and museum audio tours.

12:00 - 12:25 Monday, August 20

AUTHORS: **Giordano Jacuzzi,** *Sennheiser Electronic GmbH*

TITLE: **Augmented Audio: An Overview of the Unique Tools and Features Required for Creating AR Audio Experiences**

What a user sees in augmented reality is only part of the experience. To create a truly compelling journey, we must augment what a user hears in reality as well. In this paper, we consider Augmented Audio to be the sound of AR, and discuss a technique by which the binaural rendering of virtual sounds (Augmented) is combined with the manipulation of the real-world sound surrounding a listener (Reality). We outline the unique challenges that arise when designing audio experiences for AR, and document the current state-of-the-art for Augmented Audio solutions. Using the Sennheiser AMBEO Smart Headset as a case study, we describe the essential features of an Augmented Audio device and its integration with an AR application.

12:30 - 12:55 Monday, August 20

AUTHORS: **Jukka Holm and Mark Malyshev,** *Tampere University of Applied Sciences, Finland*

TITLE: **Spatial Audio Production for 360-Degree Live Music Videos: Multi-Camera Case Studies**

This paper discusses the different aspects of mixing for 360-degree multi-camera live music videos. We describe our two spatial audio production workflows, which were developed and fine-tuned through a series of case studies including rock, pop, and orchestral music. The different genres were chosen to test if the production tools and techniques were equally efficient for mixing different types of music. In our workflows, one of the most important parts of the mixing process is to match the Ambisonics mix with a stereo reference. Among other things, the process includes automation, proximity effects, creating a sense a space, and managing transitions between cameras.

Paper Session 2

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Perception & Evaluation

Room: Michelangelo

Session Chair: Rahulram Sridhar

2:00 - 2:25 Monday, August 20

AUTHORS: **Angela Mcarthur, Mark Sandler and Rebecca Stewart,** *Queen Mary University of London, UK*

TITLE: **Perception of mismatched auditory distance - cinematic VR**

This study examines auditory distance discrimination in cinematic virtual reality. Using controlled stimuli with audiovisual distance variations, it determines if mismatched stimuli are detected. It asks if visual conditions - either equally or unequally distanced from the user, and environmental conditions - either a reverberant space as opposed to a freer field, impact accuracy in discrimination between congruent and incongruent aural and visual cues. A Repertory Grid Technique-derived design, whereby participant-specific constructs are translated into numerical ratings, is used. Discrimination of auditory event mismatch was improved for stimuli with varied visual-event distances, though not for equidistant visual events. This may demonstrate that visual cues alert users to matches and mismatches, but can lead responses toward both greater and lesser accuracy.

2:30 - 2:55 Monday, August 20

AUTHORS: **Hanne Stenzel, Philip J.B. Jackson,** *University of Surrey, UK*, **Jon Francombe,** *BBC Research and Development, UK*

TITLE: **Reaction times of spatially coherent and incoherent signals in a word recognition test**

Using conventional sound design, the audio signal in VR applications is often reduced to a static stereophonic signal that is accompanied by a visual signal that allows for interactive behavior such as looking around. In the current test, the influence of spatial offset between the audio and visual signals is investigated using reaction time measurements in a word recognition task. The audio-visual offset is introduced by a video presented at horizontal offset angles between ± 20 degrees, accompanied with a static central audio. Measurements are compared to reaction times from a test where both audio and visual signal are presented with the same offset. Results show that the spatial offset introduces changes in the reaction times exhibiting greater within-participant differences.

3:00 - 3:25 Monday, August 20

AUTHORS: **G. Christopher Stecker,** *Vanderbilt University*

TITLE: **Toward objective measures of auditory co-immersion in virtual and augmented reality**

"Co-immersion" refers to the perception of real or virtual objects as contained within or belonging to a shared multisensory scene. Environmental features such as lighting and reverberation contribute to the experience of co-immersion even when awareness of those features is not explicit. Objective measures of co-immersion are needed to validate user experience and accessibility in augmented-reality applications, particularly those that aim for "face-to-face" quality. Here, we describe an approach that combines psychophysical measurement with virtual-reality games to assess users' sensitivity to room-acoustic differences across concurrent talkers in a simulated complex scene. Eliminating the need for explicit judgments, Odd-one-out tasks allow psychophysical thresholds to be measured and compared directly across devices, algorithms, and user populations. Supported by NIH-R41-DC16578.

Paper Session 2 (continued)

Perception & Evaluation

Room: Michelangelo Session Chair: Rahulram Sridhar

3:30 - 3:55 Monday, August 20

AUTHORS: **Olli Rummukainen, Thomas Robotham, Sebastian J. Schlecht, Axel Plinge, Jürgen Herre and Emanuël A. P. Habets,** *Fraunhofer, Germany*

TITLE: **Audio Quality Evaluation in Virtual Reality: Multiple Stimulus Ranking with Behavior Tracking**

Virtual reality systems with multimodal stimulation and up to six degrees-of-freedom movement pose novel challenges to audio quality evaluation. This paper adapts classic multiple stimulus test methodology to virtual reality and adds behavioral tracking functionality. The method is based on ranking by elimination while exploring an audiovisual virtual reality. The proposed evaluation method allows immersion in multimodal virtual scenes while enabling comparative evaluation of multiple binaural renderers. A pilot study is conducted to evaluate feasibility of the proposed method and to identify challenges in virtual reality audio quality evaluation. Finally, the results are compared to a non-immersive off-line evaluation method.

4:00 - 4:25 Monday, August 20

AUTHORS: **Gregory Reardon, Andrea Genovese, Gabriel Zalles, and Agnieszka Roginska,** *New York University*, **Patrick Flanagan,** *THX Ltd.*

TITLE: **Evaluation of Binaural Renderers: Multidimensional Sound Quality Assessment**

A multi-phase subjective experiment evaluating six commercially available binaural audio renderers was carried out. This paper presents the methodology, evaluation criteria, and main findings of the tests which assessed perceived sound quality of the renderers. Subjects appraised a number of specific sound quality attributes - timbral balance, clarity, naturalness, spaciousness, and dialogue intelligibility - and ranked, in terms of preference, the renderers for a set of music and movie stimuli presented over headphones. Results indicated that differences between the perceived quality and preference for a renderer are discernible. Binaural renderer performance was also found to be highly content-dependent, with significant interactions between renderers and individual stimuli being found, making it difficult to determine an "optimal" renderer for all settings.

Paper Session 3

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Posters

Room: Edison

AUTHORS: **Otto Puomio and Tapio Lokki,** *Aalto University, Finland*

TITLE: **ICHO: Immersive Concert for Homes**

Concert hall experience at home has been limited to stereo and 5.1 surround sound reproduction. However, these reproduction systems do not convey the spatial properties of the concert hall acoustics in detail, and specifically for headphones the sound tends to be perceived as playing inside the head. The ICHO project introduced in this paper aims to bring an immersive concert hall experience to home listeners. This is realized by using close pick-up of sound sources, spatial room impulse responses, and individualized head related transfer functions; all combined together for spatial sound reproduction with head-tracked headphones. This paper outlines how this goal is going to be achieved and how the quality of the reproduction might be evaluated.

AUTHORS: **Sebastian Nagel, Tobias Kabzinski, Stefan Kühl, Christiane Antweiler and Peter Jax,** *Institute of Communication Systems (IKS), RWTH Aachen University, Germany*

TITLE: **Acoustic Head-Tracking for Acquisition of Head-Related Transfer Functions with Unconstrained Subject Movement**

Recently proposed Head-Related Transfer Function acquisition methods include head-tracking to allow unconstrained subject movements during the measurement. This enables fast measurements with less equipment than previous fast measurement approaches. In this paper, we propose a novel acoustic head-tracking concept, which is particularly suited for this application. Only a head-mounted microphone array and additional recording channels are required in addition to a regular measurement setup. Unlike other head-tracking systems, the tracking data is inherently synchronized to the acoustic measurements and the angle of sound incidence can be accurately determined without knowledge of loudspeaker positions. The concept is developed and evaluated in simulations and measurements, which show that the proposed acoustic head tracker outperforms a comparison device.

AUTHORS: **Guangzheng Yu and Bosun Xie,** *South China University of Technology*

TITLE: **Multiple sound sources solution for near-field head-related transfer function measurements**

Near-field head-related transfer functions (HRTFs) are essential to scientific researches of binaural hearing and practical applications of virtual auditory display. In contrast to far-field HRTFs measurement, the near-field measurement is more difficult, because high efficiency, accuracy and repeatability are required in a near-field HRTF measurement. When multiple sound sources are adopted to accelerate the near-field HRTF measurement, multiple scattering among sound sources could be the major factor to influence the accuracy. In present work, the well-designed multiple sound sources solution is used to accelerate the near-field HRTFs measurement. Results show that the error caused by the multiple scattering among sound source can be controlled within the acceptable values through reasonable design and arrangement for sound sources.

Paper Session 3 (continued)

Posters

Room: Edison

AUTHORS: **Yun-Han Wu, Scott Murakami and Agnieszka Roginska,** *New York Univeristy*

TITLE: **Comparison of Measured and Simulated Room Impulse Response for an Interactive Music Making Environment in Mixed Reality**

This paper describes a musical environment created for mixed reality (MR) where virtual sound objects are superimposed on the real environment with the goal to blend seamlessly with the real environment using acoustic simulation techniques. The resulting experience allows a participant to interact with and create music by playing the virtual objects. An informal subjective study is performed where subjects are asked to evaluate the acoustics in the scene, with the different techniques applied, based on preference and the evaluation of the interaction design with the musical objects.

AUTHORS: **Marco Binelli, Daniel Pinardi and Angelo Farina,** *University of Parma, Italy*, **Tiziano Nili,** *ASK Industries, Italy*

TITLE: **Individualized HRTF for playing VR videos with Ambisonics spatial audio on HMDs**

Current systems for rendering 360-degrees videos with spatial audio on HMDs rely on a binaural approach combined with Ambisonics technology. These head-tracking systems employ generic HRTFs typically measured with a dummy head in an anechoic room. In this paper, we describe a new solution that has been developed to play 360-degrees video files with spatial audio for desktop and portable platforms, based on existing open source software. The HRTF set can be loaded from a standard WAV file chosen in an existing database or from an ad-hoc measurement or simulation. The capability to switch among multiple HRTF sets while playing has been added.

AUTHORS: **Alan Kan,** *University of Wisconsin-Madison*

TITLE: **On high-frequency interaural time difference sensitivity in complex auditory environments**

The Duplex theory of sound localization is a useful principle for guiding trade-offs between realistic production vs implementation complexity for virtual auditory environments. However, there are exceptions to this theory in the psychoacoustic literature that should be noted. One exception is that sensitivity to an interaural time difference (ITD) can be improved when either low-frequency amplitude modulation (AM) or frequency modulation (FM) is introduced into a high frequency tone. This paper presents results from a psychoacoustic experiment that show that having both AM and FM greatly improves sensitivity to high-frequency ITDs compared to AM or FM alone when presented in incoherent broadband noise. The implications of these findings to the generation of virtual auditory environments are discussed.

Paper Session 3 (continued)

Posters

Room: Edison

AUTHORS: **Nail Gumerov, Dmitry Zotkin, Adam O'Donovan and Ramani Duraiswami,** *VisiSonics Corporation*

TITLE: **Spatial Acoustic Field Simulation as a Service**

Many practical applications in VR and AR require the computation of scattered acoustical fields from complex shaped objects. Such computations arise, e.g., in computing head related transfer functions and in designing microphone arrays. We present a parallelized fast-multipole accelerated boundary-element solver which can be used to efficiently compute the solution to such problems in the cloud. This builds on our extensive previous work on developing such methods. Details of the methods, and results from problems relevant to audio in AR and VR will be presented.

AUTHORS: **Hanne Stenzel and Philip J.B. Jackson,** *University of Surrey, UK*

TITLE: **Perceptual thresholds of audio-visual spatial coherence for a variety of audio-visual objects**

Audio-visual spatial perception relies on the integration of both auditory and visual spatial information. Depending on auditory and visual features of the stimulus, and the relevance of each sound to the listener, offsets between both signals are more or less acceptable. The current paper investigates to which extent each of these factors influences how critical the perception of spatial coherence is by estimating the psychometric function for seventeen audio-visual stimuli. The results show that the maximum accepted offset angle does not depend on semantic categories but is linked to audio feature classes with harmonic sounds leading to greater acceptable offsets. A regression shows that the perceptual spectral centroid is negatively correlated with the offset angle and the slope of the psychometric spatial-coherence function. This finding, however, is not conclusive and further research is necessary to define all parameters that influence bimodal localization of realistic stimuli.

AUTHORS: **Rishabh Gupta, Rishabh Ranjan, and Woon-Seng Gan,** *Nanyang Technological University, Singapore*, **Jianjun He,** *Maxim Integrated Product Inc*

TITLE: **Investigation of the Effect of VR/AR Headgears on Head-Related Transfer Functions for Natural Listening**

With the advent of Virtual/Augmented/Mixed Reality (VR/AR/MR) applications and accompanied head mounted displays (HMD), these devices are becoming increasingly common in daily life use producing immersive virtual and augmented audio-visual content. However, presence of these HMDs can affect the acoustic propagation of the sound waves from the sound sources to the human ears, resulting in changes in head-related transfer functions (HRTFs). In this paper, we conducted the measurements of HRTFs with and without these headgears and investigated the effect of these headgears on HRTFs at different source directions using descriptive analysis and objective metrics. Furthermore, subjective listening tests were conducted to study the perceptual significance of these differences in terms of timbre and spatial performance.

Paper Session 3 (continued)

Posters

Room: Edison

AUTHORS: **Raimundo Gonzalez and Tapio Lokki,** *Aalto University*, **Joshua Pearce,** *Michigan Technological University*

TITLE: **Modular Design for Spherical Microphone Arrays**

Spherical microphones arrays are commonly utilized for recording, analyzing and reproducing sound-fields. In the context of higher-order Ambisonics, the spatial resolution depends on the number and distribution of sensors over the surface of a sphere. Commercially available arrays have set configurations that cannot be changed, which limits their usability for experimental and educational spatial audio applications. Therefore, an open-source modular design using MEMs microphones and 3D printing is proposed for selectively capturing frequency-dependent spatial components of sound-fields. Following a modular paradigm, the presented device is low cost and decomposes the array into smaller units (a matrix, connectors and microphones), which can be easily rearranged to capture up to third-order spherical harmonic signals with various physical configurations.

Workshops 1 & 2

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Audio Production & Design for VR/AR I

Room: Plato

11:30 - 12:25 Monday, August 20

Chanel Summers, *VRstudios, Inc.*

TITLE: **Compete to Win! Creating the Audio for VRcade PowerPlay^{TM}: A Next-Gen Competitive eSport for Location-Based VR**

This presentation will discuss specific immersive and aesthetic auditory design techniques and strategies as applied to create VRcade PowerPlay^{TM}, a full-motion, multi-participant virtual reality competitive eSport game experience for live commercial Location Based Entertainment (LBE) installations that allows the participants to actually forget that they are in VR. Challenges and solutions will be revealed for designing the dynamic audioscape for an intensely athletic team eSport played in free-roaming, arena-scale VR.

12:35 - 1:30 Monday, August 20

Jeffery Stone, *Artisyns Audio*

TITLE: **Audio Production in a New Reality**

The demand for VR/AR content, in the near future, is potentially explosive. We, the creators of 50% of the experience, need to be ready with a solid understanding of what is possible with 3D sound design, as well as its unique limitations, and how to produce it effectively. With this workshop, presented from a sound designer's perspective, I will discuss and demonstrate some tools and platforms I have used, and their potential workflows, for production, post-production, and distribution of 3D cinematic audio for 360 video, as well as production and design techniques for this unfamiliar aesthetic..

Workshops 3 & 4

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Audio Production & Design for VR/AR II

Room: Plato

2:30 - 3:25 Monday, August 20

Robert Rice, *Microsoft*, **Kedar Shashidhar,** *Magic Leap*

TITLE: **The Role of Audio and Multimodal Integration for New Realities**

An effective VR/AR/MR experience is dependent on content and technology to work together in harmony to suspend disbelief for the participant. These new realities demand an understanding of the connection between audio design and technologies that vary in immersiveness and deliver to variable end-user environments. On this panel, experts of interactive audio will discuss the role that immersive audio plays when interacting with multiple modalities of perception in order to create top-notch virtual and augmented reality experiences.

MODERATOR: Kedar Shashidhar

PANELISTS: Tom Smurdon, Chanel Summers, Viktor Phoenix, Guy Whitmore, and Robert Rice

3:35 - 4:30 Monday, August 20

Martin Rieger, *VRTONUNG, Germany*

TITLE: **Sound for challenging 360° productions**

The talk shows various examples of 360° productions under challenging conditions for sound on vision on location and in post-production. Working on virtual reality films requires a whole new understanding for the entire sound department. Not only that, 360° videos tend to be more adventurous than the average film production since they start feeling like pioneers again and want to shot footage that simply hasn't been there before. This is not only crucial for the camera but also for the sound department. Sometimes even more. How to approach onboard recordings on moving motorcycle with dialogue to ski-stunts in snowy mountains -Martin describes 360° recordings on set and fixing them in the post.

Workshop 5

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Immersive Audio & Education

Room: Plato

5:00 - 6:30 Monday, August 20

John Merchant, *Middle Tennessee State University*

TITLE: **Immersive Audio + Education**

This will be a panel discussion of topics regarding higher education for immersive audio, with consideration of skills and knowledge required for long-term student successes as well as ways to balance the needs of industry with calls for academic research. The selected panelists represent a cross-section of industry professionals and academics to assess essential concepts and teaching methodologies. The panel will include significant time for questions and answers.

Panelists:

Agnieszka Roginska, Assoc. Director of Music Technology at New York University

Tom Smurdon, Audio Content Lead at Oculus VR

Jean-Marc Jot, Distinguished Fellow at Magic Leap

Sally-anne Kellaway, Senior Audio Designer at Microsoft

(Moderator) John Merchant, Assoc. Professor and Director of the Immersive Story Lab, Middle Tennessee State University

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