

57th International Conference The Future of Audio Entertainment Technology

Cinema, Television,
and the Internet

Hollywood, CA, USA
6–8 March 2015



CONFERENCE REPORT

Several dramatic changes are occurring in cinema exhibition, with immersive sound the new buzzword. Ultra High Definition Television (UHDTV) looks to be the next step in home entertainment, and consumers are increasing their use of personal media devices, with headphones looking to be a major segment of the future, reported Brian McCarty, conference chair, in his introduction to the 57th International Conference, “The Future of Audio Entertainment Technology—Cinema, Television and the Internet,” which took place at the TCL Chinese Theaters in Hollywood, California, March 6–8. Welcoming delegates to the conference, McCarty explained that the conference would cover important topics such as dialog intelligibility, loudness, headphone rendering and immersive audio, as well as the acoustics of cinemas, bringing together some of the world’s leading experts on these topics.

Brian McCarty,
conference chair,
opens the event.



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CINEMA REPRODUCTION AND ACOUSTICS

Kicking off the proceedings with a keynote address entitled “Acoustics for the Theater and Home—Moving Forward on a Foundation of Common Acoustical Science,” Floyd Toole explained that we listen through rooms. It’s absurd, he suggested, to integrate a complex room response into a simple measurement such as an overall frequency response or one-third octave plot. No single “curve” can represent all of the relevant information, nor could it relate properly to what the listener hears. One important rule is emerging—that early reflected energy from the loudspeakers needs to be similar to the direct sound in order to have a high-quality listening experience. In cinemas the reverberation time rises at low frequencies because the amount of absorption is not very great. This tends to lead to bass levels being turned down. At higher frequencies in cinemas, the X-curve is often achieved simply as a result of screen loss and not as a result of equalization. Why, though, he asked, do we roll off high frequencies in the cinema, as we don’t do it anywhere else in audio reproduction? It seems that in practice, measured cinemas deviate from the X-curve in that the bass levels are higher and the treble lower than the curve.

Toole introduced Linda Gedemer, who explained her work on predicting in-room responses from anechoic loudspeaker data. A known constant directivity index, she said, is important for predicting this. The details of this work can be found in the related conference paper contained in the proceedings. Toole suggested that two ears and a brain are more useful than an omnidirectional microphone in evaluating the performance of loudspeakers in rooms. Designing loudspeakers for a flat direct response is desirable. If you add an EQ boost to counteract a dip in the loudspeaker-room response you will effectively create a loudspeaker resonance, he said.

In his paper on electroacoustic measurements of cinema B-chains in Australia, David Murphy confirmed Toole’s observation that low frequencies are relatively uncontrolled in most cinemas. Perceived quality, he said, is improved by measurement and EQ of high frequencies so as to have an extended response and consequently greater clarity. It seems important, though, to acclimate audiences to this gradually, as it’s not been the norm in movie theaters. It’s also difficult to achieve this aim



Glenn Leembruggen talks about the effects of cinema screens.

when the loudspeakers are obscured by a screen.

Keith Holland reported on the audibility of comb filtering due to cinema screens. Reflections of sound from the loudspeakers off the back of the screen causes this effect, but it turns out that it is barely audible in practice, partly because there is no comparison for the listener with a

reference condition and partly because the magnitude of the effect is relatively small.

Glenn Leembruggen reported similar results to others in his paper on equalizing the effects of perforated movie screens. The X-curve at HF is mainly the result of low-pass filtering by the screen losses. If you attempt to introduce an inverse X-curve to compensate for this it can result in increased stress on the loudspeakers. This can amount to as much as 3.5 dB more power requirement for movies, depending on the crossover frequency of the loudspeakers, but this is within the realms of possibility for most real program material. The crest factor of movie sound tracks, though, is very large and can be as much as 25 dB, so some limiting might be required if one was to successfully equalize the effects of a perforated screen. This was supported in a question that suggested examples of recent driver failure in a movie theatre because of excessive HF transients on a particular “worst case” movie sound track.

MANAGING LOW FREQUENCIES

A workshop on low-frequency issues in cinemas started with Leembruggen looking at what happens at low frequencies in a range of different theaters for different audio channels. He had undertaken a very large number of measurements that gave clear insights into the behavior of current systems. He was followed by Manny LaCarrubba who considered the challenge of “how to create really great bass.” In subjective terms, he proposed, people use terms such as punchy, tight, extended, balanced, clean and so forth. Why, though, is it so hard to achieve? It turns out there are many relatively uncontrolled factors. Manny looked at subwoofer response in different room locations, which was variable as a result of room modes. By introducing more subs in different locations and a bit of delay the response could be evened out quite a lot, and he suggested that parametric EQ could be applied to flatten out the response, averaging it at a number of positions. If we used bass management in cinemas, he proposed, we could probably achieve better results than we do now.

“Everyone loves bass”, enthused Anthony Grimani. It gets you further than anything else when persuading people of sound quality, but it is hard to do in a small room. Putting an excellent sub (one that measures well in the near field) in a small room in different locations give rise to very different results. There can be as much as 20 dB peak-to-peak variation,



Manny La Carrubba describes how to get really good bass.



Floyd Toole explains how we listen “through rooms.”



David Murphy on electroacoustic measurements in cinemas



Brian Long of Skywalker poses a question in the cinema acoustics session.

so proper bass management is desirable. Multiple subs are needed as is modal distribution if the room dimensions are controllable.

According to Keith Holland and Philip Newell, two bass loudspeakers gives rise to a more even response below 70 Hz, whereas one is better above that (because of the interaction between multiple drivers at higher frequencies). A lot depends on the spacing, though. Concerning spatially-averaged responses, they rightly pointed out that no one listener actually hears a spatially-averaged response, they just hear the response at their location, so the value of these is questionable and they do not remove response variability with position. Calibration measurements should be of the source itself, and not done in the room.

In his paper on enhanced LF reproduction in cinemas, Adam Hill explained that stereo subwoofers may make very little difference to the spatial image, but they can decorrelate the LF so that interactions and comb filtering are less of a problem. Confirming the previous speaker's point that spatially-averaged equalization does not improve seat-to-seat variation in response, he introduced an optimization strategy with multiple subs that can help instead. Diffuse signal processing decorrelates the LF speaker outputs, and this needs to be done in such a way that local technicians can manage the process easily.

DIALOG INTELLIGIBILITY

In a tour de force presentation covering virtually everything that is known about speech and dialog intelligibility in audio entertainment, Peter Mapp explained that speech is so robust that you have to work quite hard to mess it up. Why then, he asked, do we have so many problems in this area? He reviewed the reasons for poor intelligibility, showing that a listener's understanding of speech is the key factor. He looked at the various types of hearing loss in relation to phoneme level, referring to the so-called "speech banana" known by audiologists, which is a curved region of the hearing curve most critical for speech intelligibility. Most of the critical frequencies for intelligibility lie between 1 and 4 kHz. Visual contact between talker and listener can give as much as 15 dB improvement, it seems. The average syllable rate in spoken communications has increased over the last ten years for some reason, Peter said, which doesn't help matters. Also in movies, directorial decisions are often made for reasons other than dialog intelligibility.

There is no standard that says how intelligible sound in entertainment venues such as theaters and cinemas should be, despite the standards that exist in other walks of life, such as aircraft, stations, stadiums and the like. STI (speech transmission index) values of 0.65–0.7 are desirable, and it has been found in a recent project that complaints cease when the value is above 0.6. There is a



Peter Mapp gets excited about dialog intelligibility.



By the light of his laptop, Kurt Graffy discusses perceptual matters.



TCL Chinese Theaters seen from Hollywood Boulevard

reasonably linear relationship between signal-to-noise ratio and intelligibility, which is convenient, but raising levels can result in poorer intelligibility unless it is done to overcome noise.

People with hearing impairment mostly seem to prefer mono to spatial versions of a mix when dialog and effects are combined. With normal hearing listeners the results are the same when it comes to intelligibility, but their overall enjoyment is lower for mono versions. When we realize that only about half the world's population has "normal" hearing, this becomes quite striking. The home environment gives rise to a different experience from the cinema, as attention is differently focused, so we need to do things to help. Custom remixing of films can be done to enhance dialog intelligibility, with limiting, EQ, and compression used to carve a clearer window for dialog to cut through. Expert mixing is needed though, and it does not seem that this can be left to a machine. The HIPflx process is said to be the audio equivalent of large print books, presenting clear dialog in the presence of competing sounds.

David Smith of Bose pointed out that flat screen TVs had poorer loudspeakers than former designs, and they were often mounted at the back, which makes intelligibility poorer. Sound bars, too, seem to be less good than discrete loudspeakers, some not having a true center channel, although multi-axis beam steering is possible using multiple drivers. Considering the differences between home and cinema listening, David said that the dialog is lower in level at home. Facilities like Dolby Night Mode can help with intelligibility, and object-based audio control will increasingly enable flexible handling of dialog content in such situations.

Looking into the psychoacoustics of dialog intelligibility, Kurt Graffy discussed Bregman's ideas on auditory scene analysis, and reviewed the principles of critical band filtering and spatial unmasking. It may be possible to get better intelligibility, he said, simply by locating a sound object in a different place rather than needing to use level.

KEYNOTE

At the end of the first day, a keynote presentation by Louis Hernandez, chairman and CEO of Avid Technologies, dealt with the need to change business models so as to make workflow more efficient. The current model is broken, he said, and the business is changing rapidly, requiring that content creators connect more efficiently to the consumer. Using an all-digital chain one can make sound quality better and the economics of working more viable.

Processing speeds and connectivity are accelerating at a remarkable rate, Hernandez reminded the audience, and distribution of

content has changed, which has previously been a huge cost that is taken away from the creative process. *Captain America* for example has more than 350 distribution masters, mainly because of audio compatibility issues, so better standards would help here. We need to be better focused, more responsible and better organized, he said, with security being an important issue that needs to be addressed in collaborative systems. Data security attacks, he said, are becoming the third world war, so this has to be taken seriously.

While media consumption has risen dramatically in terms of hours per week, unless we enable people to be fairly rewarded for their work we will lose the creative talent that generates the content. Hernandez therefore outlined a new Avid project that amounts to a collaborative ecosystem, a marketplace with free entry at the outset, and the option for subscription or outright purchase of the tools. In terms of standards, he said, Avid will launch its own, as someone needs to step forward and make this happen.

RECEPTION

An enjoyable evening reception, held in the historic Hollywood Roosevelt Hotel, enabled the many delegates to the conference to meet each other and unwind after a packed day. Further amusement could be found outside the front door, watching the passing parade and sidewalk circus that is Hollywood Boulevard.

LOUDNESS WARS AT THE CINEMA

Although eminent otolaryngologist Dr Robert Sataloff, was unable to be present in person to deliver his tutorial on hearing loss, he had prepared a narrated presentation that everyone was able to absorb at the start of the second day. Sataloff reviewed the hearing system with pictures of the cochlea under different degrees of damage due to noise exposure. He explained the basics of occupational hearing loss, and the different terms of impairment, handicap, and disability that are important for U.S. compensation laws. Under OSHA regulations, levels higher than 115 dBA are not permitted, which is significant for movie theaters. Levels between 85 and 89 dB require monitoring of



Louis Hernandez Jr., chairman and CEO of Avid, gives the keynote address at the end of the first day.



During the reception on the first evening: from left, Schuyler Quackenbush, Francis Rumsey, Brian McCarty, Peter Mapp, and Tom Ammerman.

employee sound exposure, and 90 dBA for eight hours is regarded as 100% of the allowed noise dose, above which hearing protection should be employed.

A substantial project designed to evaluate loudness issues in cinemas had been undertaken by Eelco Grimm. Measurements made during a showing of the *Transformers* movie (which is aimed mainly at children) exhibited peak levels of 134 dB (slow), and a 50-minute averaged level was greater than 100 dBA. Seventeen movies in a survey peaked more than 115 dBA (which had been quoted by Sataloff earlier as the legal maximum). Belgian law now limits Dolby fader settings in cinemas to 4.5, way below the standard setting of 7 that was originally intended. Grimm discussed adapting the ITU-R BS.1770 loudness standard for the cinema, proposing a measure called PLcin for the average loudness of a movie, that used the K weighting curve, and was adapted to Dolby fader scaling. This would be encoded in metadata and the film replay level set accordingly by the projectionist. An average loudness of

–27 LUFS was proposed, with a distinction between dialog movies and action movies.

In a subsequent paper on loudness and dynamic range in popular music, Michael Oehler and his colleagues showed that songs have become sadder and slower in recent years, for some reason. The loudness has increased and the dynamic range decreased, there being more LF in recent songs. This did not seem to be dependent on chart rankings.

OPPORTUNITIES AND CHALLENGES IN THE TRANSITION TO STREAMED DELIVERY OF AUDIO CONTENT

Everything is moving in the direction of streaming and downloads, said Roger Charlesworth of the DTV Audio Group, at the start of a workshop on the above topic. Members of the panel included Sean Richardson of Starz Entertainment, Jeff Riedmiller of Dolby Laboratories, Jeff Dean of Meridian Audio, and Tim Carroll of Telos Alliance. Physical media are still important for music, particularly in Japan and Germany, though. Despite the prevalence of downloads as the means of delivery, no one on the creative side is getting rich from them, although there is potential for financial reward on the side of the labels. New services will move forward if the technical solution is compelling enough, without waiting years for ratification of standards. It's still the "Wild West" in this field, however,



Eelco Grimm discussed loudness proposals for cinema reproduction.



Roger Charlesworth chairs the session on streaming audio

it was suggested. Proprietary market chains are not interoperable and music delivery is highly fragmented. In general one should avoid preconditioning content for streaming, it was recommended. This allows audio to be encoded once and scaled for different media devices.

There followed three research papers on diverse topics, one by Andrew Mason on adaptive audio reproduction using personalized compression, a second by Gavin Kearney on auditory distance perception with static and dynamic binaural rendering, and a final one on using a binaural spatialization tool in current sound postproduction and broadcast workflow by Pierre Bezaud and his colleagues. These can all be found in the formal conference proceedings and AES E-Library.

HEADPHONES: DESIGN, PERFORMANCE AND ENTERTAINMENT CONTENT PRODUCTION

During the afternoon of the second day there was an extensive session on headphones, as these are fast becoming the predominant mode of listening for many people. Bob Schulein chaired the session and introduced the basics of binaural reproduction, emphasizing the importance of visual cues in overcoming some of its limitations (what he called cognitive dissonance). Sennheiser had generously sponsored the session, providing wireless headphones for the entire audience to be able to hear the demonstrations.

Tom Ammerman then described the headphone virtualization of spatial audio formats, with a demonstration of a spatial audio design package capable of authoring for any loudspeaker layout and for sound objects. He pointed out that 85% of people listen on



Headphone reproduction was Bob Schulein's topic on Day 2.

headphones, so we have the chance to create something new for them in 3D. Ammerman described immersive audio for computer games, using a system in which audio objects can be mapped to any speaker layout. He gave a demo of Doom 3 in 50.1 surround on headphones.

Making repeatable headphone measurements was the topic of Tad Rollow's presentation, in which he explained that there are a lot of different standards and a number of methods using a head and torso simulator. Todd Welti then talked about preferred alignment curves and headphone equalization. One might want to equalize headphones to flatten the response or to aim at a certain target curve that is



Tom Ammerman explains authoring of 3D content for headphones.



The audience enjoys listening to the headphone demonstrations, courtesy of Sennheiser's wireless sets.

preferred by the majority of listeners. He had found that leakage around headphone surrounds caused large variations at LF on human subjects, so he had made a modified softer artificial pinna and done lots of repeated measurements to confirm stability. With regard to target curves, Welti had found that people tend to prefer a slight bass rise and about a 1 dB roll-off at HF.

Martin Walsh introduced DTS Headphone:X, designed to make high-end audio more accessible over headphones. A reference equalization is employed to deal with the massive difference that exists between consumer headphones, tailoring them so as to meet the reference response. There are various other specifications in the certification program, such as distortion performance, and content mixed for headphones is also certified.

OBJECT-BASED BROADCASTING

According to Frank Melchior, accessibility is one of the main aims of developments in object-based broadcasting. Content could be adjusted to users' needs, but the current infrastructure is not set up for this. We are missing the distribution and rendering technology. Immersion is another important feature of object-based technology, in that it can help to future-proof content so that one version can be reproduced over different reproduction layouts. Binaural delivery is also enabled this way, allowing dedicated mixing for headphones, but first it's necessary to prove that the audience wants this. To that end a survey had been done and a strong preference had been shown for a binaural pilot production over conventional stereo with headphone listeners. Interactive features are enabled too, with users getting control over what they hear and see—the BBC is using a web API to test some of these offerings. Frank went on to describe a project known as Responsive Radio, in which objects are delivered to a browser that assembles a program according to users' wishes. It can be made as long or as short as desired, not by changing the speed but by actively editing the content. In order to facilitate object based content production, the EBU's open-source Audio Description Model (ADM) was released on March 12.



Frank Melchior discusses object-based broadcasting

A compelling demonstration of particle-based handling of audio signals was then given by Nuno Fonseca, being a concept widely used in graphics systems, where the content is broken up into tiny units for mapping to different spatial locations. It is ideally suited to content such as fire, smoke, dust, rain and so forth. Instead of controlling each particle directly, a limited set of parameters is used to govern the behavior of the particle system at a macro level. Nuno demonstrated a software prototype that enabled sound particle motion to be captured with different virtual microphone setups from mono to immersive formats. He addressed the question of how particles could be handled as audio objects as there could be many thousands of such particles. The solution proposed involves a hybrid channel/object model in which each channel is treated as an object. He showed three impressive examples of immersive audio DCPs (digital cinema packages) made up of particle sources, and explained that a public beta of the system is available for people to try.

There followed two papers on object-based media production, the first from Alejandro Gasull Ruiz and his colleagues from Fraunhofer, the second from Ulli Scuda and colleagues on using audio objects and spatial audio in sports broadcasting.

TOUR OF UNIVERSAL STUDIOS

In the evening of the second day there was an optional tour of Universal Studios, not far from the conference venue, during which delegates got the chance to visit the sound department. The tour included a demo screening of the movie *Unbroken* in Dolby Atmos, presented by seven-time Academy Award nominated mixer Frank Montaño. The screening took place in the historic Alfred Hitchcock Theater, equipped with the largest available Atmos system (91 speakers), Auro 3D, & Imax. The tour also included a look at the machine rooms and TV mix stages.

IMMERSIVE AUDIO DAY

The last day of the conference was dedicated to immersive audio, and chaired by Francis Rumsey. During the first hour, Rumsey's keynote charted the history of immersive audio and the various abortive attempts there have been to get it off the ground. As with surround sound before it, it seems that movies are the key to successful introduction of a new immersive audio format, with audio

alone not being a sufficient driver. Rumsey reviewed the various standards efforts that are taking place in the ITU, EBU, ATSC and SMPTE, among others, aimed at coordinating delivery and interoperability, and he highlighted some of the key challenges that face

the industry if it is to move forward successfully in this area. As ended up being repeated numerous times during the rest of the day, one of the most important and yet relatively ignored parts of the signal chain is the increasingly important rendering device that converts immersive audio content and metadata into a suitable spatial reproduction over whatever loudspeaker array is available. There is no point specifying the rest of the chain and the delivery format very carefully if we don't know what the rendering device will do, or what its performance is.

Following the keynote, three research papers were presented on aspects of immersive and spatial audio. Jens Ahrens looked into the properties of large-scale sound field synthesis, Hervé Desjardin and Edwidge Ronciere spoke on how Radio France is making available immersive audio to the public using a website and binaural audio, and Matthias Frank discussed the production of 3D audio using ambisonic tools.

CINEMA DELIVERY STANDARDS

Brian Vessa, chair of the SMPTE working group on the topic, chaired a workshop on delivery standards for immersive audio to the cinema, with Ton Kalker of DTS, Bert Van Daele of Auro Technologies, Charles Robinson of Dolby Laboratories, and Brian Claypool of Barco. It's a good period, Vessa said, as there is increased interest in quality and the public is beginning to notice. He reviewed immersive audio terminology and some basic psychoacoustics, moving on to talk about work flows for immersive audio. These are complicated, requiring separate workflows for Atmos, Auro, and MDA

(DTS's open standard for immersive audio description); one also needs different home and cinema exhibition versions. We need standards because of a lack of interoperability, which currently makes work flows inefficient and costs high. The National Association of Theater Owners and the Digital Cinema Initiative have asked for a common standard. We also need to be able to take a cinema mix and repurpose it for the home in a simpler fashion.

In the cinema the immersive sound has to be rendered through



The lucky delegates booked on the tour arrive at Universal Studios.



Explaining the super-wide mixing desk at the Universal dubbing stage.



Francis Rumsey gave a keynote talk on immersive audio.

whatever loudspeaker system is available, but one SMPTE DCP should be usable in any theater. It seems that agreement has been reached on using a Cartesian coordinate system for describing the locations of audio objects, but they still need to define the metadata and file formats precisely. There's also the question of the data security of these DCP files.

As Ton Kalker pointed out, when loudspeaker layouts and acoustics are not the same, and there is a renderer in the way, we cannot expect the same results between the mixing stage and the cinema. They will be similar but not the same, so trust has to be developed if a universal delivery format is to be introduced. We have already achieved this to some extent with 5.1, although the issues are less complex. Charles Robinson hoped that the engineer-listener link would not be broken in the quest for a universal format, saying that his company would do all it could to preserve this for cinema applications. Bert van Daele suggested that any standard should allow companies to preserve the quality they want to guarantee with proprietary systems, while Brian Claypool suggested that most novice listeners find little difference between 5.1 and immersive audio. We therefore need mixes to be more persuasive, he argued, and training is really important.

Some of the discussion in this session centered on the need for mixing rooms with hybrid or different replay systems so that mixers can hear the results, as well as the need for a more clearly specified renderer, otherwise no one knows what they are aiming at. It's almost impossible to define the metadata without knowing the characteristics of the renderer that will use it to generate the immersive result over loudspeaker arrays. There was also some discussion of how far such a standard should go, whether we need to wait for everything to be fully determined before fixing a description and file format, and whether it will be possible to objectively qualify renderer performance. We will end up making a compatible mix, suggested Vessa, so it will be the mixer's responsibility to decide what is acceptable. According to Kalker, we cannot possibly cover every possible configuration, so we need to come up with some representative profiles that exercise all the metadata, use listening tests with a reference renderer to check the results, assuming various different loudspeaker layouts.

In summary, it was suggested that the quicker we can get



A SMPTE-sponsored cinema delivery standards panel was chaired by Brian Vessa.



Juha Backman asks a tricky question.



Jens Ahrens discusses sound field synthesis.

immersive content to the cinema the better for the market, elevating the experience for everyone. If we standardize too much we leave no room for innovation, and "we can't bolt everything down too early." Getting the most important things done first and then extending the standard seemed to be a way forward.

IMMERSIVE AUDIO DEMOS

Just before lunch, the audience was presented with a demonstration of some movie clips in the Atmos format, over the system installed in the theater, and Matthias Frank's demonstration of the ambisonic 3D production tools, prerendered for the Atmos array in the theater.

SPATIAL AUDIO PAPERS

Three further research papers followed after lunch. Etienne Hendrickx asked "Does Stereoscopy Change our Perception of Soundtracks?" Thomas Sporer looked into the localization of audio objects in multichannel reproduction systems, and Mark Vinton and his colleagues described next-generation surround decoding and upmixing for consumer and professional applications. These papers can all be studied in the conference proceedings and E-Lib.

INTEGRATING OBJECT-, SCENE-, AND CHANNEL-BASED IMMERSIVE AUDIO FOR DELIVERY TO THE HOME

The first of the afternoon's workshops dealt with the question of whether and how object-, scene-, and channel-based immersive audio can be integrated for delivery to the home. In the home there is likely to be a reduced reproduction setup compared with the cinema, and people could be using headphones, sound bars and various other transducers. Audio can also be delivered to the home using a range of technologies such as streaming, broadcasting, download, and physical media. Panelists here were Schuyler Quackenbush representing MPEG-H, Jean-Marc Jot of DTS, Brett Crockett of Dolby Labs, and Wilfried van Baelen of Auro Technologies. There are many ways of describing immersive audio content, and the panel looked at how these can be integrated in various ways for delivery to the consumer, for replay on a wide range of devices. While object-based audio is not synonymous with immersive audio, it is often



Thomas Sporer explains how audio objects are localized.



Schuyler Quackenbush discusses the principles of MPEG-H.



Wilfried van Baelen describes the delivery of Auro 3D to the home.

talked about as if it is. In fact it is just one tool for enabling multi-channel audio to be delivered in a flexible way that allows for a degree of remixing and remapping at the rendering stage. There is an ATSC 3.0 call that invites technology proposals for dealing with these issues in a U.S. broadcast context, where interactive facilities are combined with immersive delivery capability.

HOW TO MAKE BIG SMALL—CAN WE REALLY BRING IMMERSIVE SOUND TO THE HOME?

The final session of the day considered the question of “how to make big small,” asking whether and how immersive mixes designed for the large screen can be translated for consumer contexts, the challenges of designing rendering devices that can give a convincing impression over reduced loudspeaker setups, sound bars, headphones, etc.

Frank Melchior of the BBC argued strongly for a “baseline renderer” that would provide a reference point specifying the minimum functionality and performance that upstream systems could assume. There was general agreement that we are placing a lot of expectations, both in the cinema and in the home, on the “magic” rendering device that is given the job of converting the immersive content and meta-data into a convincing sonic result, given the replay system and layout in question. Unless we can know more about the performance of such renderers, and specify them more closely, it is very difficult for anyone working upstream to know what the end result will sound like.

Brian Vessa discussed translating immersive cinema mixes to the home, including the challenges and compromises for the studio. He pointed out that a well-mixed track usually works surprisingly well in the home and that mixers don’t seem to be “cranking up the high end to compensate for the X-curve.” The aim is to translate the mixing intent into a smaller space with lower playback volume and a smaller spatial image. This cannot be automated, it was proposed. Adjustment of the dynamic range is the most common thing done to home mixes, but they hardly ever adjust overall EQ.

Arnaud Laborie described the engineering of a home cinema processor to handle immersive audio. This involved loudspeaker remapping as well as room and loudspeaker optimization. It’s necessary to measure where the loudspeaker is in the room and adapt accordingly, he said, then the results should be accurate no matter where speakers are placed. This process uses a sophisticated 3D microphone to measure the loudspeaker locations based on a test signal. The system he described works with Dolby Atmos, DTS:X, Auro 13.1, and MPEG-H formats.

WRAPPING UP

Brian McCarty and Sean Olive closed the conference with a summary of the action points and key conclusions reached during the con-

ference. They also thanked the dedicated conference committee for its efforts in bringing about such a successful event: Keith Holland and Sunil Bharitkar, papers chairs; Bob Shulein, headphone and binaural sound chair; Francis Rumsey, immersive and spatial audio chair; Peter Mapp, dialog intelligibility chair; Neil Shaw, facilities; Linda Gedemer, student volunteers coordinator; and Garry Margolis, treasurer.



Linda Gedemer, student volunteers coordinator

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