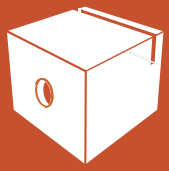

EARLY VISUAL MEDIA LAB

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DOLBY ATMOS

A BREAKTHROUGH IN CINEMA SOUND?

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Abstract

Today one could argue that cinema has reached a point of 'technical perfection', certainly the closest that we have been to what Bazin denominated "total cinema". Film art has constantly evolved in parallel to technological developments, which have gradually moved forward towards the 'achievement' of such a total cinematic experience. In terms of audio, the cinema is today able to absorb us with sounds that emanate from around and above the audience, creating this way highly realistic—although imaginary—three-dimensional worlds. Under this premise, this article aims to explore the technical characteristics of *Dolby Atmos*, an object-based sound system that has consolidated its position as the leading solution for the production and delivery of immersive cinematic sound. The potential and challenges that this platform presents will be analysed here considering the opinions of several sound professionals, which shall give us clues regarding a better utilization of Dolby's most advanced sonic platform.

Keywords: *Dolby Atmos; Immersive sound; Object-based audio; Cinematic sound design; Three-dimensional sound*

In the fifties, Bazin (1967) argued that "with panchromatic stock in common use, with an understanding of the potentials of the microphone, and with the crane as standard studio equipment, one can really say that since 1930 all the technical requirements for the art of cinema have been available" (p. 30). If such a claim was made based on the technology that was available during that time, today one could argue that cinema has reached a point of 'technical perfection', certainly the closest that we have been to what Bazin denominated "total cinema" (1967, pp. 17-22), namely a cinematic experience that could offer "a total and complete representation of reality; […] the reconstruction of a perfect illusion of the outside world in sound, color and relief" (ibid, p. 20).

Film art has constantly evolved in parallel to technological developments, which have gradually moved forward towards the 'achievement' of such a total cinematic experience. In terms of audio, the cinema is today able to absorb us with sounds that emanate from around and above the audience, creating this way highly realistic—although imaginary—three-dimensional worlds. Under this premise, this article aims to explore the technical characteristics of *Dolby Atmos*, an object-based sound system that has consolidated its position as the leading solution for the production and delivery of immersive cinematic sound. The potential and challenges that this platform presents will be analysed here considering the opinions of several sound professionals, which shall give us clues regarding a better utilization of Dolby's most advanced sonic platform.

Channel-Based vs Object-Based Audio

For many years, the intention of sound technology developers has been to offer audio tools capable of recreating reality as accurately as possible, that is, their aim has been to give filmmakers the possibility of creating lifelike three-dimensional soundtracks. Today, a film's soundtrack is normally delivered as channel feeds (channel-based audio) or as spatial scene descriptions (object-based audio). Channel-based audio systems deliver each channel of audio to a specific loudspeaker (normally a group of loudspeakers) in the cinema. Object-based audio, on the other hand, defines sound elements—audio objects—with individual metadata that indicates how they will be reproduced during playback (Füg, Marston and Norcross, 2016, pp. 1-2).

Channel-based technology is still the most common way of using audio for cinematic and broadcasting purposes. Traditional digital surround sound formats such as 5.1 and 7.1 are examples of two-dimensional channel-based audio layouts, the X-axis being represented by the front speakers, and the Y-axis by the surround speakers. Dolby Laboratories refer to *Dolby Digital 5.1* as "the established standard for home theater, broadcast, and cinema surround sound" (Dolby, 2022a). Dolby Digital 5.1 integrates five discrete full-range channels and a sixth channel that carries the low-frequency effects (LFE). The '5' full-range channels are connected to specific speakers/arrays distributed in the cinema in the form of left, center, right, left surround, and right surround, whereas the '.1' channel goes in the form of a subwoofer (twice as loud as the other channels) located in front of the audience. Fig. 1.1 illustrates a typical Dolby Digital 5.1 cinematic configuration.

Further developments were then gradually launched by Dolby and its competitors, establishing the 7.1 format (which divides both surround channels into two) as the upgraded alternative to the 5.1 layout.

Furthermore, in the ongoing quest for improving realism in cinema, developers have recently introduced more advanced sound platforms that add more loudspeakers around and above the audience, moving from what has been commonly known as surround sound to what is currently referred to as *immersive sound*. Auro Technologies in partnership with Barco, announced in 2011 a three-dimensional channel-based audio system by the name of *Auro 11.1*. Whereas surround sound systems like Dolby Digital 5.1 are two-dimensional, Auro 11.1 adds the third dimension (height), with a determined number of overhead speakers (Claypool, et al, p. 2). Although the 11.1 sound format is clearly more immersive than the traditional 5.1 configuration, it is also less practical as its improvements are based on increasing the number of channels, which is one of the limitations of channel-based audio (Lossious and Anderson, 2014, p. 1338). Hence, as a response to the need of a single and open format for immersive sound, three competing companies launched a new generation of immersive sound systems designed under an object-based approach. Dolby Laboratories developed its latest cinematic sound innovation, *Dolby Atmos*, DTS launched *DTS:X,* and Auro Technologies in its alliance with Barco introduced *AuroMax*.

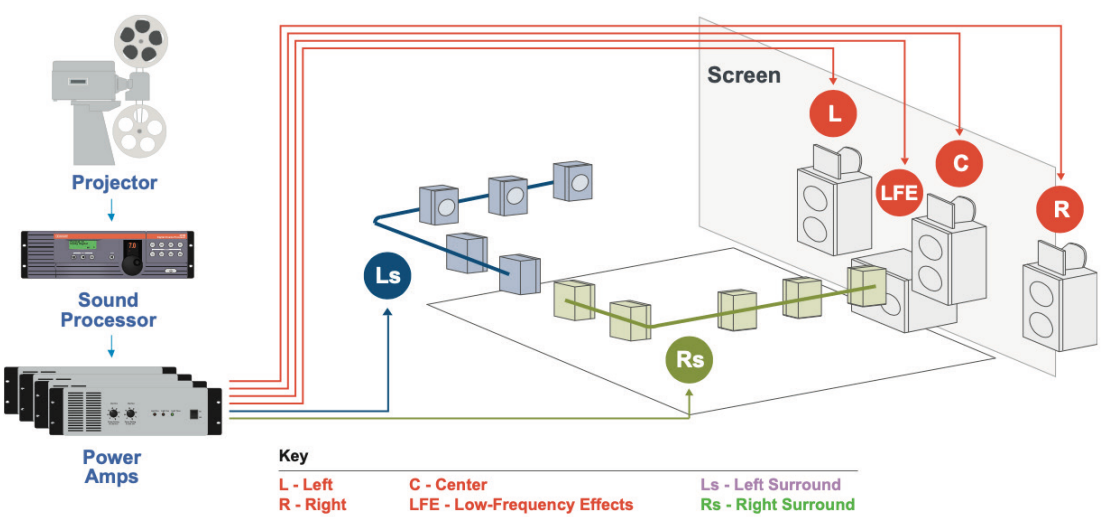

Fig. 1.1 Dolby Digital 5.1 Configuration

Considering the need for a more versatile way of delivering audio content, object-based sound platforms are channel agnostic. Their technology is not based on a determined number of channels but on audio objects that can adjust to any speaker layout. In channel-based audio, the sound mix had to be made for a specific speaker configuration, such as stereo, 5.1, 7.1, 11.1 etc. On the other hand, in object-based audio, the spatial position of sounds can be defined in relation to speaker-independent 3-D coordinates (Oldfield, Shirley and Spille, 2013). The process of playing back audio objects is based on information that determines the location of each object in relation to the position of the available loudspeakers (Zhang et al, 2017, p. 8-9). Moreover, object-based audio can be *down-mixed* to a variety of formats depending on the sound system that is available, covering the traditional 5.1 and 7.1 to more immersive configurations that include overhead loudspeakers (Oldfield, Shirley and Spille, 2013, p. 2719).

Rob France explains that in the production side of the chain, there is nothing particularly new about object-based audio. An object, he says, is basically an audio track with some positional metadata. It is important to notice that although object-based systems make use of audio objects, their mixes include two types of audio content: beds and objects (Auro Technologies and Barco, 2015, p. 14). The so-called beds are basically surround stems addressed as arrays to be reproduced on a group of loudspeakers (Rumsey, 2013, p. 343), they integrate channel-based content—such as music and atmospheres—that does not require to be treated under an object-based approach. Beds are typically more static and do not take specific positions in the mix, hence they can be rendered as channels or 'static objects' (Auro Technologies and Barco, 2015, p. 15). Hence, beds can be created out of traditional multichannel configurations like 5.1 or 7.1 or based on more immersive formats with overhead speakers like the 7.1.2 layout. For the sake of example, a 7.1.2 bed is a 10-speaker layout, which adds 2 overhead speakers to the common 7.1 setup as explained below:

> [7] Refers to the number of traditional surround speakers (left, center, right, left surround, right surround, back surround left, back surround right).
>
> [.1] Refers to the number of powered subwoofers.
>
> [.2] Refers to the number of overhead—or Dolby *Atmos* enabled speakers (Dolby, 2018c).

Objects, on the other hand, are all those elements that can be precisely localized and moved through the speakers across the auditorium, and hence are individually rendered with metadata that indicates their position for playback, their size, diffusion and other sonic characteristics (Rumsey, 2013, p. 342).

The hybrid functionality of this new format asks for production and postproduction workflows that integrate beds and objects within the same mix, exploiting this way the capabilities of each mode to the full. Given that Atmos has consolidated its position as the global leader in immersive audio, we will now focus on exploring the technical specificities of this system.

What is Dolby Atmos?

Since its theatrical debut in Pixar's *Brave* (2012), Dolby Atmos has gradually achieved the top position in the field of cinematic immersive sound. As Gianluca Sergi (2013) observes, Dolby Atmos is defined by its creators as a revolutionary immersive sound system that addresses all key areas of film sound: filmmakers have more tools, distribution is easier for studios, exhibitors get greater 'pull', and audiences enjoy more the cinematic experience. In terms of its technological design, one of the most important factors that Atmos introduced was precisely the utilization of audio objects, which, as Dolby claims, can virtually be placed anywhere to create a realistic three-dimensional soundscape (Dolby, 2018a).

Previous cinematic surround sound arrays forced the soundtrack to be reproduced within a limited number of channels, while in Atmos, in its full configuration, there are up to 64 individually driven speakers available, each one of them offering full frequency response. Every speaker is powered independently and gets its own separate audio feed, meaning that in contrast to the traditional channel-based configurations where several speakers are part of the same zone (e.g. left surround zone, right surround zone, etc.), each speaker in an Atmos configuration gets to be its own independent zone. These speakers are not only located horizontally, as Atmos adds a vertical dimension with two overhead speaker arrays. Moreover, Dolby Atmos adds more speakers around the auditorium (Fig. 1.2), which provides better localization capabilities, increased definition and improved audio-visual coherence.

The ability to precisely position sources anywhere in the surround zones also improves the audio-visual transition from screen to room. If a character on the screen looks inside the room toward a sound source, the mixer has now the ability to precisely position the sound so that it matches the character's line of sight, and the effect will be consistent throughout the audience. Moreover, Dolby claims that Atmos is their first 'room-centric' sound system, meaning that the 'sweet spot'—the zone in the theatre in which the spectator gets the optimal listening experience—is no longer a concern because sounds get to any member of the audience with equal power, range and directionality (Sergi, 2013, 111).

Surround speakers in the traditional theatrical sound systems (e.g. Dolby Digital 5.1) offer a reduced amount of power and frequency response compared to the screen channels. This is clearly a limitation during mixing, as panning sounds from the front to the surround channels leads to notable differences in level and timbre matching. Atmos addresses this problem with the implementation of identical full frequency-range loudspeakers, improved room equalization, and bass management. For better results, besides the subwoofer traditionally located behind the screen, Dolby suggests the implementation of two additional subwoofers located on each side wall. Additionally, to smooth the transit of sounds from screen to room and vice versa, Dolby recommends installing side surround speakers along the whole length of the wall.

Karlsson explains that a Dolby Atmos master file has the capacity of packaging 118 audio objects plus a bed—e.g. 118 objects plus a 7.1.2 bed (Personal interview, 2019). The

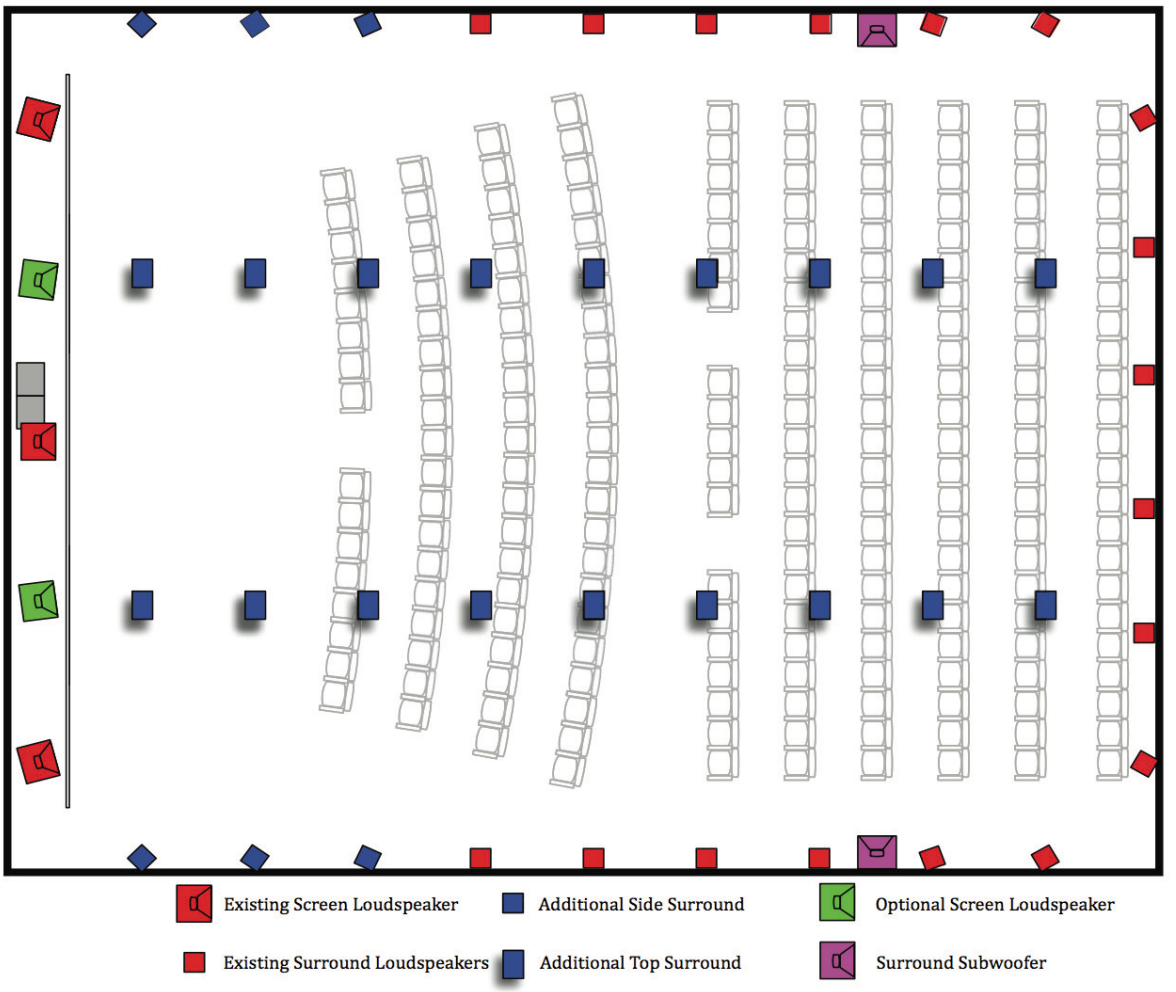

Fig. 1.2 Dolby Atmos Theatrical Configuration

beds are mapped to the speaker or speaker array assigned to each channel, while the objects are rendered in real time and positioned based on the physical location of the loudspeakers available in the auditorium, up to a maximum of 64 loudspeaker outputs (Dolby, 2014). France observes that rendering is the process of mapping beds and objects into the speaker or headphone environment that is available. For example, if one wishes to render an Atmos mix into a listening environment that has a 5.1.4 speaker array, the mixer will have to set the renderer up to derive those 5.1.4 channels, which will position each audio source into that configuration depending on their positional metadata (France, 2019). "It is a clever sort of bussing and panning structure ultimately" (ibid).

The key thing, France explains, is that Dolby Atmos uses different renderers that will work for each specific environment, so if physical speakers are available—a 7.1 theatrical layout, for instance—then it would be adequate to use a renderer that will spread the audio elements in a typical channel-based manner; but if the intention is to deliver the mix onto headphones, then the renderer should be consistent with that individualized listening environment. Ultimately, the renderers "are trying to take the best content you have created and reproduce it as close as they can with ultimately the speakers or the headphones that are available at that time" (ibid). With-height Atmos content can thus be rendered to traditional multichannel formats, which eliminates the need of having different mixes for each deliverable. Dolby Atmos can produce automatic re-renders to traditional channel-based formats like stereo, 5.1 and 7.1, which derive from the original Atmos master file (Connor, 2017).

Karlsson explains that Dolby Atmos offers mixers the possibility of having a live feedback of a 5.1 or a 7.1 channel-based downmix while they are still mixing in object-based Atmos (Personal interview, 2019). He argues that "by thinking of sound in the 3-D space the quality of the 7.1 and 5.1 mixes that come out of it is higher, because when thinking more about sound in the 3-D space the surrounds just naturally sit better where they want" (ibid). Sound practitioner Enrique Greiner confirms this asseveration by noting that a 7.1 downmix from Atmos is much better than a native 7.1 mix. "The way to position things, and how they move, Atmos translates it to 7.1 in a much better way than if you had mixed it directly in 7.1" (personal interview, 2019, translated by author). Similarly, sound practitioner Javier Quesada asserts that the process of downmix from Atmos to 7.1/5.1 "is incredibly transparent". Quesada believes that

> Atmos has achieved this convertibility like no other format, starting from Atmos and going down to 7.1, 5.1, LCR, web. It is part of the virtues of Atmos, you do not have to worry about making various mixes. You do the Atmos mix well, and you can be sure that it will translate well. (personal interview, 2019, translated by author)

In the DCP (digital cinema package), a Dolby Atmos mix is hence stored along with other rendered deliverables (e.g. Dolby Digital 5.1 or 7.1), allowing the reproduction of different formats when necessary without the need of additional workflow steps for creating the 5.1 or 7.1 versions. Consequently, if a particular theatre is not equipped with Dolby Atmos, for

instance, compatibility is still assured as the DCP contains a rendered 5.1 (or 7.1) version of the mix.

And besides its strong engagement with cinematic theatrical reproduction, Dolby Atmos has also innovated the home entertainment industry with Atmos-enabled products such as AVRs, soundbars, mobile phones, tablets, games, PCs, headphones and more. Moreover, aiming to become the new standard for home entertainment, Dolby Atmos is now available on digital media players such as Apple TV or Amazon Fire TV, and within video-on-demand services such as Netflix, Amazon Prime, Vudu, and iTunes (Dolby, 2018a). Ultimately, says France, "the aim of Dolby is about bringing immersive audio everywhere […] So we want immersive audio to be there on whatever platform the consumers listen on" (Personal interview, 2019). In June 2017, Netflix released Bong Joon-ho's *Okja* (2017), its first Atmos-enabled content; and nowadays the streaming giant offers a variety of original and third-party films and TV shows with Dolby Atmos soundtracks—e.g. *Guardians of the Galaxy 2* (2017), *Mowgli: Legend of the Jungle* (2018), *Roma* (2018), *Extraction* (2020) and others.

In this regard, Rob France acknowledges that in the consumer space, many people that have a Dolby Atmos enabled system at home do not install speakers in the ceiling (France, 2019). That market, he says, "is less than 1% of the potential costumers out there" (ibid). Therefore, Dolby had to develop other technologies that permit to bring the immersive experience to the home. One of these solutions are the so-called 'up-firing'[1] speakers, which aim to simulate the existence of overhead elements by bouncing the sound waves off the ceiling as illustrated in Fig. 1.3. This technology works through a combination of *psychoacoustic signal processing* and *speaker directivity and angling* (Dolby, 2016), the former being conducted by the modification of certain frequencies through filtering, while the latter being achieved by firing the acoustic energy upward (ibid).

All these capabilities have encouraged the adoption of Dolby Atmos, which is gradually becoming the new standard of cinematic sound mixing and reproduction. To date[2], over 2080 features have been released (or committed) in Dolby Atmos, there are more than 6900 Dolby Atmos screens installed (or committed) within more than 100 countries, over 70 multiplex offering Dolby Atmos theatrical exhibition, and over 240 Atmos-equipped mixing facilities (Dolby, 2022b), which includes all US major studios and most leading post-production-houses around the world (Sergi, 2013). Dolby asserts that 79% of costumers prefer an Atmos enabled theatre and a stunning 91% have reported being likely to return for a Dolby Atmos experience (Dolby, 2019). Matt Cuson, former Senior Director of Product Marketing, Cinema Products at Dolby Laboratories, highlights that "[t]he long-term goal […] is for (Atmos to be in) 'every movie and every theatre'" (Fuchs, 2012, as cited in Sergi, 2013, p. 108). Karlsson asserts that

> the rate of adoption of Dolby Atmos has been faster than Dolby Digital ever was in 1991 onwards. And

1. Also referred to as Dolby Atmos enabled speakers.
2. As of 5th June, 2023

that's part because of Dolby's experience in working with the content creators […], the exhibitors, the cinemas themselves and what they need and how they can do it, and how we distribute these mixes everywhere […] The cinema is becoming, for Dolby Atmos, quite a mature market, it is not a question now of is it going to last?, it is more a question of when are you going to put it in? (Personal interview, 2019).

For *Roma*'s (2018) sound designer and supervising sound editor, Sergio Diaz, Atmos is "the ideal format for all types of films"; he observes that Atmos "should become the universal platform" (personal interview, 2019, translated by author). With Atmos, Diaz asserts, "you really go into the heart of each moment, the only thing you do is enriching the scene more and strengthen the film through immersive sound" (ibid). Academy Award winner Skip Lievsay, who has worked as

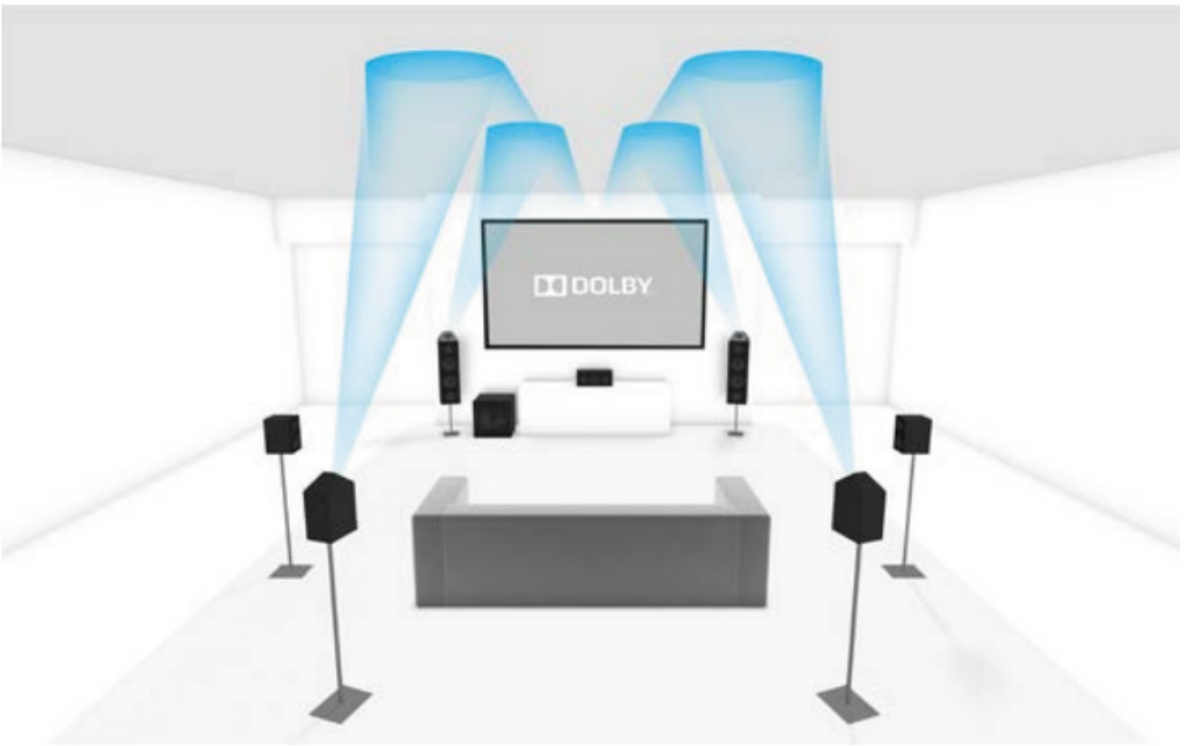

Fig. 1.3 Dolby Atmos 'Up-Firing' Speakers

sound designer/supervisor and re-recording mixer for filmmakers like the Coen Brothers, Darren Aronofsky, Alfonso Cuarón, and others, comments:

> I think Dolby Atmos is a great format because it has a kind of unlimited potential. You can do minimal Dolby Atmos movement and panning, and you enjoy increased fidelity in theatre. Many more high-quality channels than normal 7.1 or 5.1, and the potential to really move stuff around and get the soundtrack moving and the excitement that that creates I think is a real breakthrough for cinema sound. (personal interview, 2019)

Undoubtedly, "[a] powerful weapon such as *Atmos* can create a large disruption, hence a substantial window of opportunity for change" (Sergi, 2013, p. 118). Sergi (2013) suggests that Dolby Atmos is a good reason to start changing the way sound and image departments collaborate. To fully exploit Atmos' cinematic capabilities, this immersive sound platform challenges filmmakers to adopt a sound design approach that integrates with the image earlier in the production process. As Karlsson asserts, "the more people understand about Dolby Atmos, the more they can then engage on how they want to do the production part of the project" (Personal interview, 2019). In this regard, Academy Award winner sound designer/supervisor and re-recording mixer Randy Thom comments:

> I think [Dolby Atmos] is potentially a great tool, I think that we need to figure out how to use it well […] [*Gravity*] is a great example of a first solid first step in terms of using it well and there have been several other films that I think have used it well. But I think in order to take full advantage of it you need to write for it, to design a scene for it […] But unfortunately the way it is now, just like with the rest of sound, we do not have a plan like that, we do not start out with a plan and everything just kind of falls out the way it falls out and very often it does not make any sense of visually to try to impose that kind of soundscape. And so, your hands are tied sonically because the scene has not been designed for it […] We need to find ways to at least simulate that kind of sonic environment as early as we can in the process (Thom, 2015).

Dolby Atmos: An Opportunity for Change

As Randy Thom notes, Alfonso Cuarón's *Gravity* (2013) stands out for effectively utilizing Dolby Atmos. In this film, Cuarón offers a completely three-dimensional soundtrack, with all kinds of sounds (including dialogue) moving around and above the auditorium depending on the position of the sound sources in the three-dimensional space of the movie. Such a creative decision was—among other factors—able to work effectively thanks to the capabilities of Dolby Atmos. Sound practitioner Emma Butt comments:

> I think [Dolby Atmos] is giving us a chance to get directors to see more ways of using sound to help enhance their film, and I think that's only a good thing. The more they understand about it and the more they try things out and they experiment with it, the better because it gives Dolby Atmos the chance to

> grow and become bigger and become basically the new 5.1, become widely used by all of us. (Personal interview, 2019).

In previous channel-based formats made from arrays of surround speakers, putting dialogue in the surrounds meant that it was going to sound coming out of a group of speakers. This, Karlsson comments, "never felt natural because when I'm talking to you it is a discrete sound from one acoustic source. Whereas, in the cinema there were […] seven or eight of these acoustic sources talking to you" (Personal interview, 2019). Nowadays, with Dolby Atmos and its object-based technology, "you can discreetly move a voice around the room, and it still sounds like this point source effect" (ibid). Therefore, according to Karlsson, Dolby Atmos opens the possibility of breaking the screen-centric convention and using dialogue better (ibid). Yet, in relation to the panning of dialogues, sound practitioner Emma Butt argue that:

> directors don't understand [Atmos] yet, and that's a big problem. So, in traditional 5.1 mixes dialogue is always centered, and it doesn't move. You can move it slightly if the characters move from left to right onscreen, but it is very rare that your dialogue will ever come to the side or back speakers, it is unusual. And as soon as you do that to a director and you play it to them, if you move their dialogue anywhere else in the room, they don't understand it. They don't understand why they are not hearing it right in front of them. And I think until directors understand sound more, we are not going to see enough creativity happening with Dolby Atmos. (Personal interview, 2019).

Re-recording mixer Dan Johnson explains that when using channel-based systems, such as Dolby Digital 5.1, it is difficult to put dialogue on the surround speakers because they are "generally not as good as the screen speakers. They are smaller, they are hidden somewhere, they are behind something, they have single drivers, they haven't got bass, they haven't got top treble" (Personal interview, 2019). Hence, mixers are normally very conscious with what to put in the surround speakers. Yet, he argues that with Atmos' full-range surround speakers, "there is not that kind of technical reason for not doing it" (Personal interview, 2019).

Indeed, Dolby Atmos and the latest advances on spatial sound mixing and reproduction can certainly facilitate, and in fact, in certain cases, have facilitated the creation of truly immersive narrative worlds; yet, as Kerins (2015) claims, that big potential is only feasible when filmmakers allocate enough time and money to that end (p. 147). In this regard, sound practitioner Enrique Greiner comments that if you want to use Atmos effectively you must do it since the preparation that has to take place before the film is shot, and not only for the final mix.

> If you don't do that, it's a bit like what happened with 3-D movies. There were movies that were shot in 3-D because they shot them with two cameras, but then they found a computer algorithm that did that for you also with movies that were shot in 2-D, using only one camera. So, they did a sort of trick and returned them to you as a kind of weird 3-D. Doing Atmos after a movie has already been shot is like that. (Greiner, personal interview, 2019, translated by Author)

Dolby Consultant Robert Karlsson explains that some of the best Atmos mixes that they have got have been the ones that have taken Dolby Atmos as the core mixing structure, from which all other deliverables are derived. "They follow Dolby Atmos from the shoot, maybe with the long shots to mixing it from scratch, doing most sound design and more detail using sound objects" (personal interview, 2019). Karlsson, who oversaw providing technical support for the pre-mastering of *Roma* (2018) and a variety of Dolby Atmos films, acknowledges the work of Alfonso Cuarón as being exemplar for its effective utilization of object-based technology. He comments:

> [Cuarón] has always been a huge fan of Dolby Atmos. So *Roma* has a very large number of objects in the mix, *Gravity*, they are two examples [of effective Dolby Atmos mixes] […] There are some films perhaps which have used a lot of sound objects, but because they are bombarding you a high level, in high density, there is that possibility that they are not going to be able to resolve or hear the detail of them […], you may have been better off just using the bed. So, it is about knowing when to use them in relation to how we hear and localize sound. […] The reason why *Roma* works so well at times is because there is no music and so it very much feels like a very big soundscape piece […] So every little sound you hear, and the detail is amazing. There would be other films where if there is a driving musical score throughout the whole shot, then you probably won't be able to hear that detail. (Personal interview, 2019)

In a similar way, when asked about the films that have used the full capabilities of Dolby Atmos, Dolby Specialist Rob France replied:

> The one that always stands out to me is always *Gravity*, it was one of the first movies that was done in Dolby Atmos […] None of us know how space sounds like, so they had the total flexibility to come out with their idea of what space sounded like. But having the individual voices coming out from different places in the surrounds, starting to move around, and particularly when they start to get hit in the sort of boom arm […] that swings around in the air, it is a compelling experience. (France, 2019)

Indeed, in his two most recent films, Cuarón was able to create an effective 3-D soundtrack because he planned his movies with three-dimensional sound in mind, considering the film's fictional setting as an important carrier of narrative information. In relation to Cuarón and his work, re-recording mixer Dan Johnson comments:

> He is not just a filmmaker who gets a script and thinks 'how am I going to shoot it? What is it going to look like?' He is like, 'how is it going to sound? How am I going to use my sounds?' What may work with sound that means that I can cut these lines from the script or whatever it might be. He is always thinking about it from the beginning […] In a lot of productions it fills like they get to almost right at the end and they go 'right, what are we going to do with the sounds?'

Certainly, most films that have been mixed on Dolby Atmos do not exploit its spatial capabilities to the fullest, and only a few filmmakers have truly experimented with a complete three-dimensional sound. Kerins (2015) notes that a lot of filmmakers acknowledge the greater creative possibilities offered by the new immersive sound formats and recalls Cuarón's appreciation for Dolby Atmos (p. 115). Yet, Kerins points out that not all of them have shown interest on making significant changes to the ways they approach sound design in their films (ibid). Karlsson acknowledges that *Gravity* and *Roma* did a great job by exploiting the full capabilities of Dolby's most recent audio innovation, and in his opinion, there will probably be more experimentation to come with filmmakers trying to do new things. Yet, "we are still coming from a world where […] dialogue off the screen speakers is very rare […] People don't want to take risks sometimes" (ibid). For sound practitioner Javier Quesada, Dolby Atmos has a great potential, and "it's just a matter of directors and producers being encouraged to break conventions, and instead of wanting to please fans who are already used to something, betting on taking audiences to new terrains" (Personal interview, 2019, translated by author). In relation to the potential impact that Dolby Atmos can have on filmmaking, Randy Thom comments:

> I think Dolby Atmos does have the potential to change the ways films are made. I wish more film sequences were designed by the director with Dolby Atmos in mind. I think that's the way that Atmos would really be able to make a change. As it is now, I think very few directors think in terms of Atmos when they are writing or shooting their films, it's something they delay thinking about until postproduction. (personal interview, 2019a)

For Dolby Atmos to be completely exploited, those long-lasting conventions need to be adjusted. Ultimately, as Karlsson comments, filmmakers "are still figuring it out" (Personal interview, 2019).

Final Discussion and Conclusions

Dolby Atmos is undoubtedly a powerful solution, with technical characteristics that have captivated the attention of those responsible for sound design in the film industry. Sound professionals acknowledge that Atmos opens new possibilities, the most important being the alterative of spatializing music, sound effects and even the voices of characters throughout specific, discrete and full-range speakers located all around and above the audience. Although such a capability is limited to the theatrical realm, industry practitioners have confirmed the effectiveness of Atmos's rendering process, meaning that the same theatrical mix can be reproduced seamlessly at the comfort of one's home.

But beyond that, Atmos should be seen precisely as an opportunity to offer immersive cinematic experiences that cannot be found on our TV. The theatrical market's box office is losing the battle against SVOD platforms[3], which calls for new creative strategies that can work as a pull for audiences to return to the cinema. Sound design could be one of those

3. See for instance The Numbers' domestic movie theatrical market summary 1995 to 2023 (The Numbers, 2023)

strategies if filmmakers begin to seriously explore the immersive possibilities of object-based audio.

This article has gathered the opinions of several sound professionals, and all of them appraise Atmos as a highly powerful tool. Yet, the idea of transporting the audience member into the world of the movie through the utilization of an immersive Atmos mix is not always the case, and in fact, Dolby Atmos has failed to produce any major change in the way movies are made. After the release of films such as *Gravity* and *Roma*, one could have expected more of such kind of experimentation to come. The truth of the matter, however, is that only a very small portion of Atmos titles have really taken advantage of the immersive possibilities of the format. It is difficult to know what the future of cinema is going to sound like, but perhaps it is just a matter of time before we get to experience Atmos as an actual breakthrough in cinema sound.

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