STEREO – WAS A NICE TRY

Creating and Producing Immersive Music

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INTRODUCTION

Welcome to Immersive Music

When you walk around, at home or in a city, do you hear sounds in stereo? Or when you go for a walk in a park, or at the seashore? Well, no. Stereo does not exist in real life. Stereo is just a two-dimensional representation of it, one which is artificial, but at the same time one to which we are used, and therefore feels natural.
In the real world, we only hear mono signals, and those come from all around us, in 360° and are captured by two astonishing pieces of gear: our ears. Sound sources are mono, but our perception is 3D. Being immersed in sound is so real and is part of our subconsciousness. But when it comes to music, most people still think that immersive sounds are not their business.

Immersive audio technologies represent a revolutionary shift in how we experience sound. Unlike traditional audio formats, immersive audio creates a three-dimensional soundscape, enveloping the listener in a rich sphere of sound from every angle. This approach allows us to hear and feel sound in ways we never thought possible, adding depth, space, and movement that were previously restricted by stereo limitations.
Stereo was just a nice try, and the best possible solution at a certain time. In a traditional mix, sound is confined to two channels—left and right—which creates an artificial sense of space. While stereo has served us well for decades, it's limited in its ability to replicate the true spatial characteristics of the world around us. With immersive audio, however, sound is no longer locked into a fixed position. Instead, sound objects are free to move through a three-dimensional space, shifting dynamically around the listener in real time. This creates a much more realistic and lifelike listening experience, and often with a much bigger emotional impact.

Since Apple hooked up with Dolby Atmos in 2021, immersive music seems to be a recent phenomenon. But the opposite is true: 3D music is already there for half a century, and Dolby Atmos is not the only available immersive technology. It may not even necessarily be the best

one. But Dolby became the market leader in immersive music consumption and has opened many eyes for 3D audio—including mine.

Don’t Fear the Sphere

The term “sphere” might sound intimidating at first, but it's simply a metaphor for the vast, immersive sound space that Dolby Atmos and similar technologies provide. Instead of sound emanating from a pair of speakers positioned in front of you, it now surrounds you, coming from above, below, behind, and all around. Imagine the sound of raindrops falling from above, the subtle rustling of leaves from behind you, or the voice clearly positioned to the side, all seamlessly coming together in a way that stereo simply can’t replicate. This is the magic of immersive music. It's not just hearing sound—it’s experiencing it, in a way that’s closer to how we naturally perceive sound in the world around us.
Once you experience immersive audio, the difference is clear: **hearing is believing.** The sensation of sound coming from every direction is more than a novelty—it’s transformative. It deepens your connection to the content, whether it's music, movies, or video games. Sound moves fluidly in space, enhancing your perception of the environment and creating an unparalleled sense of realism. In the sphere, the boundaries between the listener and the sound blur. The result is an environment where the listener feels fully immersed, as if the sound is a part of their physical space. It's like stepping inside the audio world rather than just listening to it from a distance. Instead of looking onto a scene, like listening to stereo played over two loudspeakers, immersive music places listeners “inside” the scene (see Barrett 2022: 186).

For too long, we’ve confined ourselves to the limitations of stereo sound. Stereo has been the standard for half a century (although it exists longer than that, the real breakthrough of it was only in the early 1970s), and while it is still dominant, it’s time to move beyond it. Think of how cinema evolved from silent films to sound films, and later to surround sound. Immersive audio is the next logical step in that evolution. Just as the jump from mono to stereo opened up new possibilities, immersive audio expands those boundaries even further.
It's time to stop limiting ourselves to the two-dimensional soundscape of stereo and start embracing the potential of immersive audio. The technology is here, and it’s rapidly becoming more accessible. From headphones to soundbars to full home theater systems, immersive audio is now within reach of everyday listeners. Whether you're a casual

listener or a professional, this technology promises to change the way you engage with sound.

Embracing immersive audio is not just about upgrading your equipment—it's about adopting a new mindset: **start thinking immersive.** It's about seeing sound not as a static entity coming from a single direction, but as a dynamic, living experience that moves and evolves in three-dimensional space. Whether you're a musician, producer, mixing engineer, a content creator, or just an enthusiast, thinking in immersive terms opens up new creative possibilities and ways of experiencing audio.

Make music art again...

As we continue to explore this new frontier, we'll learn how to unlock the full potential of immersive audio. It will influence how music is composed and mixed, how films are scored, how games are designed, and how we enjoy all forms of art and entertainment. Creating immersive music is the result of skills and vision, both on the composing and recording side and the mixing and presentation side. By expanding our minds and ears to the possibilities of immersive audio, we'll be able to experience sound in its fullest, most organic form, much like how we experience the world around us.

In making music immersive, both in the production studio and the live venue, there are always two poles. On the one side there is an enhancement of the room. The main action is frontal, but as a listener you feel surrounded by the reflections of the sound source. On the other side, there is an enhancement of the source itself: it's like the sounds themselves surround the listener, without having an actual frontal sound anymore.
But in both cases, as immersive audio is immersing the listener, it is **not background music**! If you need music as a backing soundtrack when reading a book, when talking to friends, doing the dishes, or making a puzzle or a diorama miniature in your spare time, stereo (or even mono) is good enough. Even more, it often suits better than fully immersive music, which can be very distracting or overwhelming. Music that surrounds you in 360° is not wallpaper music and doesn't work that way. It is music to actively listen to. When creating and listening to immersive music, music gets a more prominent place. It needs time and space to be listened to actively.

That's why I'm not afraid to advocate the statement "Make music art again". Even when the broader audience is not entering the immersive era, and even when it just remains a hobby for a niche, that would be a pity, but at the same time that's how it is. That's why art is art. Art needs some effort, some time to open yourself to impulses from outside, to reflect. Immersive music makes this experience so much stronger that—in my experience—there is no way back. When music is finally entering the immersive era, it's time to rethink its place. Immersive audio should be an **artistic production**, right from the first compositional idea, not a technical add-on at a later stage. This needs another way of thinking. The more people jump onto this train, the better. But don't let us bring us down by those who don't care.

Overview

This book is about immersive music in all its forms, from creation and production to mixing and presentation. The writing perspective is music creation in a **home studio environment**. That should come as no surprise. It is my own habitat. I like to do everything myself, in the comfort zone of my own space: playing, writing, composing, mixing, mastering. But the home studio is also the main place for most students and beginning music producers these days. Therefore, an important focus in this book is on **educational institutions** and their curricula. Although professionals with big studios and major deals can (hopefully) benefit from parts of this book, the main focus is a warm welcome to all music creators and producers who want to embrace immersive music.

In this book I look at the several stages that are involved in creating an immersive music project. In the first part, I give an overview of the whole artistic process: the history of immersive music, how to listen to it, how to compose in 3D, some thoughts about recording and mixing it, and how to present it live on stage.
The second part is a practical guide to setting up an immersive home studio, working with a DAW, building a template, and exploring multichannel plugins.
The third part focuses on the practical mixing of immersive music. The main focus will be on Dolby Atmos, as this is currently the most important format for immersive music consumption. However, comparisons with other immersive formats will also be made. We will look at the architecture of an immersive mix, channel placement, binaural mixing, up to the delivery formats and mastering.

While the first part of the book is more “beginner-friendly,” this part contains more **advanced information**, sometimes far beyond the scope for starting producers and aimed more at experienced ones.

Disclaimer and thank you

A few things are important to notice before we start. First of all, English is not my mother tongue. I even have a more analytical mind than a linguistic one. Nevertheless, I wrote this book in English, but I used AI to check grammar and spelling. I didn’t want AI to have any influence on the content of the book, but without its grammatical help, I just couldn’t publish this book (as there is no publisher budget to invest in translation and editing).
The second disclaimer also has to do with money. Although I write about a lot of plugins from several different companies, and even publish screenshots of some of them, these are not paid advertisements. All plugins mentioned I paid with my own money (luckily, most companies offer educational discounts). In some cases, I got an extended trial period from a company, and for around five of the mentioned plugins I got an NFR license, for which I’m of course very grateful.

Typical when writing a book is that the more you’re involved in it, the more you discover, and the more you realize what you don’t know yet. Putting all this information together was a big job. The original idea was to write a book about mixing in Dolby Atmos, but it turned out to be much broader than that.
Some important subjects that I left out on purpose are all things concerning virtual reality and gaming, simply because I don’t have any experience with these (yet?).
Inevitably, this book has shortcomings and will contain mistakes. Parts of it will also be dated very soon… That’s the main reason for publishing this book as “print on demand.” I can easily correct small mistakes (and a second edition will surely follow in the future). So, if you have comments, or if you think I completely screwed up, please contact me! I would love to hear from you.

And I’m also very thankful for all the academics, engineers, and YouTubers that shared their knowledge and experience. Lots of what you will read is a combined vision of things I have heard and read; a collection of ideas formulated by different professionals. Without them, I would be nowhere. A big thank you for all who are mentioned later on

in this book and whose credits are in the reference pages. And for Kurt, for designing the cover of this book!

The last big thumbs up is for Libelia, my wife and my greatest help and support. And Barrie, for lots of husky fluff and love!

Welcome to the sphere.

PART 1

FROM CREATION TO PRESENTATION

1 “ATMOS IS A POINTLESS FAD” – A DOZEN REASONS WHY IMMERSIVE MUSIC SUCKS AND WILL DISAPPEAR (NOT!)

Before diving into immersive music creation, let us first reflect on all the skepticism surrounding 3D music. As **Dolby Atmos** is a buzzword in the music industry and is getting a lot of criticism at the same time, we start our journey with the major complaints music lovers, consumers, and people in the industry have about immersive music.
There are lovers and haters. And sometimes the haters have a louder voice. Here are 12 reasons why they think immersive music isn’t worth the hype. And I’ll try to respond to them…
But first of all: as will become clear in the next chapters, immersive music is much more than Dolby Atmos. Dolby Atmos is just one format in a bigger story, but it is the most important and best-known one. That’s why the non-believers are shouting at Atmos in the first place. Why do they think Dolby Atmos sucks and will disappear?

1.1 A Money-Making Machine for Big Companies

A critique often heard is that Dolby Atmos only exists because companies like Apple, Dolby, and speaker companies have a financial interest in pushing it: Apple wants to sell more AirPods, Dolby is promoting its own products, and speaker companies are hoping to cash in on this latest trend and sell more speakers. Of course, it’s true that business interests are behind its rise, but that’s nothing new in the world of **market capitalism**. Apple and Dolby are not promoting this out of charity. Of course, it’s a commercial business, like all (cultural and technological) businesses. I also earn money by teaching, doing mastering, and I want to sell this book…
But Apple, Dolby, or the speaker companies are not the driving force — this technology already existed in various forms, such as video, gaming,

AR/VR (augmented reality/virtual reality), and post-production. It was already there before the big guys started working on it.
As for **speakers**, immersive audio goes beyond traditional monitor setups and is therefore not the playground of just a few manufacturing companies. Immersive audio is not designed for one traditional speaker system; it is designed to work across different devices and formats. Currently, Dolby Atmos can be experienced on millions of devices worldwide (mobile phones, PCs, tablets, gaming consoles, cars, soundbars, smart speakers, sound systems, etc.). Of course, only a small percentage of the owners of these devices are listening to immersive audio, but the potential is there. In the end, it's the (active) consumer 2.0 who decides what works and what doesn't. And this brings me to the second point.

1.2 The Consumer Isn't Interested

If immersive audio was truly revolutionary, platforms like **Spotify** would have adopted it by now, right? This is 100% accurate. As a business, Spotify will react to consumer demand, and that is not the case yet. Spotify is set up for mass consumption (with a CEO more interested in money and weapons than in music…). Artists don't get fair payment and the sound quality is not that good (unless you are a Premium user with access to lossless streaming). But the masses are listening to it and they don't care. Just like bad lager beer from multinationals is marketed as "premium pilsner" and people like it… That's common for Western capitalist economies.
When Apple entered the immersive world, it seemed everything would take off fast. But that didn't happen. I even got the impression that acceptance of this technology is slowing down (or is simply less hyped) in the last couple of years, especially in Europe. Immersive music remains a niche market, a costly hobby for a select few, one could say. The general audience is not yet convinced. But we'll have to wait a few more years before knowing for sure if there is a broader audience for immersive music or not.
At the same time, the worldwide combined market share of streaming services that offer Dolby Atmos (Apple Music, Amazon Music and Tidal) is around 25% (the percentage of Tidal is only around 0.5 to 2%, depending on the market; and in the U.S., the combined market share in 2025 of Apple and Amazon is even bigger than Spotify's). As a result, more and more new releases are also mixed in Dolby Atmos.

On the other hand, immersive music is ultimately an **artistic choice**. It's not just about delivering audio through headphones or speakers — it's

about crafting a new auditory experience, and an artistic urge to express yourself in an immersive way. Artists and software developers (such as Atmos-integrated DAWs and developers of multichannel plugins) are embracing this immersive format more and more. For the moment, this appeals to a niche but that's no reason to let it go.

1.3 We Only Have Two Ears, So We Only Need Two Speakers

This comes up frequently, but this argument is fundamentally flawed. Human hearing isn't confined to two channels. It is not because we have **two receivers** (two ears) that a **sound source** comes to us from only two directions. Sound comes from 360° around us and is perceived by our two ears. Our natural ability to detect directionality and depth means we hear mono sounds coming from all angles and are able to localize them.

As already stated in the introduction, stereo just doesn't exist in nature. Stereo is, at best, a simulation of the real world, and immersive audio is designed to capture this natural sound experience. Listening to music in a 360° sound field offers a more authentic and even social connection to the music, as in the past, when we gathered around a fire—experiences that go beyond the artificial limitations of stereo.

Stereo is indeed a limitation, and we have (only) been listening to it actively for around half a century. But that is long enough for generations to make this a habit, and ultimately the norm. It's part of our culture, and changes in this field are difficult and take a lot of time. But in the end, there can always be a paradigm shift. That's what sociologists research.

1.4 Just Like Quadraphonic and 5.1 Surround, It Will Fade Away

It's true that surround sound formats have a history of failure. The reason quadraphonic sound and 5.1 surround sound didn't last for music consumption is that the listener doesn't want to have lots of speakers in their living rooms. That's also why I was personally never involved in surround music production myself.

But systems like Dolby Atmos have a key distinction: it's **speaker-agnostic**. Unlike the rigid requirements of 5.1 surround sound systems, Atmos adapts to whatever playback device you use, whether it's a phone, soundbar, or headphones. Consumers can enjoy immersive

audio without needing a complicated setup, making it far more versatile and appealing. This flexibility sets it apart from previous surround sound formats that never gained widespread adoption. If the headphone experience is better with immersive music, this alone is a good reason to go for it.
But even if Dolby Atmos disappears, or be replaced by a better alternative (MPEG-H? Eclipsa Audio?), 3D audio will always be there. Can you imagine film, VR/AR, or games without immersive sound?

1.5 Atmos Sounds Bad If You're Not in the Sweet Spot

It's a bit of a mixed bag. Here's why. To start, you can enjoy immersive audio on **headphones**, **soundbars**, or **smart speakers** without worrying about the sweet spot at all.
Second, in a professional immersive studio, the system is calibrated for the sweet spot. However, in **larger studios** or setups with bigger or multiple speakers, more people can experience the full effect of Atmos.
Third, when it comes to **stereo**, the sweet spot issue is even more pronounced. Stereo sound is best experienced exactly between two well-placed speakers. Stereo systems are designed to create the illusion of a spatial sound scene, with sound sources positioned between two speakers placed in front of the listener. Even a small head movement can change the sound's path and alter the directional cues. But how many people actually sit in the ideal position when listening to stereo, especially with poor speaker placement (like in corners or directly facing each other)?
And fourth, a thought on **mono**. Monophonic sound can still give a sense of depth and space if there are enough reflections or reverberation. It also has a much wider listening area. Interestingly, Atmos could be seen as a **collection of mono speakers**, each contributing to the overall spatial effect. Together, they create a strong sound field.

1.6 Mixing Engineers Don't Need It; Stereo Works Just Fine

History repeats itself: when stereo was first introduced, many mixing engineers thought mono was perfectly fine. Why use two speakers when one could do the job?
Fast forward to today, and you'd be hard-pressed to find a stereo mixing engineer who doesn't use a panner or think about **depth and width**. Everyone is working hard to position sounds between the speakers —

and sometimes behind them — in an effort to create a more "immersive" stereo mix. They're constantly navigating the limitations of only having two speakers, striving to mimic a 360° experience with a setup that wasn't designed for it. A talented mixer succeeds in this, crafting a mix with a lot of width and depth. But there is an easier way… Enter Atmos. This format transforms the process of mixing and production by offering a more straightforward path to creating immersive audio. Unlike stereo, where engineers are forced to manipulate and shape the sound to fit into the narrow confines of two channels, Atmos allows them to position sound sources freely within a 3D space. The result? It often requires far less signal processing and fewer technical workarounds compared to traditional stereo mixing. The immersive experience is built in, making it **more intuitive** and less restrictive for engineers. With Atmos, the potential to create truly enveloping soundscapes is at their fingertips, and the challenges of working within the limitations of stereo are significantly reduced.

1.7 Atmos Mixes Sound Bad

This is true in some — or even many — cases: Atmos mixes often don't sound that good. We have a quality problem, and maybe that's why consumers aren't convinced yet. But this is an issue of experience and technique, not a flaw in the technology — just like early stereo mixes.
I remember playing Bob Dylan's debut album during a music history lesson: the album was mixed in stereo, but the college where I was teaching had only a mono sound system (although we were already in the 21st century…). In the classroom we could only hear the guitar: the voice was on the other channel that wasn't amplified. Hard to teach that way… The same happened with The Beatles' first stereo releases: one instrument in the left speaker, the other in the right. Some stories say that members of the band got angry when they heard these stereo versions at parties, just because they couldn't hear all instruments. After spending months mixing the mono version of *Sgt. Pepper's Lonely Hearts Club Band* (1967), the stereo mix was wrapped up in only a couple of afternoons, and The Beatles themselves weren't even there… Stereo wasn't a priority back then, but that was just a matter of time.
The same applies to Atmos mixes. There is a **learning curve**. Over time, the industry will develop best practices, and we already see improvements in the quality of Atmos mixes. Early-stage innovation always carries some growing pains, but the potential for immersive sound is too great to ignore. This goes far beyond simply using an upmixing plugin to turn a stereo mix into 3D. That does remind me of the old stereo amplifier I had in the late eighties. It had a "surround

function" and two surround speakers; a small portion of the front stereo signal was repeated to the surrounds, creating a very unnatural sound.

This is a crucial point: when you make an Atmos mix starting from stereo stems, you work with material that is mixed, perceived, and processed for the stereo format. A good engineer can make a good immersive mix out of this, but spreading those stems around the place can also make the mix fall apart, making it flat and unbalanced. In an ideal world, it's better to build an immersive mix **from the ground up**, starting from the idea of making music in 3D. We need artists to start thinking immersively. But first we have to get through the phase of countless back-catalog titles needing quick Atmos mixes to fill up the streaming libraries.

1.8 Atmos Mixing Is Just Panning and Using Upmixing Plugins

Not exactly. Atmos mixing goes beyond simple panning or using automatic upmixing plugins. It's about taking everything we already know about mixing and expanding it into three-dimensional space. The first part of the mixing process is exactly the same as in stereo: you need to adjust every track according to its needs (EQ, dynamic processing, saturation, etc.). **Traditional mixing techniques** remain fundamental. Nothing has changed. Nothing will disappear.
But the panning is different. And working with more channels opens the door to multichannel processing (multichannel EQs and compressors). New steps are needed to optimize the experience for a 360° sound field. In this way, immersive audio is an upgrade from stereo — not something completely different.

Upmixing plugins can be part of the whole mixing process, though (spreading a single sound or effect in the sphere and making it wider), but they aren't the main focus. Furthermore, streaming platforms are unlikely to accept mixes generated with just a few tweaks. Apple Music, for instance, rejects uploads if they detect **an automated upmix workflow.** Creating a high-quality Atmos mix requires a thoughtful, creative approach — one that blends old and new techniques.

1.9 Atmos Mixes Lack the Punch and Energy of Stereo, Especially in Loud Genres

While it's true that some Atmos mixes lack the intense punch of a classic stereo mix (particularly in genres like punk or metal), this is more of a mixing issue than a format fault. That's because Atmos lacks a typical mix bus. There can be up to 128 channels processed at the same time, and the master file you deliver is not a stereo file but a **multitrack** (which will be rendered on the consumer side). When mixing in stereo, you can send all signals to a two-channel bus, where you can do bus processing and push the loudness as much as you want. You can even try to win the loudness war (which is still not over yet).

Although there are ways in which Atmos can have a combined or a real mix bus as well (we'll discuss that later), you can also still mix into a limiter on group tracks/busses if you want. With proper mixing techniques, you can retain the energy of loud genres while benefiting from the increased space and depth Atmos provides.

The core of this discussion arises from the technical standards of this format: an Atmos mix has to have an integrated loudness of -18 LUFS and a maximum true peak of -1 dBTP. Compared to a stereo master (which can end at -8 LUFS or higher and with a -0.1 dB peak), a Dolby Atmos file sounds a lot quieter. But at the same time, an Atmos mix has the potential to offer **greater dynamics**, giving more room to accentuate individual elements. You've got more parking space for your car.

In fact, Atmos may offer a solution for the loudness war: mastering an extremely loud album (like Metallica's *Death Magnetic*) is just not possible anymore. This allows for more dynamic range and less compressed audio (for those who want it). A hard-compressed stereo mix to meet the wishes of the record label — and that had to be loud on the radio — can make room for a mix with lots of details (like backing vocals, extra guitar lines, etc.). Loudness is one thing, but musical impact is more than that.

1.10 Atmos Pulls Budget from Real Mixing Engineers

This is a misconception. Dolby Atmos should be seen as an **enhancement**, not a replacement for traditional mixing. Mixing in both stereo and Atmos can even be done in the same session, allowing engineers to produce both formats simultaneously. It should become a skill that every mixer needs to master.

Rather than taking budget away from the industry, it can motivate engineers to expand their toolset and provide more value. In the same way that engineers had to learn stereo mixing back in the mono days, they have to approach sound in 3D today. More studios are investing in Atmos equipment, and for anyone who's hesitant about Atmos, think of it — once again — as an upgrade to stereo: a more advanced version of a format we all know and love. And for pro engineers who have enough work and clients in stereo and don't want to go Atmos: no problem— you can stay in stereo.

1.11 Binaural Doesn't Do Anything

Immersive audio can also be adapted for **headphone** use, thanks to binaural audio. But binaural audio can sometimes not sound that special or that different from stereo. This is often because of the use of generic **HRTF**s. We'll discuss the topic of HRTF later, but in short: every human ear is different, and in order for binaural audio to work well, you need a personalized adjustment of the sound reaching your ear. This personalized HRTF is hard to obtain, so we have to rely on generic ones, which sound different. In many cases, they don't do anything at all (it's like wearing somebody else's glasses).
Luckily, there are alternatives like the one Apple is using: by filming your ear and using machine learning, a more personalized HRTF is created. But even then, binaural audio is still under development, and on headphones, a very well (read: spatially) mixed stereo record can sound as spatial as binaural.

1.12 I Have Never Seen a Compelling Immersive Live Concert Yet

Immersive sound is not limited to recorded and produced music. It can also enhance the **live experience**. Here too, it can deal with the limitations of stereo amplification of what's happening on stage. But an immersive live concert only works when it's done right: the performing band needs to have a vision and experience with 3D audio (rehearsals!), and the same applies to the mixing engineer. But that was no different for stereo.
For most bands, this is an extra obstacle and a cost they can't afford. They don't have an immersive concert hall to practice in, and the fee will go up. Both the venue and the band need more time and money. Again,

for now immersive music is an artistic choice for those willing to go down this path—not for the (alternative) mainstream.
Once you experience an immersive live concert, stereo will sound flat and unrealistic. Most concerts are amplified in **dual mono** so that all instruments can be heard clearly from every position in the venue. However, this approach breaks the connection between what we see and what we hear. An immersive setup can make a concert feel far more realistic and appealing. We'll explore this in more detail later in the book.

Atmos Is an Upgrade, Not a Fad

Rather than dismissing immersive music as just another passing trend, it's important to recognize its potential as a natural evolution in audio technology. It's an experience that goes beyond the limits of traditional stereo, offering a more authentic way to connect with music.
While there are certainly challenges and growing pains, immersive audio has the potential to redefine how we experience sound—just as stereo did decades ago. As the industry and technology continue to evolve, Atmos, or another format, could very well become a standard, integrated seamlessly with devices, software, and content creation. In the end, immersive music has earned its place; you don't have to compare it to stereo all the time.
Immersive audio is an **upgrade** from stereo. Like any upgrade, it comes with a learning curve and a small investment—but there's no pressure to switch. You can still have lots of fun in the stereo world. Everyone gets to choose their own path, and we'll stay friends anyway.

2 A BRIEF HISTORY OF IMMERSIVE SOUND

Immersive sound is not as new as it may seem. In fact, the search for a more spatialized sound already began when stereo was invented. In this chapter, we take a step back into the history of sound, both in cinema and in music.

2.1 Alan Blumlein: The Pioneer Who Invented Stereo

The story of immersive sound traces its roots back to one of the most groundbreaking innovations in audio history: the invention of stereo sound. At the heart of this revolution is the visionary **Alan Blumlein**, an electronics engineer from England whose work in telecommunications, television, and sound recording changed the way we experience sound forever.

Born in 1903, Blumlein's curiosity about reproducing sound in a more lifelike way began during his time at EMI (Electric and Musical Industries, as it was then formally called). In the 1930s, Blumlein noticed something peculiar while attending the cinema. The movie itself was visually dynamic, with characters and action moving across the screen, but the sound was always locked in one place—mono. This presented an immediate problem: why should sound stay fixed when the action on screen is constantly shifting?
Blumlein's mind began to race with ideas on how to bring cinema closer to real-world experience by making sound follow visual cues, just as it does in reality. This observation led him to experiment with using two speakers at the front to simulate sound coming from different directions. He was determined to replicate how we naturally hear sound, with directionality and depth.
In 1931, he coined the term ***binaural sound*** (yes!) to describe his invention, aiming to capture sound as heard by the human ear, with each ear receiving sound from different angles. His goal was to produce a near-replica of the original directional sound image, recorded using two directional microphones (the "Blumlein pair").

Blumlein's work eventually evolved into what we now call **stereophonic sound**, and in 1933 he patented his invention. But despite its innovation—and just like Dolby Atmos today—stereo was initially met with skepticism. Both the general public and industry professionals dismissed it as a novelty, with many considering it an impractical gimmick. It would take decades before stereo was widely adopted. At the time, the technology was simply ahead of its time. Blumlein's invention would lay the groundwork for the multi-dimensional sound experiences we now take for granted, but few recognized its potential in its early days.

Although stereo became his most famous contribution, Blumlein had even more ambitious ideas. He didn't just want two-channel sound; he envisioned capturing sound in a full **three-dimensional space**, both horizontally and vertically—what we now call immersive sound. He imagined a system capable of creating a complete auditory environment surrounding the listener. Unfortunately, this vision was never fully realized during his lifetime.

Blumlein's career was tragically cut short during World War II. He worked on top-secret projects for the British government, including the development of airborne radar systems. In 1942, during a test flight, the aircraft he was on crashed, killing him at just 39 years old. His death was shrouded in secrecy, as details of his work had to remain classified. As a result, Blumlein was buried with little public recognition of his groundbreaking contributions to audio technology.

It wasn't until years later, when engineers revisited stereophonic concepts in the late 1950s and early 1960s, that it became clear Blumlein had already invented and patented stereo decades earlier. By then, his name was largely forgotten, and his role was not properly acknowledged. Finally, in 2017, Blumlein received a posthumous Grammy Award for his contribution to audio technology. There is a brilliant episode of the *Twenty Thousand Hertz* podcast (episode 168) in which Blumlein's grandson tells this stunning story.

Although Alan Blumlein's original vision of fully immersive sound—capturing audio both horizontally and vertically—was never realized during his lifetime, his invention of stereo laid the foundation for all immersive audio technologies that followed. His story is a reminder that innovation often comes from challenging the status quo and imagining new ways of experiencing the world. Stereo was only the first step in a journey toward fully immersive audio —but it was exactly the journey Blumlein had in mind.

2.2 It All Started at the Movies: The Evolution of Immersive Sound

The concept of immersive sound didn't just emerge from laboratories or drawing boards; it was sparked by the movies. Cinema has long been the birthplace of new audio technologies, pushing sound beyond its limits to create more lifelike experiences. From early experiments with stereo to today's cutting-edge immersive formats, film has played a central role in shaping how we experience audio (see Rumsey 2018 and Rothermich 2021).

2.2.1 The Birth of Surround Sound

It all began with a revolutionary idea: breaking free from mono and creating an audio experience that mirrors how we hear the world. Blumlein took the first step with stereo. A major leap followed in the 1940s with **Fantasound**, developed for Disney's *Fantasia*. This groundbreaking system was one of the earliest attempts at **surround sound**, using multiple audio channels to create a more immersive experience. Although Fantasound was limited to a small number of theaters, it laid essential groundwork.

A few decades later, surround sound gained broader acceptance. In 1977, *Star Wars: Episode IV – A New Hope* marked a significant milestone with the debut of what was somewhat confusingly called ***Dolby Stereo***. Developed by Dolby Laboratories—then primarily known for tape noise reduction—this system was a four-channel surround format (left/center/right/surround). *Star Wars* became famous not only for its visuals, but also for its sound design. The system was further refined in 1979 with *Apocalypse Now*.

Francis Ford Coppola and sound designer Walter Murch were among the first to push multi-channel sound to its limits. For *Apocalypse Now*, they adjusted the surround mix. One channel was reserved for deep bass sounds, but because analogue tape had limited headroom, this channel was recorded at around −10 dB to prevent distortion. This workaround allowed intense low-frequency sounds without tape saturation.

Apocalypse Now became a milestone in surround sound history, showing how filmmakers pushed audio technology despite technical limitations of analogue recording systems. Coppola even considered building a custom theater for the film, to showcase this new sonic experience properly. By the time of release, however, surround sound had already begun spreading, making custom venues unnecessary.

2.2.2 Surround Sound + Subwoofers: A New Level of Impact

The next step was the addition of subwoofers, bringing deep bass capable of physically shaking the audience. This became mainstream with **5.1 audio** in films like *Batman Returns* (1992) and *Jurassic Park* (1993). Dolby Digital and DTS became industry standards, and the LFE channel (Low Frequency Effects) became essential to the cinematic experience. In *Jurassic Park*, the dinosaurs' footsteps felt terrifyingly real, thanks to deep sub-bass that made it seem as if the creatures were stomping through the theater.
By 1993, **SDDS** (Sony Dynamic Digital Sound), first heard in *Last Action Hero,* used more channels than the standard formats of the time. Discrete theatrical **7.1 surround sound** was introduced around 2010, with *Toy Story 3* as one of the first releases. This expanded the surround field further and increased its precision.

2.2.3 Immersive Sound: The Next Frontier

As technology progressed, filmmakers sought a more complete immersive experience—one that included height as well as horizontal surround. This marked the birth of true immersive sound.
The journey began with **Auro-3D**, a Belgian innovation that added height channels to traditional surround setups. It was developed in 2005 and launched for cinema around 2010. In 2012, **Dolby Atmos** was introduced with Disney Pixar's *Brave*, allowing sound objects to move freely above and around the listener. **DTS:X** followed a few years later, offering another object-based immersive format.
Today, there are more than 8,000 Atmos cinema screens worldwide, and some of these theaters are also used for immersive music playback.

2.3 Dolby Atmos Everywhere

What began in movie theaters has now spread across almost every form of media. The shift from surround to immersive audio has transformed how we experience films, music, games, sports, and even cars. As technology evolves, immersive sound is becoming increasingly embedded in daily life (see also Rothermich 2021).

Home Theater (Films & Series) – Dolby Atmos, which became a household name in 2012, is now commonly featured in home theaters, with streaming services like Netflix introducing Atmos support in 2017. The partnership between Dolby Atmos and OTT services ("over-the-top") like **Netflix** and Apple TV has helped make immersive sound a