Instant Surround Sound

Jeffrey P. Fisher
Dedication
It might seem unusual for an author to dedicate a book to three people he's never met. Nevertheless, these three legends have had (and continue to have) a profound impact on my music and sound career: Sir George Martin, Ben Burtt, and Gary Rydstrom. Thank you all for opening up my ears to the possibilities.

—Jeffrey P. Fisher

Acknowledgments
Once again I'd like to thank Douglas and Mannie at VASST for their continued support of my work. Kudos also to the whole CMP team who make these books a reality. Also, very special thanks to Tony Santona for his illustrations used throughout the book.

—Jeffrey P. Fisher
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Welcome to the huge world of surround sound. Surround sound has been available to professionals for many years, but is just now coming of age in the desktop authoring world as a common choice for multimedia and music authors.

Surround sound isn’t a simple matter of just taking a stereo or mono audio track and porting it to 6 different locations, it’s about understanding balance, relative power, phasing, realistic placement techniques, downmixing, resampling, encoding, compression, equalization, and so much, much more. This book from Jeffrey P. Fisher is about the discovery process that makes all these seemingly complex subjects become clear and concise.

What few books are currently available on surround sound are essentially white papers with pretty colored covers. The Instant Series books aren’t designed to talk down to readers; they’re designed as a book you can settle comfortably back in your computer chair or other favorite reading place, read this book, and not find yourself puzzling over numbers, tables, or other challenges. The purpose of this book is to immerse you in the world of surround sound and get you moving down the path of making a great sounding blockbuster hit!
Jeffrey P. Fisher has a knack for making the comprehensive appear second nature, and doing so in a manner that is smooth, sensible, and most importantly, workflow-oriented.

This is Jeffrey's third project in the VASST Instant Series, and we're confident you'll find this a great read, just like his previous efforts.

From us here at VASST, we thank you for your support of our training materials, and invite you to view our other training products both for purchase and for free, at www.vasst.com.

Douglas Spotted Eagle
Managing Producer

Mannie Frances
Managing Director
Introduction

Perception Conception

The primary reason to use multichannel sound is to enhance the listening experience. Surround sound helps both music and visual producers deepen the realism and involve the audience further. For example, the approach of a rescue helicopter sent to save the movie hero has greater impact when it first appears in the distance behind the audience, flies its way to the front of the viewing room, and then across the screen. Similarly, music recordings have more intimacy when the singer’s voice moves about the room in the same manner she might on a live stage. Surround sound also enhances live performances presented on CD/DVD by placing the listener in the auditorium, keeping the performance on stage and the original audience and room sounds in the surrounds.

Surround sound works because of the four ways we humans perceive sound:

- Audible periphery—each ear functioning as an independent receiver
- Binaural perception—hearing the same sound with both ears
- Spatial perception—perceiving both where we are and where other sound elements are in space
Cognitive perception—how well we perceive and localize sounds

The ear works by collecting sound, via the outside of the ear called the pinna, and sending it down the ear canal. The ear drum, a piece of tightly stretched skin, sits at the end of the canal and vibrates when struck with sound energy. The three bones of the ossicles—the hammer, anvil, and stirrup—transfer this vibration into the cochlea or inner ear. Sound energy from the ossicles creates an analogous wave pattern in the cochlea. Tiny hairs in the cochlea are sensitive to the movement and send an electrochemical response to the brain, which perceives the sound.

Our head helps us to localize sound sources because sounds arrive at our ears at different times. Because of the distance between the ears, sounds can arrive approximately .7 milliseconds apart. Our brain assumes that first-arriving sounds are the loudest sounds, although this may not be the case.

We perceive only loudness and pitch for all the sounds that we hear. However, this perception isn’t that precise. Instead we tend to recognize sounds as objects or sources and not focus on specifics of loudness and pitch. Because of this, a surround sound mix often allows for more intimate, quieter overall sound as there are more point sources to deliver unique sounds for the ear to perceive. This can be used to the advantage of both music mixes and audio for video mixes.

When preparing to mix, keep these perceptual contributors in mind. Compared with two-speaker, conventional stereo, surround sound offers:

- Better perception of object and sound location. Listeners more readily identify the general direction from which sounds are initiated.
- A different loudness balance over stereo playback alone. The volume can be lower yet provide more enjoyment due to perception of placement.
- More accurate perception of tone due to the additional placement options of sound sources.
- Significantly greater perception of ambience. The audience can be more immersed in the listening field.
- More involved listener perception of sound points. Keep in mind that more speakers equals greater perceptive involvement.
- A greater awareness of the quality of the mix, both individual components and as a whole.
Quality Control

Although this book deals directly with the quality of the mix and how to record, process, and deliver the audio to the listener, it's important to address the quality of your recordings, too. When delivering your mix in surround, low-quality components such as inexpensive microphones, preamps, and other equipment used in audio processing become more apparent. The listener is more aware of individual sounds spread out over the listening space. For example, a mix containing low-frequency noise due to rumble might be easily masked by other sound elements in a two-speaker stereo mix. In a 5.1 mix, however, there are now four additional locations for that noise to be heard; it may be exposed and more prevalent in the multichannel environment.

Additionally, consider using more elemental ambiances to cover up or mask weak recordings. For example, a poorer quality sound can mask problems in the mix such as adding wind noise to create a constant “room tone” in an outdoor scene. The wind helps mask other noises in the mix.

Don’t be afraid to supplant existing ambience or environmental sounds with your own. For instance, a forest scene with great dialog may also have a few crickets or other sounds on the production track. Rather than attempting to clean it up, augment the ambience instead. Lay these tones into your mix and craft a better experience. If you anchor the dialog to the center channel, and place the ambient element around the surround field, the audience accepts that they are in a forest setting with sound all around them. Most importantly, their attention focuses on the dialog, which should help mask any other sounds that may creep into that track, such as the cricket noises.

Surround can also work in our favor when the mix has problems. For example, if a car drives by during a critical point in a scene and it cannot be totally mixed out of the dialog track, find or create a recording of a similar car-by. Place this drive-by in the rear speakers. At the critical segment, modify the dialog EQ to cut the car element from the main dialog track while enhancing those same frequencies in the rear channel's car-by. Mixed properly with good balance, the audience will not be aware that you've got two different car drive-bys taking place. They'll know only that one is in the rear speakers and that shades of it are heard in the center or dialog location. Dynamic panning of the elements can help enhance the effect, too.
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Chapter 1

Surround History 101

First there was monaural recording (mono for short) with its single speaker playing the sounds of our world. By 1877, Edison’s crude cylinder-based phonograph was a huge leap forward for both recording and reproducing sound. A decade later, the Gramophone introduced shellac disks that could be mass-duplicated and distributed. It wasn’t until 1948 that 45s and LPs emerged on vinyl.