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Are You Really Ready for 7.1?
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Once upon time, I wandered into the showroom of a custom installer. A salesperson caught me giving their dedicated screening room the once-over, so he asked if I had any questions. To make polite conversation, I wondered aloud if they were using dipole surround speakers. After a somewhat pregnant pause, the salesperson haltingly replied, "No, sir, we only use a single pole to mount surround speakers."

This anecdote underscores the rampant confusion over surround speakers in home theaters. It's really nothing new, nor is it likely to go away in the near future. In fact, I'd put money down that the confusion will only increase now that 7.1 has finally arrived on the scene.

Wait, though! Hasn't 7.1 been around for years? After all, you've had a system with side and rear speakers for nearly a decade, right? Unfortunately, if you thought that was 7.1, you weren't entirely correct. What's more, you may be missing out on an opportunity to upgrade them now that the real 7.1 is here.

OK, OK, so you want me to slow down, go back to the beginning, and explain this whole mess so it makes sense. You're in luck, because that's exactly what I'm going to do.

In The Beginning

In order to understand 7.1, you must know a little history about multi-channel sound in the home. After some failed attempts at quadraphonic in the 1970s, the first truly successful multi-channel format was Dolby ProLogic Surround in the mid-1980s. To be fair, ProLogic isn't an actual discrete sound format. The Left, Center, Right, and Surround channels are encoded into two channels using an amplitude-phase matrix scheme. The process suffers from some audible artifacts but works quite well overall to create a surround soundfield. About a decade later, Dolby and DTS introduced digital coding formats to record six tracks of sound on Laserdisc, DVD, broadcast, etc. These formats are, in fact, called 5.1. There are five main wideband channels: Left (L), Center (C), Right (R), Side Right (Sr), Side Left (Sl). The sixth channel is low frequency only,

with 0.1 of the bandwidth of the other channels. It is called Low Frequency Effects (LFE). These channels are created and mixed by a sound team and approved by the film director, record producer, etc., before the content is released.

Figuring out what to do with surround speakers for 5.1 is pretty easy. Usually, you just install one speaker for Sl and one for Sr. If you like dipoles, you put them up on the wall at around 90 degrees' rotation from the C. (If you are unfamiliar with this terminology, imagine that you are sitting in the primary seat in the middle of the room. The Center speaker is 0 degrees and directly behind you is 180 degrees.) Direct-radiating speakers go at about 110 degrees. If you have a big room with multiple rows, you might add a second speaker for each side channel – fairly simple stuff.

Then Came 6.1...or Not

Long about the time Lucasfilm was working on *Star Wars Episode I: The Phantom Menace*, Oscar-winning sound mixer Gary Rydstrom and I were discussing his longstanding frustration with panning sounds around a screening room. He just wasn't happy with the options for pans from the screen to the back of the room. About the best 5.1 systems could do was move the sound off the screen to the sides, then fuzz it out as it moved to the rear wall. That wasn't enough for Gary; he wanted the pan to clearly go all the way back.

We batted around a few concepts to address his concern, and the one that stuck became known as Surround EX. The idea was for Gary to create and mix 6.1 channels: L/C/R/Sr/Sl/Rear (R)/LFE. In Gary's dubbing stage, Sl would go to the existing array of surround speakers on the left wall, Sr would go to the right wall, and Rear would go to the rear wall. We then had to make those 6.1 channels fit onto existing 5.1 cinema release formats. I suggested that we encode the Rear channel into the Sl and Sr using amplitude-phase matrix. The resulting track was backwards-compatible with 5.1 formats, and cinemas that wanted to upgrade to Surround EX could buy a decoder and access the Rear channel content.

Eventually, Surround EX found its way to the home market. It essentially works just like the cinema, except that two speakers are used for the Rear channel instead of an entire array. These Rear speakers are either dipoles or directs (depending on your preference) up on the wall at about 150 degrees from the C.

While this is still the "default" configuration for Surround EX, there are several popular alternatives. Mostly notably, THX Ultra2 calls for the Rear speakers to be much closer together. Special processing is then used to spread the rear soundfield as necessary. One advantage of THX Ultra2 is that the physical proximity of the Rear speakers more closely emulates the original effect Gary wanted – for pans to clearly go to the back of the room. When the Rear speakers are far apart, the soundfield becomes much less

directional. Dolby also introduced a processing algorithm called ProLogic IIx that takes any source – from 2 channels all the way up to Surround EX – and post-processes it for two Rear speakers. ProLogic IIx tends to create a spacious stereo effect rather than directional rear wall pans.

Regardless of the speaker configuration, the Rear channel is still encoded into the Sl and Sr. A decoder is necessary to extract it. Therefore, Surround EX is not a true discrete 6.1 format. (The mix is, but the track on the release format – e.g. DVD – is not.) To give credit where it's due, DTS did come up with a version of Surround EX called DTS-ES Discrete where the Rear channel is stored discretely on the release format. However, the Rear channel is *also* encoded into the Sl and Sr, so it has to be subtracted out for 6.1 playback. In my book, this disqualifies DTS-ES Discrete from being *truly discrete* 6.1. Besides DTS, Windows Media Audio supports 7.1, but decoding hardware and software is scarce.

Now There Is 7.1

Thanks to Blu-ray and HD DVD, we now have widespread capability for both 6.1 and 7.1. Both disc formats support uncompressed PCM, Dolby Digital Plus, Dolby TrueHD, and DTS-HD – all of which are capable of storing 7.1 discrete channels of audio: L/C/R/Sr/Rr (Rear Right)/Rl (Rear Left)/Sl/LFE channels. What's more, Dolby TrueHD and DTS-HD offer lossless compression, which means that the output of the decoder in players or A/V controllers is identical to the PCM studio master that was encoded. Given these advancements, it's easy to understand why we're starting to see some titles released with 7.1 tracks.

7.1: Home vs. Cinema Mixes

Most of you probably know that movie soundtracks are originally mixed for commercial cinema release. The rooms used to prepare these mixes are very comparable to an average cinema in terms of size, equipment, and layout. From their inception, home video releases received the same soundtracks that were mixed for the cinema, which resulted in some rather audible large/small room translation issues. As the DVD format matured, a few studios began engineering special home video mixes that attempted to compensate for the most prominent sonic inconsistencies. While their efforts were not always successful, the studios were at least trying.

Why does this have any bearing on 7.1? Well, 7.1 as format with 3 fronts, 2 sides, 2 rears, and LFE doesn't exist in the cinema world. (They technically do have 7.1, but, ironically enough, it's a little-used format with 5 fronts, 2 sides, and LFE – NO rears!) The mixes prepared by a movie's original sound team for commercial release don't have two rear channels. The overwhelming majority don't even have *one* rear channel – Surround EX hasn't been terribly popular (not that it was ever intended for widespread use). Where 7.1 enters the picture is aftermarket remixing of soundtracks for home

video. In addition to being tweaked to sound better in small rooms, cinema mixes may also be expanded from 5.1 to 7.1 channels. Typically, this involves “unwrapping” the 5.1 dialog, music, and effects stems (the building blocks of a soundtrack), adjusting the pan of certain effects in the surround field, and mixing the new 7.1 stems down into a final track. I won’t go into the minute details of the process, because most of you probably aren’t sound mixers! Suffice it to say that the resulting remixes are, indeed, 7.1 discrete channels even though they weren’t created that way by the original sound team.

From the Disc to the Speakers

There may be 7.1 channels on the disc, but they won’t do you much good unless you can get them to the speakers. Most problems with 7.1 occur between the player and the A/V controller, and this is where your system will probably require the most attention. As of this writing, there are three common ways to get the signal from the player to the controller.

Way number one is to connect the player to the controller with HDMI and transfer the audio as PCM. This method is popular because it’s currently the only way to hear menu-based sound effects (button clicks and cursor swooshes) and secondary audio that plays alongside the feature (director, etc., appears in a PiP window and talks while the movie plays). Another reason for its popularity is the short supply of controllers that decode the new Dolby and DTS formats. Players are far more likely to have the appropriate decoders, and therein lies the problem with way number one. Players may decode *some* of the new formats, but usually not *all* – or at least not for 7.1 channels. If you plan to have the player handle decoding, be sure it supports Dolby Digital Plus, Dolby TrueHD, DTS-HD High Resolution, and DTS-HD Master Audio all the way up to 7.1. You also need to make sure the controller will accept up to 7.1 channels of PCM and still engage listening modes like Dolby ProLogic IIx and THX Ultra2 when necessary. (A few controllers will not apply listening modes to PCM.) Finally, something must do speaker distances, channel levels, and bass management (including the +10dB LFE gain boost). Not all players will, and neither will all controllers when the input format is PCM. Be sure yours do.

Way number two is similar to way number one, except the player is connected to the A/V controller with eight analog cables (7.1 analog) instead of HDMI. The player still decodes the audio, but also converts it to analog. For the most part, the advice from above applies here, too. Be sure the player decodes up to 7.1 channels, be sure it has a 7.1 analog output, be sure the controller has a 7.1 input, and be sure either the player or controller adjusts speaker distances, channel levels, and bass management. With 7.1 analog, you also have to watch the gain of the player’s subwoofer output. It can legitimately be up to 15dB low, requiring a boost that not all controllers supply.

Way number three is to connect the player to the A/V controller with HDMI 1.3 and transfer the audio as bitstream (non-decoded). Obviously, this requires the controller to decode all the latest audio formats up to 7.1 channels, which it will probably do if it has HDMI 1.3 inputs. Keep in mind, though, that menu-based sound effects and secondary audio will be lost. Beyond that, there's not too much to worry about.

Where O Where Do My Speakers Go

Admittedly, getting the signal from the disc to the speakers is only part of the picture. The speakers have to be positioned correctly in the room, or else you'll never hear what the mixer intended a soundtrack to sound like.

By and large, the people who are remixing tracks for home video have adopted monitoring systems that are laid out much like the typical home theater. The side speakers are +/-90-110 degrees, and the rear speakers are +/-135-150 degrees. As far as the height of the speakers in the room is concerned, six feet up from the floor is always a safe bet. The monitors in a studio may be a little lower than that, but the extra height will add more of a cinematic feel and substantially improve coverage for multi-seat rooms.

The good news is that the surround speakers in your system are probably already in these positions, or close to it. They are the same ones that groups like Dolby and THX were recommending as far back as the introduction of Surround EX to the consumer market in 2000.

And, of course, the debate over whether to use dipole or direct speakers rages on. As someone who has followed the controversy from the beginning, I will leave you with this thought on the subject: The answer to the dipole vs. direct question may lie in the type of room you have. Dipoles are probably going to work better in small, well-damped rooms, while directs may be the way to go in larger or more reverberant spaces. The goal is for the surround speakers themselves to disappear into the soundfield: ambient effects should be spacious, and discrete effects should be localizable – but not necessarily to a specific speaker. The decision of whether dipoles or directs achieve this goal in a given application is ultimately yours, so feel free to experiment.

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