

FOR AN AUDIO SYSTEM TO SOUND GOOD, IT REQUIRES MORE THAN JUST TOP-OF-THE-LINE COMPONENTS.

THERE ARE FUNDAMENTAL SPEAKER PLACEMENT RULES THAT MUST BE ADHERED TO WHEN STARTING TO SET UP THE SYSTEM.

DIFFERENT TREATMENTS MADE FROM SPECIFIC MATERIALS WORK MOST EFFECTIVELY FOR CERTAIN FREQUENCY BANDS.

Acoustics and the Well-Tuned Theater

How to improve a sound system's largest component—the room itself.

by Christopher Klein

CONSIDER THE ROOM ... IT'S THE LARGEST COMPONENT IN YOUR CLIENTS' SOUND SYSTEMS, AND PROBABLY YOUR OWN AS WELL. IT ALSO HAPPENS TO BE THE LARGEST SIGNAL PROCESSOR; IT CAN HAVE THE MOST DRAMATIC EFFECT ON AN AUDIO system's overall performance. [] Oftentimes the room is the most overlooked part of a sound system. However, when raising the issue of acoustically treating the room you're likely to be asked, "Why do I need it if I'm buying the best electronics? Shouldn't great equipment sound good wherever it's put if the speakers are set up properly?" [] It's a fair question, especially since acoustically treating a home theater can be quite costly. Fortunately for the well-versed custom integrator, answering that question is simple: No sound system can be considered complete without addressing the role of the room in terms of reproducing audio properly.



A home theater needs acoustic treatments in order to sound as good as it looks. Owens Corning offers a complete home theater kit, the Visionaire FX, that includes acoustic wall panels, as well as all the essential audio and video gear, dimmable lighting, and elegant furnishings. Cost: \$35,000 to \$65,000.

An inexpensive electronics package heard in a well-treated room can sound better than much costlier audio systems in the same room that is untreated. If you're able to start with top-flight electronics and also treat the room, you can bring your client a truly amazing experience.

LEARNING ROOM ACOUSTICS 101

Of course, it's possible to significantly improve a home theater's sound by following a few basic rules. Perhaps the most important rule is the proper placement of speakers and seats. Keep the speakers away from large reflective objects, as well as walls. These starting points involve the objects within a room. But treating the room itself raises the enhancement to a new level. And while it's not necessary to know acoustical theory, a few fundamentals about sound wave behavior will prove helpful.

Acoustic treatments can do three things to a sound wave: absorb it, reflect it, diffuse it. Diffusion is really just the controlled reflection, or scattering, of sound waves in many directions. In treating a home theater or any room, the key is striking

the correct balance in applying materials to absorb, reflect and diffuse high-, mid-range- and low-frequency sound.

What do we mean by high-, mid-range- and low-frequency sounds? Most of us understand the terms bass and treble, and think of anything below about 300Hz, as low frequencies, and anything above about 2kHz as high frequencies, with what's left in the middle as mid-range frequencies. But the border between low and high is not rigidly fixed. You can visualize this by thinking about speech patterns. Many consonant sounds (s, t and c) are high frequency, while all vowel sounds (a and e, for example) are mid and low frequencies.

If you were to add an acoustic treatment to walls that only absorb frequencies of 500Hz and above, you'd be effectively absorbing the room reflections containing the consonants, or high frequencies, while ignoring many of the lower-frequency vowel reflections. The vowel sounds below 500Hz. can take over in the room and mask many other frequencies, destroying the intelligibility of specific sounds and making speech more difficult to understand.

To sound natural, an acoustic treatment needs to achieve the right balance between high-, midrange- and low-frequency characteristics. If you don't, the room will end up controlling the bandwidth of the reproduced sound by virtue of the amount and location of the sound absorption used within the room. What the world sounds like when you have a head cold is what a room sounds like with too much high-frequency absorption. You can simulate this effect by sticking your fingers in your ear. Notice, you can still hear bass.

A good place to start correcting room acoustic problems is by applying products designed to absorb high frequencies. Of the many available, the most common are made of fiberglass and foam. Properly placed, these will control the flutter echo—the springy sound you hear when clapping hands in a room with hard parallel walls. These types of treatments can improve the overall stereo imaging of an audio system by taming first-order reflections.

But high-frequency absorption cures only a fraction of acoustical problems. Most of the conditions afflicting many home theaters are found between 50Hz and 300Hz. To fix them, you need bass trapping that's capable of absorbing low frequencies, not just reflecting or diffusing them back into the room.

This is where installers encounter most of their costs, because the cost of treating a room goes up exponentially as you go down the frequency range. It is simply more difficult—hence more costly—to absorb low frequencies. Yet absorbing low frequencies cannot be overlooked when treating a room for a good high-end system.

CURING LOW FREQUENCIES IN THE REAL WORLD

Absorption down to 100Hz can be handled with fiberglass. The difficulty is that at this level, the fiberglass needs to be about 27 inches thick to work efficiently. Such depth not only makes it impractical, but also over dampens everything above 100 Hz to the point where listeners will feel like they're in a lifeless anechoic chamber.

Other products designed to work in the bass area, absorbing lows, are able to do so without taking up as much real estate. For example, Acoustic Sciences Corp. manufactures products called Tube and Tower Traps, which are designed to be placed strategically around a room to absorb bass as low as 35Hz. The Traps can also be turned to provide diffusion in the high-frequency range. Other companies, like RPG and SDG, specialize in acoustic products that focus on diffusion in the higher fre-



A room's overall dimensions can play an integral part in how an audio system will sound in it, as sound waves reflect off height, width and length boundaries, in addition to the materials in the room.



The bipole/dipole radiation pattern of today's rear surround speakers can create havoc in a room that doesn't use acoustical sound treatments.

quencies.

Some acoustic consultants make their own bass traps by creating large cavities in the walls, or using available closets, then filling or covering them with fiberglass or foams like Sonex or the less costly Markerfoam. Either way, this technique is not quite ideal, since it requires extra planning, as well as enough space and the right locations to work effectively. It also provides only low-frequency absorption, leaving high frequencies still to be dealt with.

Acoustic Room Systems uses the combined system characteristics of fiberglass and sheetrock panels. These panels are 1 1/4 inches thick, and they provide diaphragmatic absorption down to 100Hz along with mid-range and high-frequency absorption when and where it's needed within the room. The panels, along with a diffuser system, can be used to precisely tune any home theater. Once a room is treated, fabric is stretched over the surface of the panels to insure a pleasing appearance.

CONTROLLING A RESONANCES IS JUST THE BEGINNING

Acoustically treating a home theater should really be thought of as the first step in the playback process. Remember that studio recordings are mastered in acoustically correct rooms because engineers need to hear the accuracy of the performance, not the signature of the room. If a recording engineer entered an untreated studio, he'd walk right out because he knows he would never capture the essence of the performance he's expected to record. The same rules should also apply to your own room or any room you're working on—whether it houses a home theater or simple two-channel stereo—acoustic treatment is the finishing touch. [CE Pro]

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