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The Custom Home Theater Experience, Part 2
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by A. Grimani

In a December 2006 article, I started talking about how to achieve a high quality home theater experience. That first installment discussed how to buy the home theater experience. This time around, I'm going to talk about designing it. There's a ton of stuff to cover here, so I'm going to jump right in. If you've heard it before, pat yourself on the back and skim through as a refresher. If what follows is Greek to you, don't panic. Look at it as an opportunity to improve your knowledge of home theater design.

Aural Design

First up, you have to design the aural experience of a home theater. The place to start is room dimensioning. You've probably heard that low frequency resonances develop inside the room boundaries and completely destroy bass quality. There's no magic ratio of room dimensions that eliminates them, but you can make sure that none of the resonant frequencies from the length, width, and height coincide. It would take much more space than I have here to explain how to find all the resonances, so go to the web. Many programs have been written to calculate frequencies and predict overlaps; quite a few are available to download. Poke around for them. Here's a lead. Ultimate AV has one free, and it's pretty decent. However, I disclaim responsibility for any results you get!

After dimensioning, you need to soundproof the room. You can't afford for things making noise in the theater to bother people in the rest of the house, and vice versa. Sound Transmission Class is generally used to measure the "soundproof-ness" of a room boundary. STC isn't perfect because it ignores frequency extremes, but it's still useful. Your Mr. Universe target should be STC 80 for walls/floors/ceilings and STC 55 for doors and windows. That's bloody hard to get (think one foot thick walls consisting of many layers), and you may not be able to do it. Just try your best. To get started, look through the diagrams and STC ratings on Kinetics Noise Control's website.

Next up is noise control. As a general rule, anything – no matter how indispensable it seems – that makes noise in the room should be removed. The kicker is usually HVAC,

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which is useless unless it dumps into the room. Companies like Kinetics and others make all kinds of gadgets to silence HVAC, so start Googling.

The final part of aural design is acoustical treatment. Once sound leaves the speakers, it reflects around between the walls, floor, and ceiling. While some amount of reflected sound is good and necessary, too much of it ruins the aural experience. You want to do two things. First, reduce the total amount of reflected sound, or the *reflection decay time* as it's called by acousticians. Second, acoustically treat any hard surfaces that fire discrete reflections directly from the speakers to the listeners.
Start by predicting a target reflection decay time for the size of the room, and then calculate the amount of absorption needed to achieve it. Unfortunately, I know of no simple, commercially-available program to help you with this; you will need to do the math. Alternatively, you can fall back on the following rule of thumb. The room's surfaces should be about 25% absorptive, 20-25% diffusive, and the rest reflective. Remember to spread the acoustic treatments around the room. Don't let all of one thing collect in one area. Low frequency absorption of some description is good, too, but I lack the space to go into much detail here. Suffice it to say that springy, resilient, soundproof walls often work very nicely as low frequency absorbers.
Treating discrete reflections is a little harder. During design, you can use a ray-tracing program like Ulysses to predict where all the discrete reflections will hit off the room's surfaces. It's almost easier to wait until the room is built and search for the reflection points using a flashlight or laser pointer and a mirror. Whichever approach you take, make sure that acoustic treatments, whether absorbers or diffusers, occupy those reflection points.

Visual Design

With aural design complete, you can move on to visual design. It's best to start with room dimensioning here, too. Ideally, everyone should have a view of the screen that is about 35-40 degrees wide (angle formed by the left edge of the screen, the viewer's head, and the right edge of the screen). If the room is long and skinny, people on the front row will have a super-wide viewing angle, while folks in the back will be looking at a narrow one. So, you want the room to be square-ish, but not absolutely square (bad for low frequency resonances). Hand-in-hand with dimensioning is screen size and location. Be absolutely sure that everyone has unobstructed sight lines to the entire screen and that no one is looking up more than 15 degrees to the screen center. Also avoid seats that are past 15 degrees laterally off center of the screen.

Ambient light control, or "lightproofing," comes next. This is pretty simple. If you can see your hand in front of your face, there's too much ambient light. Doors and windows account for most light leakage, so avoid them as much as possible.

You do need *some* lighting in the room, though, which brings me to lighting design. Lights that shine on the screen are always bad, so go for small task lighting that is focused specifically on things like the viewers' chairs and steps. One thing you might easily overlook is the color temperature of the room lighting. You know that the light on the screen should be D65, but guess what – the room lighting should *also* be D65! Otherwise, it will skew the viewers' perception of the color temperature of the image on screen. There are some D65 lights available, but you can always use color filters with standard lighting fixtures. My technical editor does this kind of thing all the time for his commercial stage lighting designs.

Finally, you should use very flat, dark, neutral colors in the room. A glossy, bright color will throw light reflections back on the screen and tint it that color. Gray and black are ideal for a home theater, but spouses and special friends will rarely go along with them. So, go as dark and flat as you can. Just like with sound, it's especially important to avoid even small reflective patches that throw a direct light reflection from the screen back to a viewer. I'm talking now about things like shiny metal trim or the glass top of a coffee table.

Now you know how to buy and design the home theater experience, but these are only some the pieces in the puzzle. The next column will cover how to select the right gear for the home theater experience. Until then…

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