Acoustics: Win The Battle Before It Begins Part 1

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We've all heard the phrase before, but what does it really mean? It means to achieve victory by taking proactive steps to prevent the conflict from occurring in the first place. This may involve anticipating and addressing potential challenges or obstacles before they arise or establishing a strong position or advantage early on. The idea is to be so well-prepared and strategic that victory is essentially assured before any actual confrontation takes place.

How do we apply this to acoustics?

Acoustics for a home theatre involves both sound quality and noise control. Sound quality meaning; optimal tonal balance, dynamic range, articulation, etc. Noise control meaning; no unwanted vibrations. We only want to hear the movie soundtrack. We do not want to hear additional noises coming from the equipment, the house, or from outside. Noise is a two-way street, so if sound can get out, it can get in too.

More often than not, I get calls after the home theatre has been built with acoustical complaints. They might be about poor sound quality, which is comparatively easy to deal with. Sound quality generally refers to airborne sound waves. For example:

1. Reverberation times
2. First order reflections
3. Room Modes

Or we could be talking about noise control, which is usually much more difficult to deal with after the build. I can tell you that most people do not think about noise control, until they discover that they cannot use their home theatre when someone needs to study or sleep. It is of course, much more difficult and expensive to deal with after construction. Noise control generally refers to structurally related vibrations. For example:

1. Sound Transmission
2. HVAC
3. Plumbing
4. Resonances, Buzzes and Rattles
5. Impact noise
6. Appliances

Let's look at each of these and discuss what is needed to prevent their unique problems from occurring in the first place.

We'll start out with noise control because you have to get the noise under control before you can have sound quality. As mentioned, most of the noise issues deal with mechanical sound transmission or structureborne, but not all. Some are airborne. Note they all finally become airborne in order to be heard.

There are steps to take in order to determine the amount of noise reduction required to address the specific noise issue:

The noise must be evaluated:

a. Evaluate the noise environment under existing or expected conditions. This may involve on-site testing for existing situations, or computer modeling for new projects in the designing stage.

b. Determine what noise levels are acceptable. This is the minimum level (expressed in dB SPL) the receiver (listener) is not going to be disturbed at. Note, the receiver maybe you in the home theatre, or may be someone in another part of the building.

c. Identify the noise source(s). What is the noise generator?

d. Identify or estimate what the sound source frequencies and their associated sound pressure levels are.

e. Identify the sound path(s). Nearly always the sound path from the source to the receiver includes multiple paths and include both structural and air travel.

f. Identify budget, physical limitations, time frame, and available resources to help determine possible solutions.

With this information, solutions can be evaluated. The solutions will be mathematical inverses of the noise spectrum and energy levels. The solutions must meet acceptable physical, budgetary, and atheistic requirements.

1. Sound Transmission. Noise reaches a listener typically through several pathways. For example, you are in your theatre and you can hear your daughter playing the piano. Some of the


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possible sound paths might include:

a. Direct Air. This could be from the open theatre door, so that the sound waves travel directly from the piano soundboard to your ears.

b. Reradiated Structural. The piano sound waves in the air strike the common wall or floor, forcing the partition to move, and radiate sound on both sides.

c. Direct Structural. Some of the energy is mechanically coupled from the piano soundboard to the piano frame, to the floor. This radiating floor may be the same floor you're on, or maybe the piano is on the floor overhead.

d. Indirect Air. Ductwork for HVAC systems are notorious for acting as acoustic intercoms between connected rooms.

Flanking noise is sound transmission that involves elements other than that of the common partition between the two spaces. Once sound energy enters the structure, it will travel far, and is nearly impossible to control. These vibrations travel faster and farther in materials denser than air, and will continually reradiate energy on both sides of the materials. The amount of transmission loss depends on the construction materials and methods. Typical single dwelling construction is all interconnected, so vibrations travel to all end points of the structure.

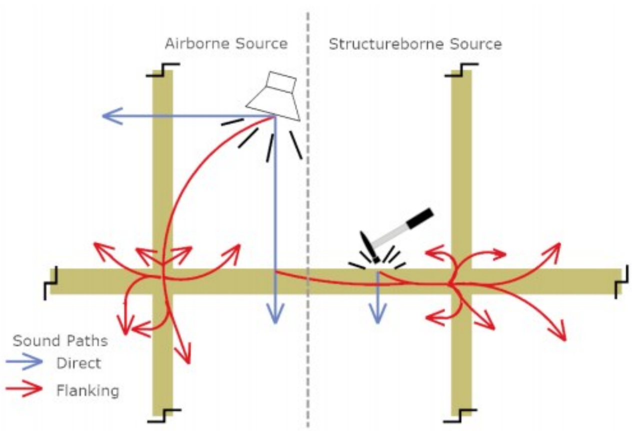

Figure 1 Typical construction allows direct and flanking noise to spread through the structure.

Introducing breaks in the path with resilient connections is the best means of stopping the transfer of structureborne vibrations. Making the source room an independent, resiliently supported unit is therefore the most effective line of defense to stop the spread of vibration to other spaces from both direct and flanking sound energies.

Flanking paths have more serious consequences for impact sound transmission than for airborne sound transmission. This is because impacts involve more vibrational energy being transferred into the structure, and typically more low frequencies content, which is the most difficult to control.

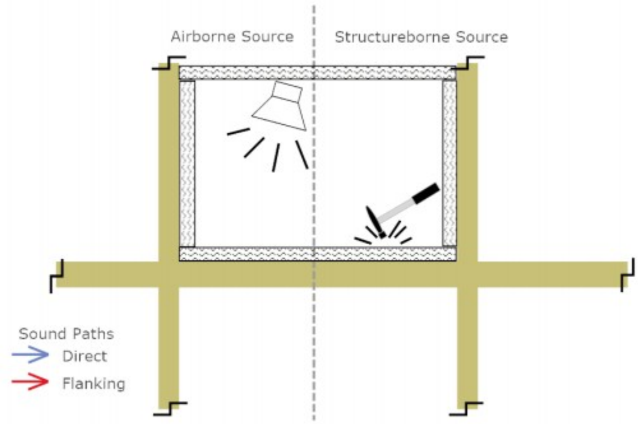

Figure 2 Resiliently supported floor, walls and ceiling contains the sound from spreading throughout the structure.

We all know how well the sound from a subwoofer travels to the other end of the dwelling. The hammer shown applies just as well to subwoofer low frequency energy. One of the best bangs-for-the-buck is to properly isolate subwoofers and loudspeakers on resilient supports (such as Equipment Vibration Protectors). It not only provides noise control for the rest of the house, but improves sound quality within the space by mitigating structural resonances, buzzes and rattles.

Most people have never experienced the wonderful sound of a room quieted of these noises. The sound quality is improved in areas of dynamic range, low-level detail, soundstage, timbre, etc. It is always best and most cost effective to design correctly in the first place. I hope that this wets your appetite for more regarding preparation for the battle of noise control. We will cover more noise control in the next part, and finish with sound quality issues as well. WSR

"Thanks for all the years"

Jim Winey with the
first Magneplanar prototype

I had a very simple idea: to create a better-sounding speaker that all music lovers could afford. It has been 51 years since I started Magnepan. In 2001, it was time to pass on the family business. My son Mark is the president now. I've retired and since been inducted into The Absolute Sound's "Hall of Fame" (and I'm still alive!!!).

So, what do I want for my golden years and how do I want to be remembered?

I like clever ideas, whether mine or someone else's. I am not a genius, but I am able to envision simple ideas that are powerful. So maybe I am clever.

I am a supporter of the Minnesota Orchestra. I saw the reviews in The Absolute Sound and Stereophile of Gabriel Sakakeeny's OSIRES invention that helps small orchestras. I am able to "think outside the box" (pun intended) and so is Gabriel. But, like all audiophiles, I don't believe reviews unless I can hear the product for myself. From one inventor to another, *"Gabriel, build it so we can all hear it for ourselves."*

To help make that happen, you can be involved. **For every Magneplanar that you buy from now until the Axpona Audio Show in 2021, I will donate $35 to help Gabriel Sakakeeny demonstrate his OSIRES invention during the show.**

James M. Winey

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