



REALTRAPS - Acoustic Basics

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..GET THE BASICS IN 5 MINUTES..

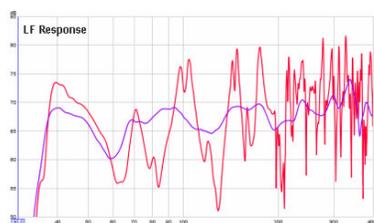
By Ethan Winer

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Most budget electronic gear these days is very high quality, and can create first-rate music that sounds as good as anything on the radio. Yet many recording enthusiasts, unhappy with the quality of their productions, wrongly blame their gear. Of course, experience matters, but so does having accurate acoustics. This "Tip Jar" article from Music Connection magazine explains the basics of acoustics in a way that everyone can easily understand. All of the information herein also applies to audiophile and home theater listening rooms.

BASS IN THE PLACE



Bass frequencies are the most difficult to tame in the small rooms many people use to record and mix their music. One common problem is a mix that sounds great in your room is too bassy when played

anywhere else. The culprit is bass waves bouncing off the wall behind you, creating deep nulls in the response you hear. Nulls as deep as 30 dB are not only common, but typical. Most small rooms have several nulls in the bass range below 300 Hz. The Before / After frequency response graph above was measured in a typical domestic room. Click the image to see it full size.

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Since you hear less bass than is really in the track, you add too much bass with EQ to compensate. The finest loudspeakers in the world are of little value if your room skews everything you hear. The solution is bass traps placed in the room corners. When bass traps are added to a room, the low frequency response becomes much flatter and tighter, and also changes less around the room. Note that rectangle rooms have 12 corners: four where each wall meets another wall, four where each wall meets the ceiling, and four more where each wall meets the floor.

ROOM ORIENTATION AND SPEAKER PLACEMENT

In a standard rectangular room, it's best to orient the mix position so the speakers are firing the longer way down the room. This improves the response at low frequencies by putting the reflecting wall behind you farther away.



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Symmetry is equally important, so center your desk and speakers left-right in the room. Placing the mix position in the front part of the room also helps the low end response. The ideal speaker height is with the tweeters at ear level, because the flattest response is on-axis. I prefer speakers to be level, not angled down to your ears. Otherwise, as you move forward and back slightly the high frequency response changes. The article [How To Setup a Listening Room](#) explains more.

AVOID EARLY REFLECTIONS

Another common mixing problem is poor clarity and imaging caused by "early" reflections. Sound from the loudspeakers travels directly to your ears, but a few milliseconds later, reflections arrive after the sound bounces off the side walls and ceiling. This is known colloquially as "time smearing," though the more proper term is *comb filtering*. Comb filtering is a specific type of frequency response error that creates a series of peaks and dips. The cure for early reflections is absorber panels made of rigid fiberglass or acoustic foam, placed at specific points on the side walls and ceiling. Once these points have been treated, clarity and soundstage magically come to life. All of a sudden you can easily hear EQ changes of less than half a dB, and very small changes in left-right panning. See the article [Creating a Reflection-Free Zone](#) for more information.

DIFFUSION ROCKS

Diffusion avoids the damaging echoes and comb filter effect caused by reflections off nearby walls, but without reducing desirable ambience as absorption does. The best type of diffusor is called a QRD, which stands for Quadratic Residue Diffusor. You don't need to understand the math behind a QRD diffusor to appreciate how much better it sounds than a bare reflecting wall! Unfortunately, good diffusors cost more than good absorbers. If the room and budget are both small, placing absorbing panels on bare surfaces works well. But when cost is no object and you want to retain as much liveness as possible, diffusion is the key. Good diffusors also make a small room sound much larger than it really is. But forget bookshelves - that's just an Internet myth. Our two videos [Hearing is Believing](#) and [All About Diffusion](#) let you hear what diffusion sounds like.

JUST SAY NO TO ROOM EQ

Trying to use an equalizer to fix room acoustics problems does not work very well. Every location in a room has a different response, so no single EQ curve can help everywhere. Even if your goal is to correct the response only where you sit, it's impossible to counter nulls. If you have a 25 dB dip at 60 Hz, adding that much boost with EQ will increase low frequency distortion in the loudspeakers. And at other places where 60 Hz is too loud, EQ makes the

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problem worse. EQ can reduce peaks a little, but it does not reduce the extended decay time that accompanies most peaks. Our [Audyssey Report](#) article explains why EQ is not a suitable substitute for bass traps and other treatment.

PROFESSIONAL MATERIALS = PROFESIONAL RESULTS

Forget packing blankets, egg cartons, non-acoustic foam, and carpet: These do not work. That's just another Internet myth. Egg cartons are too thin to absorb low frequencies which is needed for music rooms. Likewise, non-acoustic packing foam is not suitable because it's not the open cell type that absorbs sound. Rigid Styrofoam panels meant for home insulation have no useful acoustic value either. The best bass traps and absorber panels are made from rigid fiberglass. Inch for inch, rigid fiberglass absorbs more, and to a lower frequency, than any other material available.

RECORDING SPACES

Most of my tips are about improving your ability to mix well. After all, if you can't hear accurately, it's impossible to know what mix elements need adjusting. But good acoustics is just as important where you record instruments and singers with microphones. The same reflections that reduce clarity when listening through speakers also make live instruments sound boxy and off-mic. The closer the performer and microphones are to bare walls, the stronger the reflections will be. Important places for absorption or diffusion in a recording room are surfaces closer than about ten feet, and especially on the ceiling above drum overhead microphones.

JUST FOR THE FUN OF IT

In my experience, problems due to poor room acoustics are the biggest cause of dissatisfaction among home recordists. Sadly, many people consider everything *but* acoustics when they're unable to make a mix sound the way they want. Besides making it much easier to hear what's actually "on tape," high quality acoustic treatment makes recording and mixing a lot more fun. It's a real eye-opener when you first hear every note clearly articulated by an electric bass, and are able to hear very small changes in EQ and reverb settings. It may seem surprising, but acoustic treatment will improve the quality of everything you record and mix *far more* than your choice of microphone, preamp, and sound card. In that one moment, when you first work in a well-treated room, it's immediately clear what you've been missing all along!

Ethan Winer plays the cello and electric guitar, and loves to write pop instrumentals. Ethan has, at various times, earned a living as a studio musician, computer programmer, audio engineer, composer/arranger, technical writer, and college instructor. Ethan now designs acoustic treatment products

and runs RealTraps where you'll find many more educational articles and videos about acoustics.

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