

# Alan Ratcliffe

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## Articles: Home Studio: Acoustics 2 - Acoustic Treatment

A room with good acoustics is essential to recording and mixing your music correctly. "Good acoustics" can be defined as getting the sound from the speakers to your ears as unchanged as possible. A good home studio room should be as neutral as possible while still having some life to enable you to hear detail (such as stereo positioning) properly. This ensures that music you have mixed and equalised to sound good has the best chance of sounding good in other rooms.

Controlling the sound in a room is achieved by selective acoustic treatments. Once again, let me stress acoustic treatment is not [soundproofing](#) - it does not stop sound from getting in or out of the room, it controls the characteristics of sound within the room.

### The Problems

These are the common problems which you need to fix to make your room conform to the ideal listening environment mentioned above:

#### Problem 1: Room Reverberation

We home reccers are often at a disadvantage as we are working in relatively small rooms with parallel walls, as well as a parallel ceiling and floor. Any sound in a room like this reflects repeatedly backwards and forwards between these surfaces, creating reverberation. You know what this sounds like - we have all clapped our hands in an empty room and listened to the reverb (some of us do this compulsively!). Controlling these reflections is one of the most important things we can do to make the room sound good. For our purposes, the reverberation time (the amount of time it takes for the reverb to die away) should be close to a half second.

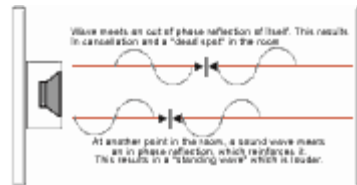


#### Problem 2: Early Reflections

When either the sound source or the listener is close to a boundary or any hard surface, the reflection from that boundary can cause a sound to arrive at the listening point via two paths (direct and reflected) at slightly different times. The two sounds will be out of phase with each other at some frequencies and these frequencies will cancel each other out. Other frequencies will be in phase and these will be reinforced. The resulting frequency response will be very uneven, and the stereo image will also be distorted.

#### Problem 3: Standing Waves & Dead Spots

Standing waves are created when you have two parallel boundaries (two walls, or the ceiling and floor). Some frequencies are reinforced by the distance between the boundaries (the sound makes exactly one round trip on each cycle of the speaker and the pressure fronts pile up). This is why it's nice to sing in the shower - the low frequencies of your voice are greatly amplified by the standing waves.



## Search Site

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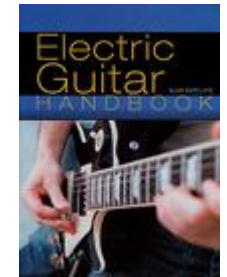


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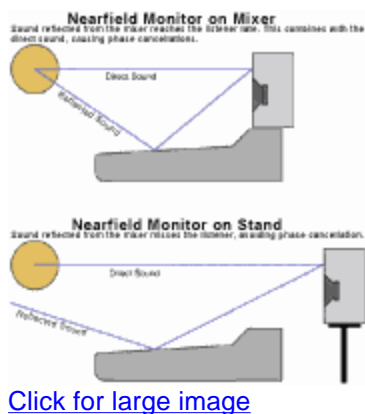
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## The Cures

You may be surprised to find that basic sound control of a room is actually quite simple and can often be accomplished with inexpensive materials.

### Tools

Fortunately, the best tools to measure sound in a room are your ears! Listen to the sound of a room before and after the acoustic treatments listed below by listening to CDs you are familiar with. Vocals and words should be clear, the bass balanced and tight, cymbals bright without being harsh. A mono signal will seem to come from a spot exactly between the speakers - and that spot should not move with different notes. Clap your hands and listen to the resulting sound - you should hear a slight thickening of the sound, but little reverb - and no definite pitches or echoes.



### Cure 1: Monitor Speaker Positioning

Everything in the room should be as symmetrical as possible. Monitor speaker placement should be symmetrical within the room - with each speaker the same distance from its closest wall. Putting speakers too close to corners tends to emphasise the bass in an unpredictable way, so place your speakers away from them. Small changes in position can affect the sound quite significantly, so experiment with moving your speakers forward or backwards while your CD is playing and aim for a smooth response, especially at the low end. If some bass notes seem louder than others, move the speakers around until this is minimised. The distance between the monitors should be equal to the distance between each speaker and your ears - forming an equilateral triangle.

Avoid strong early reflections from nearfield monitors (which cause phase interference). Put them on solid speaker stands behind the desk rather than on the meter bridge of a large mixer (this creates an early reflection path off the mixer surface). If you're getting strong reflections from the ceiling above the speakers, consider putting a foam absorber or two up there.

### Cure 2: Diffusion

You can break up reverb from flat surfaces by mounting objects called diffusers on them. When sound is reflected off a convex or complex surface, it spreads the reverberant sound evenly throughout a room. This prevents standing waves and also eliminates "dead spots" - where frequencies are drastically reduced or missing. The thicker the diffuser, the lower the frequency that will be affected. One of the best diffusers I know is a deep bookcase well stocked with a variety of sizes of book. A rough stone wall is also quite an effective diffuser.

### Cure 3: Absorption

Excessive reverb and standing waves can be tamed by using materials

which absorb sound. These are often fibreglass or particleboard panels, special foam tiles (which often double as diffusers). These generally work well down to 100 Hz or so.

Absorption materials need not be expensive. Carpet on a thick underfelt, thick curtains with backing and even plush furniture can help reduce reflections.

Don't try cover every surface of your room with absorptive material to completely deaden the room. A dead room would be unpleasant to work in, as your ears use the subtle phase differences of a live room to accurately place sound sources in a stereo image. Also, absorptive materials are frequency selective, with high frequency sound being absorbed easier than low. This means that as absorption is added to a room it becomes more and more bassy in tone.

### **In Practice**

Avoid bare walls in the front of the room (behind the speakers). Remember, you want only direct sound from the monitors to reach the listening position. So 80-100% coverage with acoustic tiles or at least some heavy drapes will work wonders.

Fix a few square metres of acoustic tiles to the walls each side of the listening position to absorb and diffuse. This will help keep the stereo image nice and tight.

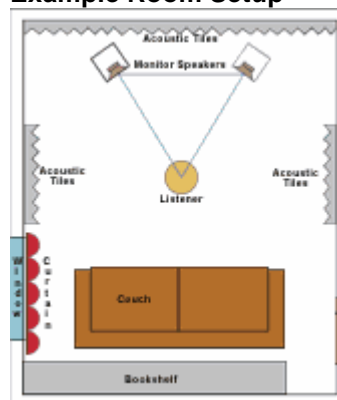
Use diffusion behind the listening position, at the rear of the room. This makes the room seem deeper than it really is.

We happily use materials which do not absorb well below 100 Hz due to the fact that normal wall and floors are absorptive in the low end, but very reflective above 200 Hz. This means that the reverb in an empty room is almost always bass deficient. This suggests a simple way to tune your room: add absorbing material until you reach the point where the new absorption material balances the original sound of the room, giving a nice flat frequency response.

Carpet on a thick underfelt is the simplest way to control floor to ceiling standing waves and is a good absorber down to about 250hz.

A thick curtain with backing is still too light to be a really broadband absorber, but over a window it combines with the low frequency absorption of glass to give a reasonably flat overall effect. If you use your room for both tracking and mixing, mounting curtains on rails along walls gives you the option of changing the liveness of the room depending on whether the curtains are drawn or open. A big, plush sofa at the back of the room can also help (and gives visitors to your sanctum sanctorum somewhere to sit!).

### **Example Room Setup**



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