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IMPROVING ACOUSTICS

A good listening environment is one in which reflections are controlled so that all frequencies decay at the same time (a reverberation time of between 0.3–0.5 seconds). This means taming both higher frequencies and the more difficult lower ones, as well as dispersing reflections which would otherwise form room modes.

In the quest for the perfect room there are two key weapons in the acoustician's armoury, diffusers and absorbers, each of which deal with a specific problem:

➤ **Diffusers** scatter sound energy over a wide angle rather than bouncing it back like a mirror. They randomise hard reflections that might otherwise confuse stereo imaging and cause flutter echo. The simplest kind of diffuser is an irregular solid surface, often made from different height wooden blocks fixed to a flat panel. Usually these are sited on the back wall of a studio – scattering the sound waves that come directly from the speakers – or on the ceiling just behind the mixing position.

➤ **Absorbers** are panels of porous material such as mineral wool or open-cell foam that absorb sound energy, reducing reflections and ambience in the room.

With absorbers, size matters. For it to be effective an absorber needs a thickness



❶ The diffuser on the back wall of Florian Meindl's Berlin studio. "This is my self-constructed quadratic residue diffuser made of 284 wood parts," he says, "it diffuses the frequencies bouncing back behind me."



❷ And Florian's absorbers. "My side wall absorbers which absorb frequencies from 20kHz down to about 250Hz, I've got more on the ceiling. They've made a big improvement to the sound in my studio; I can't live without them any more."

comparable to a quarter wavelength of the sound being absorbed. At 1kHz, for example, where the wavelength is 340mm, the absorber must be at least 85mm thick. What does this mean for the non-technically-minded? First, to get an even spread of absorption across the frequency spectrum, you are likely to need at least two different thicknesses of absorber. Second, the lower the frequency, the larger the absorber required.

In fact, it's not quite that simple as sound waves rarely hit absorbers head-on. Instead they arrive from various angles. The more oblique the angle of approach, the greater the thickness of material the sound wave has to pass through, meaning absorbers are

effective down to a lower frequency than their thickness suggests.)

The granddaddy of absorbers – specifically engineered to deal with frequencies below 100 or so Hz – is the **bass trap**, an absorber-on-steroids with dimensions to match. Frequently sited in the corners of studios (to take advantage of the oblique approaches of waves), commercially-made traps feature heavy membranes above the usual porous absorbers.

TIP Some companies offer 'absorbers on legs' – absorbers that can be moved around. These are ideal if your studio is located in, for example, a spare bedroom and you need to be able to free up space.

WHERE TO PLACE ABSORBERS

You don't need to cover every available space with absorbers. In fact doing so is not recommended – you end up with a dark, oppressive sound that is unlikely to translate. Aim instead for a coverage of around 20 per cent of wall space – you should notice a big difference.

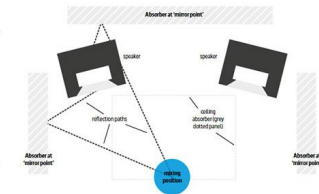
But which 20 per cent? When deciding where to locate absorbers your aim is to reduce the effect of room reflections from the perspective of the mixing position.

There is a tried-and-tested method of deciding where to place absorbers. Get a volunteer to move around the front of the room holding a mirror held flat against the wall while you sit in your mixing position.

Wherever you see a reflection of one of your monitors in the mirror you need to place an absorber to reduce the reflections bouncing directly back at you.

In most rectangular rooms, these mirror points are found on the **side walls between the mixing position and the speakers and behind and between the speakers**. Look up and you'll find one on the ceiling too.

Don't worry about the floor – aside from the obvious impracticality, we're so used to hearing floor reflections that our ears naturally tune them out.



❸ Absorbers placed wherever a mirror would show a reflection of the speakers, including on the ceiling. Note also the monitor placement, with the listener forming an equilateral triangle with the speakers.

Where the back of the room is also reflective, placing absorbers there may help, although the more usual choice is a **diffuser**. If the back wall has shelves or cupboards packed with stuff, that's normally enough to guarantee a good amount of scatter.

SPEAKERS AND HEADPHONES

High quality headphones (page 260) are good for working late at night when you don't want to disturb others and for forensic mix work – they're strong on detail – but

mixing entirely on headphones is not recommended. Stereo imaging sounds very different on phones than it does on speakers and you may also find that bass frequencies vary according to how the headphones fit your ears. Which means by all means use headphones when you're on the road or for late-night writing sessions, but when it comes to mid-down proper, treat your mix to the benefit of a reasonable pair of speakers too.

Hi-fi speakers are generally designed to flatter the music fed to them for the consumer market. The same is true of

DIY TREATMENT

Although investing in acoustic treatment is almost always money well spent, if you're handy with a hammer and saw you can save yourself a good few hundred pounds by doing things yourself.

DIY diffusers are easy to make. Simply buy a solid (ply) backing board and affix different height blocks cut from 100mm square timber – see Florian Meindl's home-made version opposite for inspiration.

To make a DIY absorber, put 30 or 50mm mineral wool cavity wall insulation blocks into 100mm deep wooden frames where the wool is flush with the front of the frame so as to leave an air space behind. Cover the construction with a porous fabric such as cotton or polyester.

Wear gloves and a dust mask when handling mineral wool or glass fibre as the fibres cause rashes and lung irritation.

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