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Practical Acoustic Treatment, Part 5

Tips & Techniques

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PRACTICAL ACOUSTIC TREATMENT

In the fifth and final part of our series on acoustic design, **Paul White** sums up the key stages of designing a project studio and touches on the subject of air conditioning. This is the last article in a five-part series. Read Part 1, Part 2, Part 3 and Part 4.

The purpose of this series so far has been to help you appreciate the role acoustics play in creating a useful mixing environment, and to provide some guidance on improving your own listening space. Though some mathematical concepts have been introduced, I must stress yet again that any major studio design work should be undertaken in conjunction with a good acoustic consultant, who will have the means to measure the actual performance of the room at various stages throughout the project. If you're working at home on a low budget or simply kitting out your garage as a studio, then by all means try applying the principles discussed so far, and if you do intend to go through the maths, consider buying some software to help you. To follow up this series, there'll be a full review of *Acoustic X* in the next issue, and though it costs around £150, it is very quick and easy to use and can be a very educational tool.

In this final part of the series, I'd like to summarise the various stages you need to go through when designing a small studio, and since relatively few structural changes can be made in most home studios, I'm also including a few alternative ways of working that might help avoid problems. Soundproofing is usually the first thing on the agenda, especially in residential areas, and while a complete cure may not be practical because of space or budget constraints, you'll almost certainly be able to make a significant improvement without having to rip the house apart or spend a fortune.

The Source Of Noise

Accepting that you're unlikely ever to get perfect sound isolation in a typical house without major building work, you may be able to meet the problem halfway by generating less noise in the first place. The choice of monitors is important here as this is where much of your noise will be coming from. Nearfield monitors are a good choice for the small studio for a number of reasons. Firstly, the overall monitoring level can be less loud than with a system located further away from the listener, so the effect of the room acoustic is minimised and the overall amount of sound generated is less. Furthermore, nearfield monitors generally produce less deep bass than large, full-range monitors, and while bass may be appealing, in a small or untreated room it is likely to be very misleading. Far better to tailor the monitor's bass response to the room so that you get a more accurate picture of what's going on in the mix. As far as noise is concerned, low frequencies cause the most problems, so by cutting down on your bass output, you also cut down on the nuisance factor of your monitoring system. If your system is still too noisy to allow you to work late at night, consider doing at least some of your recording using headphones and save the monitors for when you come to mix.

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Noisy equipment invariably causes less unwanted sound leakage if it is isolated from the floor of the room. This can make a particularly big difference if the floor is made of wood. I heard a story about one frustrated project studio owner who replaced his traditional drum kit with a set of electronic pads, only to find that the physical thump of the bass drum pedal still sounded loud and clear in the room below. Try mounting instrument amplifiers on rubber foam or even inflated inner tubes to cut down structurally borne sound. Drum kits are a different matter, and though the amount of sound leakage can be reduced by positioning the kit on a plinth built like a section of floating floor, anyone expecting to get away with Keith Moon impressions in a council house without upsetting the neighbours is doomed to a life of disappointment!

Rock guitars may now be DI'd in a quite satisfactory manner using dedicated recording preamps (such as the Tech 21 Sansamp PSA1 below) or speaker simulators. Speaker simulators plug into the speaker outlet (or occasionally the preamp output) of an instrument amplifier, and filter the sound in such a way as to

imitate the coloration of the speaker. The output is a low-level signal which can be DI'd directly into a mixing console, and one of the great advantages of this approach, apart from the lack of noise, is that what you hear over the monitors is exactly the sound going to tape. While purists still prefer to mic up their amps, some of the modern recording preamps are extremely good. If you must use an amp, try a small valve practice combo, as these often record better (and sound bigger) than a large stack, as well as minimising noise and spill.

Pragmatic Acoustics

While soundproofing follows fairly predictable physical rules, acoustic treatment is less easily pinned down. As we have seen, although there are well-documented physical laws governing the way sound is absorbed and reflected, there are so many variables in a typical room that precise calculation is virtually impossible. Perhaps this is why so many people consider acoustic design to be as much an art as a science. Even if you could be absolutely sure about the acoustic properties of all the materials making up your room, the acoustics would still change significantly once equipment and furniture was introduced into the studio.

There is also disagreement as to what actually constitutes the ideal monitoring environment, but ultimately, we have to keep firmly in mind that the end result of our efforts is likely to be a CD or cassette heard over fairly small speakers in a variety of imperfect domestic rooms or in cars. One thing you can be sure of is that few people will be listening in acoustically perfect control rooms with monitors the size of cupboards. What's most important is that you have a symmetrical room in which the reverb time is well controlled and nominally even across the audio spectrum. Strong early reflections from the monitors should also be avoided.

Choosing Monitors

Although it is important to listen to big-budget commercial mixes over full-range speakers to confirm what is going on right at the bottom of the audio spectrum, a pair of typical domestic hi-fi speakers may well miss out the lowest octave completely. Unless the control room is adequately large and properly designed to handle full-range monitors, therefore, the results are likely to be more misleading than simply relying on nearfield speakers. Even when a mix can be checked on a full-range monitor system, it is still wise to double-check that it sounds good on a typical domestic two-way speaker -- hence the tendency to use compact, two-way devices as nearfield monitors. Yet another advantage of nearfield monitoring is that the weaker bass end leaves the vulnerable mid-range more exposed so that any errors or distortions are easier to hear. This is a very important point as the strong bass from full-range monitors can easily overpower and obscure the mid-range.

Whatever the room and whatever the monitor system used, the way your ears evaluate music varies with time and with monitoring level, so it's essential you have some sort of reference against which to compare your mixes. It's good practice to listen to some known pre-recorded material over the system before mixing. It's well known amongst engineers that adding high-end EQ or processing the sound with an enhancer will tend to make you less sensitive to the actual amount of top end in the mix, so if you don't do regular comparisons with some kind of standard, you could end up with a very oddly EQ'd track. Not all CDs are as well recorded as they should be, but it should be possible to pick out a few that sound good and that cover the styles of music you tend to work on.

Realistic Aims

Commercial control rooms are designed to meet goals which are simply not achievable in the smaller studio or home facility. They have inner shells designed with non-parallel walls, specially-shaped ceilings and carefully calculated trapping. For those of us setting up a budget home studio or small-scale commercial facility, many of these aims simply cannot be realised and we often have to adapt a rectangular room of less-than-optimum proportions. This isn't always as bad as it seems though, because that's exactly the description of a typical living room, and that's where most recorded music is listened to. In reality, most living rooms can be made to sound OK with the right speaker system installed.

There is a school of thought that suggests that most of the acoustic problems of a studio are brought about by the physical needs of the studio space -- in other words, a perfectly acceptable room is acoustically spoiled by emptying it of furniture and filling it with gear! This makes some kind of sense as soft furniture offers both diffusion and absorption while studio gear tends to have lots of hard, flat reflective surfaces.

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With a little thought, however, many of these undesirable effects can be minimised. For example, carpeting the floor will help damp down ringing and shorten the overall reverb time, while a soft sofa at the back will help soak up reflections and damp resonances, as well as giving the clients somewhere to sit. Excess 'liveness' can be cut down by hanging heavy drapes or rugs a few inches from the wall, but don't fall into the trap of overdamping the high end to leave the bottom booming out of control. Possibly the worst thing you can do is to carpet all the surfaces in the room, because then you soak up all the upper mid and top, leaving a room that sounds boxy and muddy.

Air Conditioning

Professional studio air conditioning systems are beyond the scope of this series, and in any event, they are not applicable to project studios, because of the sheer volume of ducting, acoustic baffles and acoustically isolated pumping machinery required. Such professional systems can be hugely expensive as well as being bulky, and of course most need to be fitted at the studio building stage. However, some fresh air is needed because a soundproof studio is also, effectively, air tight. Even so, the heat generated by a few racks full of gear in a well insulated room means that air cooling is actually a greater priority than introducing large quantities of fresh air. For small studios, where the doors can be opened from time to time to allow fresh air in, a heat exchanger air-cooling system may be quite adequate.

Basic air conditioning units come in two types: the 'through-the-wall' type and the split system. Both work on the same principle, whereby a fan recycles the room air over a cooled element, the heat being dissipated outdoors. With a split system, the inner and outer units are connected by small-bore pipework so you don't need to knock a big hole in the wall, but these tend to be more expensive than 'through-the-wall' models and they also need to be fitted by a qualified heating engineer. Figure 1, on page 208, shows a split system. By contrast, the cheaper 'through-the-wall' system is all built into one box, which must be mounted half in and half out of the room via a large hole in the wall. These machines are not designed with sound isolation in mind, so if you do use one, it's a good idea to have a foam-lined cowl fitted over the outside of the unit, taking care to ensure there's no obstruction to the air flow. Figure 2, above, shows an all-in-one system with a DIY cowl fitted. Because of cost considerations, this is exactly what I did in my own studio, and it works fine. What's more, unlike the split system, a 'through-the-wall' unit can be set to change some of the air in the room as well as cool it.

Though a split system always cools the same air, the fact that the inner and outer elements are physically separate and joined only by narrow-bore pipes means that there's virtually no sound leakage. A further advantage of the split system is that one external unit can feed more than one internal unit, so you could cool both your studio and control room. The actual power of the system depends on the size of room it has to cool and the amount of heat normally generated within the room, which you can estimate by adding up the power requirements of all your bits of gear. Don't forget to add on the power of all the lighting. Whoever supplies/fits your system will be able to calculate the power you need so long as you have these basic figures available.

Large studio air-conditioning systems use large ducts and very low air velocities in order to keep the noise down. However, with a typical commercial air-conditioning unit, the air velocity is comparable to that of a large fan heater, so don't expect it to be completely silent. You can always turn them off for crucial takes. The outside unit can also create fan noise so you should check the specifications of your intended purchase to make sure the air conditioning doesn't annoy the neighbours! To find a supplier, check out Air Conditioning in Yellow Pages.

Bass trapping probably isn't vital so long as you pick a pair of speakers with a smooth bass rolloff and keep some large soft furnishings in the room. Wooden floors and plasterboard-lined rooms also have the natural ability to trap out some of the bass. A monitor design that rolls off gradually below 80Hz or so will work far better in an untrapped room than one that uses heavily tuned porting to prop up the bass down to 50Hz or so but then cuts off rapidly.

There's one important aspect of studio performance that can't be designed in, and that's your own hearing. A good engineer can make effective mixes on the most rudimentary equipment, so long as he's aware of its limitations and he compares his work with a known reference recording from time to time. Try to avoid the temptation to monitor at loud levels for long periods as this not only clouds the judgment and changes the perceived musical balance, it can also cause permanent hearing damage. As a general rule, monitor your mix at the kind of level you expect it to be played at by the end listener, and restrict loud listening to short periods.

Finding Materials

Many of the materials used in sound isolation and acoustic treatment, such as Rockwool, fibreglass, plasterboard, flooring chipboard, roofing felt, insulation board and timber, can be found at regular builders' merchants. However, items such as barrier mat, half-round door gasket, compression latches, specially perforated peg-board, Lamella flooring, neoprene and acoustic foam is more specialised and so has to be bought via a specialist supplier of acoustic materials. Acoustic tiles can be supplied by companies such as Studiospares, and a trawl through the *SOS* classified ads often turns up other sources of materials, as well as acoustic consultants. One large UK company worth trying for more elusive materials is Siderise Ltd (+44 (0)181 549 6389), who can also offer advice on installations using their materials. See the information box below for more useful contacts. Other specialist companies may often be tracked down via Yellow Pages.

information

T Acoustics and
Architecture Group
+44 (0)181 858 6883.

W www.aaa-design.com

T Studio Wizard
+44 (0)860 666532.

W www.studiowizard.com

T Munro Associates
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W *Acoustic X*
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