

MIKE SENIOR

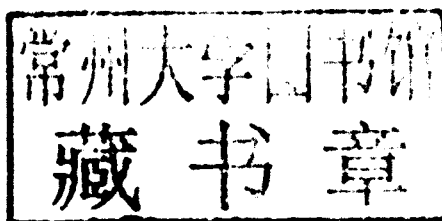
MIXING SECRETS

FOR THE SMALL STUDIO



Mixing Secrets for the Small Studio

Mike Senior



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To my parents.

Acknowledgments

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In addition, I'd like specifically to thank all the interviewers who have done an immense service to us all by shedding so much light on top-level studio practice: Michael Barbiero, Matt Bell, Bill Bruce, Richard Buskin, Dan Daley, Tom Doyle, Maureen Droney, Tom Flint, Keith Hatschek, Sam Inglis, Dave Lockwood, Howard Massey, Bobby Owsinski, Andrea Robinson, and Paul Tingen. Paul Tingen deserves special praise for his dogged pursuit of the hottest current hit-makers for *Sound on Sound's* "Inside Track" series. I'm grateful as well to Russ Elevado, Roey Izhaki, Roger Nichols, and Mike Stavrou for their own insightful writing on the subject of mixdown. Many thanks are also owed to Philip Newell, Keith Holland, and Julius Newell for permission to reproduce the results of their superb NS10M research paper; to Phil Ward for alerting me to the perils of speaker porting; and to Roberto Détrée and Mastermix Studios in Munich for allowing me to photograph their speakers.

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WHAT YOU'LL LEARN FROM THIS BOOK

This book will teach you how to achieve release-quality mixes on a budget within a typical small-studio environment by applying power-user techniques from the world's most successful producers. Using these same methods, I've carried out dozens of mix makeovers for *Sound on Sound* magazine's popular "Mix Rescue" series, working on mass-market gear in various home, project, and college studios. If you head over to www.soundonsound.com, you can find before/after audio comparisons for every one of these remixes, and this book is a one-stop guide to pulling off these kinds of night-and-day transformations for yourself.

WHAT YOU WON'T LEARN

This book will not teach you how to operate any specific brand of studio gear—that's what equipment manuals are for! The information here is deliberately "platform neutral," so that you can make just as much use of it whether you're on Cubase, Digital Performer, Live, Logic, Pro Tools, Reaper, Reason, Sonar, or any other software platform. And although I've made the assumption that the majority of cost-conscious mix engineers will now be working in software, my advice also applies equally well to hardware setups, give or take a patch cord or two. Indeed, my own background is in computerless environments, so I know from experience that equally good results are attainable there.

WHAT YOU NEED TO KNOW ALREADY

Although I've done my best to make this book friendly to studio newbies, there is nonetheless some basic background knowledge that you'll need to understand to get the best out of what I'll be writing about. In particular, I'm assuming that the reader already understands something about these topics:

- *The fundamental physics, measurement, and perception of sound:* amplitude, decibels, and loudness; frequency, Hertz, and pitch; sine waves and the harmonic series; frequency response measurements
- *Studio setup and session workflow:* transmission/storage methods for sound (electrical, magnetic, digital); the basic principles of mics, DIs, audio cables, multitrack recorders, and mixers; routing for insert and loop effects; the stages of a typical production (preproduction, tracking, overdubbing, mixing, mastering); gain, headroom, noise, and signal metering

If you need a quick refresher on any of these elements, then check out www.cambridge-mt.com/ms-basics.htm for a whistle-stop overview. Alternatively, you can get more into the equations by checking out the first two chapters of either Alexander U. Case's *Sound FX* (Focal Press, 2007) or David Miles Huber & Robert E. Runstein's *Modern Recording Techniques*, 7th edition (Focal Press, 2009).

Studio jargon can be pretty intimidating, but the sooner you get a grip on it, the quicker you'll improve your mixing. If you feel unsure of any of the terminology used in this book, then head over to www.cambridge-mt.com/ms-links.htm, where there are links to a couple of thorough and well-maintained glossaries.

HOW TO USE THIS BOOK

Because this book has been specifically designed as a step-by-step primer, you'll get best results if you work through it from beginning to end. Many later sections rely on material covered in earlier chapters, so some aspects of the discussion may not make the greatest sense if you just dip in and out. At the end of each chapter there is a **Cut to the Chase** section, which allows you to review a summary of each chapter's main "secrets" before proceeding. Underneath it is an **Assignment** section, which suggests a number of practical activities to consolidate your understanding, and these assignments could also serve as course-work tasks within a more formal education framework. The URL at the end of each chapter leads to a separate website containing a selection of related links and audio files, all of which may be freely used for educational purposes.

This book is based on my own extensive research into the studio practices of more than 100 world-famous engineers, drawing on more than 2 million words of firsthand interviews. The text therefore includes hundreds of quotes from these high-fliers. If you don't recognize someone's name, then look it up in **Appendix 1** to get an idea of the most high-profile records they've worked on—you'll almost certainly have heard a few of those! If you'd like to read any quote in its original context (which I'd heartily recommend), then follow the little superscript number alongside it to **Appendix 2**, where there's full reference information for each one. Finally, if you have any further questions or feedback, feel free to email me at ms@cambridge-mt.com.

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PART 1

Hearing and Listening

Probably the most reliable way to waste your time in a small studio is by trying to mix before you can actually hear what you're doing. Without dependable information about what's happening to your audio, you're basically flying blind, and that can get messy. In the first instance, you'll face a frustratingly uphill struggle to get a mix that sounds good in your own studio, and then you'll invariably find that some of your hard-won mixes simply collapse on other playback systems, so that you're left unsure whether any of the techniques you've learned along the way are actually worth a brass farthing. You'll be back to square one, but with less hair.

Relevant advice from professional engineers is perhaps unsurprisingly thin on the ground here. After all, most pros have regular access to expensive high-end speaker systems in purpose-designed rooms with specialist acoustic treatment. However, even the hottest names in the industry don't always get to work in the glitziest of surroundings, and if you look carefully at their working methods, they have actually developed various tactics that enable them to maintain consistent high-quality results even under difficult circumstances. These same tricks can be applied effectively in small studios too. So much so, in fact, that as long as you take care with gear choice and studio setup, it's perfectly possible to produce commercially competitive mixes in a domestic environment with comparatively affordable equipment. Indeed, all of my remixes for *Sound on Sound* magazine's monthly "Mix Rescue" column have been carried out under exactly such restrictions.

But even God's own personal control room won't help you mix your way out of a wet paper bag unless you know how to *listen* to what you're hearing. In other words, once you're presented with a bunch of information about your mix, you need to know how to make objective decisions about that data, irrespective of your own subjective preferences, because that's the only way of repeatedly meeting the demands of different clients or different sectors of the music market. Do the cymbals need EQ at 12kHz? Does the snare need compression? How loud should the vocal be, and are the lyrics coming through clearly enough? These are the kinds of important mix questions that neither your listening system nor your mixing gear can answer—it's you, the engineer, who has to listen to the raw audio facts, develop a clear opinion about what needs to be changed, and then coax the desired improvements out of whatever equipment you happen to have at your disposal.

Most people who approach me because they're unhappy with their mixes think that it's their processing techniques that are letting them down, but in my experience the real root of their problems is usually either that they're not able to hear what they need to, or else that they haven't worked out how to listen to what they're hearing. So instead of kicking off this book by leaping headlong into a treatise on EQ, compression, or some other related topic, I want to begin instead by focusing on hearing and listening. Until you get a proper grip on those issues, any discussion of mixing techniques is about as useful as a chocolate heatsink.

Using Nearfield Monitors

1.1 CHOOSING YOUR WEAPONS

Choosing the equipment that allows you to hear (or “monitor”) your mix signal is not a task to be taken lightly, because it’s the window through which you’ll be viewing everything you do. For those on a strict budget, however, the unappetizing reality is that monitoring is one of those areas of audio technology where the amount of cash you’re prepared to splash really makes a difference. This is particularly true with regard to your studio’s primary monitoring system, which needs to combine warts-and-all mix detail with a fairly even frequency response across the biggest possible slice of the 20Hz to 20kHz audible frequency spectrum—a set of characteristics that doesn’t come cheap.

That said, when choosing the stereo loudspeakers that will fulfill these duties in all but the most constrained studios, there’s a lot you can do to maximize your value for money. First off, furniture-rattling volume levels aren’t tremendously important for mixing purposes, despite what you might guess from seeing pics of the dishwasher-sized beasts mounted into the walls of famous control rooms—most mix engineers use those speakers mainly for parting the visiting A&R guy’s hair! “I use nearfields almost exclusively,” says Chuck Ainlay, “because there just aren’t many situations where the main monitors sound all that good. The mains in most studios are intended primarily for hyping the clients and playing real loud.”¹ “I don’t use the big monitors in studios for anything,” says Nigel Godrich, “because they don’t really relate to anything.”² You’ll get a more revealing studio tool at a given price point if you go for something where the designers have spent their budget on audio quality rather than sheer power. As it happens, the most high-profile mix engineers actually rely almost exclusively on smaller speakers set up within a couple of meters of their mix position (commonly referred to as nearfield monitors). If you sensibly follow their example in your own studio, you shouldn’t need gargantuan speaker cones and rocket-powered amplifiers, even if you fancy making your ears water.

SURROUND MONITORING

Before acquiring a multispeaker surround setup for a small studio, I'd advise thinking it through pretty carefully. Until you can reliably get a great stereo mix, I for one see little point in spending a lot of extra money complicating that learning process. In my experience, a limited budget is much better spent achieving commercial-quality stereo than second-rate surround, so I make no apologies for leaving the topic of surround mixing well alone and concentrating instead on issues that are more directly relevant to most small-studio denizens.

Another simple rule of thumb is to be wary of hi-fi speakers, because the purpose of most hi-fi equipment is to make everything sound delicious, regardless of whether it actually is. This kind of unearned flattery is the last thing you need when you're trying to isolate and troubleshoot sneaky sonic problems. I'm not trying to say that all such designs are inevitably problematic in the studio, but most modern hi-fi models I've heard are just too tonally hyped to be of much use, and maintenance issues are often a concern with more suitable pre-1990s systems. Speakers with built-in amplification (usually referred to as "active" or "powered") are also a sensible bet for the home studio: they're more convenient and compact; they take the guesswork out of matching the amplifier to your model of speaker; they're normally heavier, which increases the inertia of the cabinet in response to woofer excursions; and many such designs achieve performance improvements by virtue of having separate matched amplifiers for each of the speaker's individual driver units.

Beyond those issues, a lot of monitor choice is about personal preference, and there's nothing wrong with that. Some people prefer bright aggressive-sounding monitors, others restrained and understated ones, and neither choice is wrong as such. The main thing to remember is that no monitors are truly "neutral," and every professional engineer you ask will have his or her own personal taste in this department. Part of the job of learning to mix is getting

accustomed to the way your particular speakers sound, so don't get too uptight about minute differences in tone between speakers. Go for something that appeals to you, and then concentrate on tuning your ears to how your chosen model responds in your own control room. "You've got to be careful about getting new monitors," advises Dave Way. "You've got to break them in and get to know them before you start to rely on them."³ Part of doing this involves referring to a set of reference recordings with which you're familiar (discussed more in Chapter 4).

No monitors are truly "neutral," and every professional engineer you ask will have his or her own personal taste in this department. Part of the job of learning to mix is getting accustomed to the way your own particular speakers sound.

Ported Speakers and Frequency Response

I have one further piece of advice to offer when choosing monitors, but I've deliberately held it in reserve, because I want to give it special attention. It's this: the less money you have to spend, the more you should beware ported monitors. Such speakers are sometimes also referred to as "bass reflex" or "reflex loaded" designs, and they incorporate some kind of hole or vent in the speaker cabinet, which encourages the whole box to resonate in sympathy with the speaker's drivers. The main purpose of this resonance is to increase the low-frequency output, an aspect of a small speaker's performance that is naturally restricted based on its limited woofer size. By using a port to compensate for the woofer's natural low-end roll-off, manufacturers can have a wider flat region on their published frequency-response graph, as well as give the speaker a louder, beefier sound that'll help impress Joe Public's wallet in the shops. Figure 1.1 illustrates the basic effect of porting on a typical small-studio monitor's low-end frequency response. The solid line on the graph shows the kind of response you'd expect of a fairly typical small ported speaker, with the output remaining within a $\pm 3\text{dB}$ window down to maybe 55Hz. If you defeated the speaker's port by blocking it, however, you'd find that the response changed to something like that shown by the dotted line: the trace now drifts out of the $\pm 3\text{dB}$ window almost an octave higher, just above 100Hz.

So what's so bad about using a port to widen a speaker's frequency response? The problem is that porting also has several less well-advertised side effects that

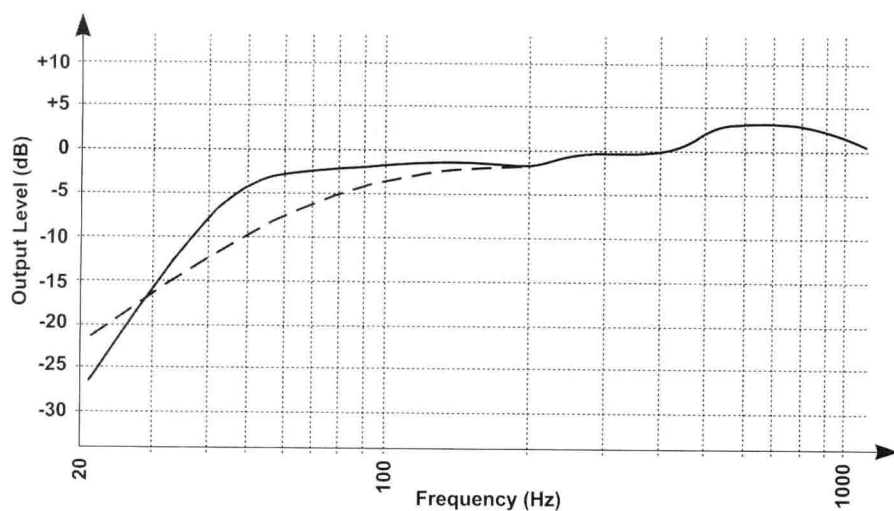


FIGURE 1.1

The solid line on this graph shows the kind of sub-1kHz frequency response plot you might expect for a small and budget-friendly ported studio monitor. The dotted line shows how the response changes when the port is artificially blocked, thereby defeating the cabinet's low-frequency resonance. The shaded region indicates the $\pm 3\text{dB}$ "flat" region of the speaker's quoted frequency-response specification.

can easily conspire to hamstring you at mixdown. Given the widespread use of porting in budget nearfield monitors, it's important to understand what these side effects of porting are. On the one hand, this knowledge makes it easier to evaluate monitors objectively when making a purchase; on the other hand, it better equips you to work around potential porting gremlins when the choice of monitors is beyond your control—for example, in a college facility or a friend's home studio. So bear with me while I look at this issue in more detail.

The first problem with porting can already be seen in Figure 1.1: although the port stops the response dropping off until 50Hz, the output takes a real nosedive beyond that. This means that although the speaker's overall low-frequency output is boosted by the port, the relationship between the sub-50Hz levels and the rest of the signal is seriously skewed at the same time, which makes it trickier to make judgments about instruments with important low-frequency components. So assuming, for the sake of example, that you're playing back the sound of a bass instrument that is completely consistent in its low-frequency levels, the perceived volume of its fundamental frequency will still dance around alarmingly as the notes change pitch, depending on how far the fundamental slips down the steep frequency-response roll-off.

Bear in mind that the lowest fundamental from a bass guitar is around 44Hz, whereas pianos, organs, and synths are just some of the sources that will happily generate fundamentals in the 20 to 40Hz bottom octave. In contrast to the fundamental, however, the first harmonic of these bass notes lies an octave above, typically in the much flatter frequency-response region above 50Hz, so it'll be tough going to decide whether there's the right amount of each of these frequencies respectively. And, of course, if we step back into the wild again, where untamed rampaging bass parts are often anything but consistent, how are you expected to judge when your mix processing has actually reined them in properly?

Kick drums are equally complicated to deal with. Let's say that you're comparing the kick level in your own mix to something on a favorite commercial record, but your kick drum has loads of energy at 30Hz, whereas the comparison track's kick is rich in the 50Hz region. Because the speaker is effectively recessing the 30Hz region by 12dB compared to the 50Hz region, you're likely to fade your own kick drum up too high, only to discover a rumbling mess lurking underneath your mix in other monitoring environments. Although the loss of low end on an unported monitor is also a problem, it's much easier to compensate for this mentally while mixing, because the relative levels of neighboring low-frequency bands are more representative.

Killer Side Effects of Porting

These porting anomalies, however, are only the tip of the iceberg, because frequency-response graphs only show how speakers respond to constant full-frequency noise, a test signal that is nothing like the varied and fast-moving waveforms of music. Much more troublesome is the way that porting hinders

the monitor's ability to track moment-to-moment changes in the mix signal. Specifically, the port causes any spectral energy at its resonant frequency to ring on for a short time, and while it's this resonant buildup that generates the port's flattering low-frequency level boost for a constant noise test signal, the same quality also adds short resonant tails to fleeting percussive attack noises (often referred to as transients), such that they can seem louder and less punchy than they actually are. Sounds that stop abruptly suffer a similar problem, with the port ringing on after they've finished. In this case, the resonance not only disguises the true decay attributes of the sound itself, but it can also make it difficult to judge the character and level of short-duration studio effects (such as modulated delays and reverb), which are often very useful at mixdown.

Another possible problem with ported speakers is that the ringing of the port can dominate over the real fundamental frequencies of low bass notes, making them difficult to distinguish from each other. Speaker reviewers sometimes refer to this phenomenon as "one-note bass," and it adds unwelcome uncertainty to tuning judgments at the low end. A commercial recording that I find particularly good for revealing this occurrence is Skunk Anansie's "Infidelity" (from the band's album *Stoosh*), where the meandering bass line quickly becomes murky and ill-defined in the presence of low-end monitoring resonances. (The track is also good for testing the frequency response of a monitoring system, as only the most extended response can do justice to that particular kick drum's almost seismic low-frequency rumble.)

Were the port-ringing consistent across the audio spectrum, you could mentally compensate for it perhaps, but of course it's not: it's more or less severe depending on how much of a given transient's energy resides around the porting frequency. Furthermore, I've so far taken for granted that the port has only one resonant frequency. In reality, however, it's difficult to stop the thing resonating at a whole range of higher frequencies too, which leads to unpredictable time-smearing artifacts right across the frequency spectrum. So it's not just bass instruments that you may be unable to judge reliably, but everything else too! Although it's perfectly possible for speaker designers to use careful internal cabinet design and damping to tame all but the desired low-frequency port resonance, that does cost them money, so this is where more affordable designs can really come a cropper.

Of course, a simple frequency-response graph leaves you blissfully ignorant of any of this stuff, because it only has axes for frequency and level. If you want to lay bare resonance side effects, then you need to add a third dimension to your frequency-response graph: time. Fortunately, there is a type of graph that does exactly that, called a spectral decay or "waterfall" plot. It reveals what happens to a speaker's output when a constant full-range test signal is suddenly switched off—as the graph develops in time (in other words moving from the background into the foreground, speaking three-dimensionally), you can see how much different frequencies ring on.

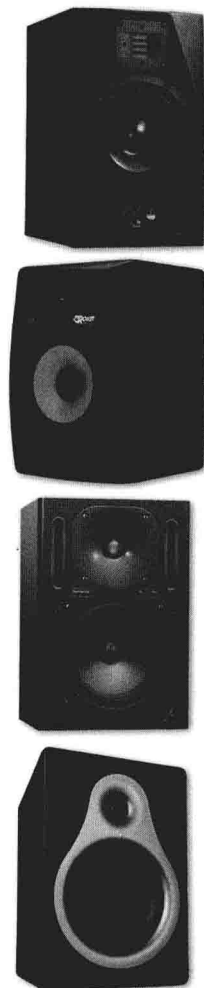


FIGURE 1.2

Some affordable two-way ported nearfield monitors (top to bottom): the ADAM A7X has dual circular ports either side of the woofer, the KRK Rokit 8 has a port slot under the woofer, the Behringer 2030A has two narrow port slots on either side of the tweeter, and the M-Audio DSM2 features a single circular port on the rear panel.

The left-hand column of Figure 1.3 shows waterfall plots for three well-designed small nearfield monitors. The top graph is for an unported model, whereas the two lower plots are for ported designs. You can see the low end of the ported models ringing on, as you'd expect, but otherwise the midrange and high end stop quickly without any obvious resonant trails. Compare this with the waterfall plots in the right-hand column of Figure 1.3, measured from three budget ported nearfields. What they clearly illustrate is that each speaker has prominent resonances well up into the midrange. (Bear in mind, though, that other factors contribute unwanted midrange resonances to speakers as

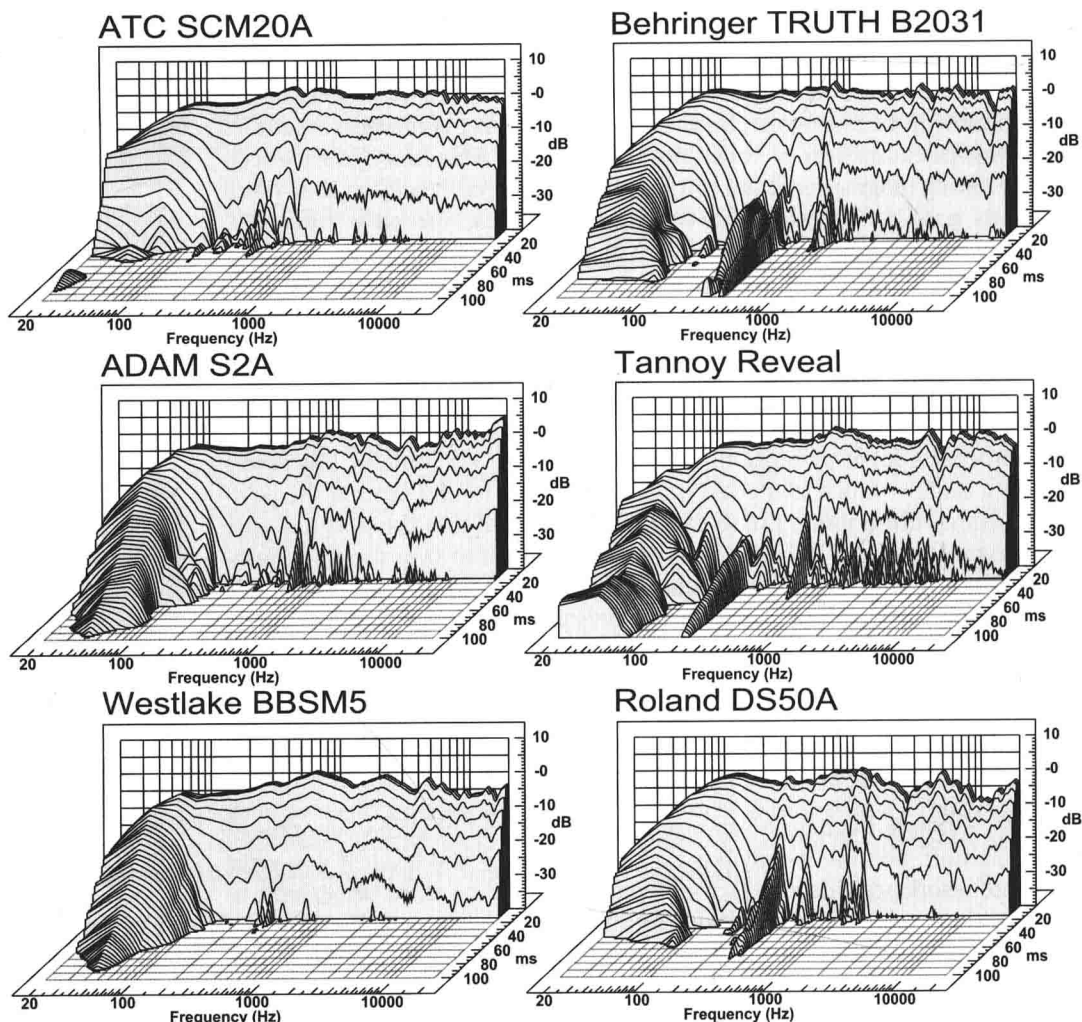


FIGURE 1.3

Waterfall plots for six different sets of studio monitors.

well, so it's not just porting side effects you're seeing here.) The less well-controlled a monitor's resonances, the less easily you can mix with it.

But even that's not the end of the story: ports can also produce turbulence noise, which obscures other parts of your mix; compression artifacts, which mess with the apparent level of bass instruments as you adjust the monitoring volume; and distortion, which misleadingly gives extra midrange body to bass instruments, making them seem more audible in the mix than they should be. If you want to hear what I'm talking about, try listening to the low-frequency sine-wave tones in the LFSineTones audio file through a budget ported monitor. (You can download this file from this chapter's URL: www.cambridge-mt.com/ms-ch1.htm.) Particularly on the lowest frequencies you'll usually hear a good dose of fluttering port noise and low-level distortion harmonics overlaid on what should be pure tones. Need any further convincing? Then consider the fact that two of the most influential mixing speakers in the history of audio production are unported designs: the Yamaha NS10 and the Auratone 5C Super Sound Cube. (You can see the waterfall plots for these speakers in Figure 1.5, and although neither has a particularly flat frequency response, both are extraordinarily well-behaved as far as resonances are concerned.)

The less money you're going to spend on monitors, the more you should approach ported models armed with holy water and cloves of garlic!

All of which brings me back to my main point: the less money you're going to spend on monitors, the more you should approach ported models armed with holy water and cloves of garlic! In my experience, you'll have to part with well over £1000 (\$1500) for a pair of ported nearfields that can reliably deliver what you need to mix competitively, whereas I don't think you need to spend this much on an unported design to get similar mixing muscle, just so long as you're willing to work with lower overall volume levels. This is why I usually point cash-strapped would-be mix engineers in the direction of products such as NHT Pro's M-00 and S-00 combination, or Blue Sky's Media Desk and Pro Desk systems, all of which are active, unported, and fairly full range.

Speaker Stands and Other Mounting Hardware

You can fork out for the fanciest monitors you like, but unless you set them up sensibly in your room, you might as well have spent most of that money on doughnuts for all the good it'll do your sound. I've visited a large number of small studios, and one thing the majority have in common is that their owners have underestimated the importance of monitor installation, with the result that the monitoring sounds only a fraction as good as it should, given the cost of the speakers. So let's look at ways you can maximize the quality of the sound, whatever speakers you're using.

For a start, the speaker cabinets should be as firmly fixed as possible, because if they move at all in sympathy with the woofer excursions it'll mess with how the low end of the mix is represented. How exactly you decide to mount the