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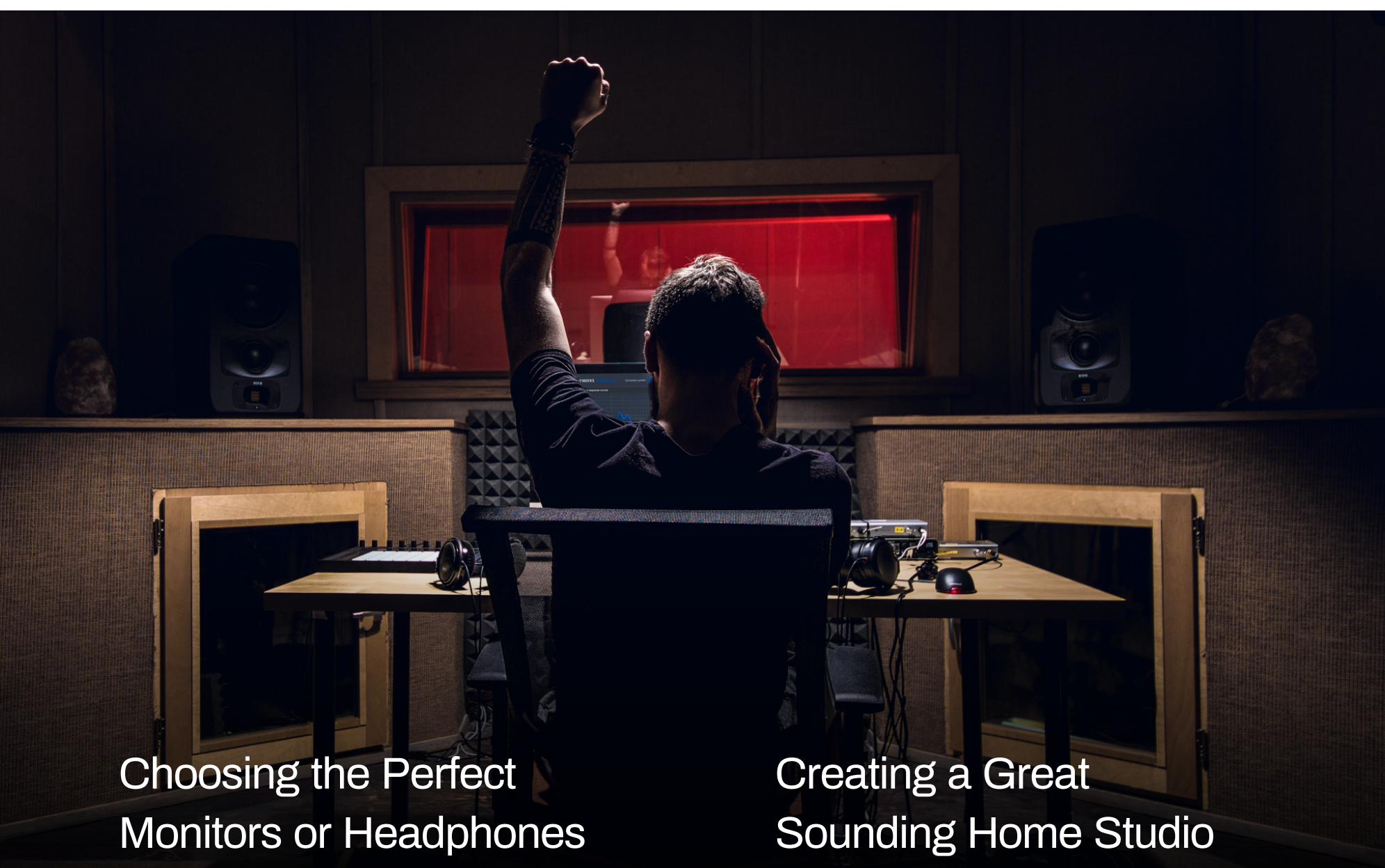
Successful Studio Setup



Choosing the Perfect Monitors or Headphones

Creating a Great Sounding Home Studio

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Introduction

Building your first studio may seem like a daunting task, and you will also find that building your third, fourth and fifth studio will seem equally daunting. A few key principles and thoughts about your personal goals, will go a long way towards achieving a terrific outcome for a creative, comfortable and sonically accurate studio space. The content presented in this Sonarworks eBook will present a foundation of knowledge as well as some basic considerations the will prove invaluable to seasoned studio engineers, songwriters, beatmakers and even music enthusiasts who simply desire an accurate listening environment.

Creating a studio space can seem like the chicken and the egg dilemma; should equipment come first or should the room and treatments come first? The truth is that each or our journeys are unique and sometimes the room choice will inform the equipment choice–while often one's workflow and equipment preferences will influence the room choice and setup. Each of the following chapters covers a topic which will help you confidently make choices for equipment, room setup and acoustic treatment, regardless of your budget and experience level.

Creating music and sound involves an artistic process that is unique to each creator and if you keep the following basic principles in the back of your mind while you setup and work in your studio, your creative expressions will successfully translate to your audience's ears and minds. Your studio will be an evolving workspace and have no fear–you can make it work by beginning with the information that follows.

Chapter 1

Creating a Great Sounding Home Studio

Most of us build our creative space where we live– in a spare room, a converted basement or garage or perhaps we share our workspace with our living room, dining room or guest bedroom. Even if set up our workspace is in a more industrial setting, we are often dealing with existing rooms and their limitations in terms of size, shape and existing construction or “bones.”

Fortunately, with a little knowledge and time and minimal financial commitment you can develop and implement an enjoyable and accurate listening space. This chapter will introduce the thought process, tools and techniques to effectively analyze and treat your room. Remember, your comfort and creativity come first, but paying attention to these basic principles, like placing your monitors in the ideal position and deploying a few basic acoustic treatment devices will go a substantial way to developing a trustworthy acoustic space.

Acoustic Considerations for a Room at Home

by Barry Rudolph

A good sounding home studio starts with careful planning, measurement, and a realistic expectation of how well a room can function within the constraints of your budget and the physical limitations of typical residential rooms. Converting an apartment, spare bedroom or garage into a studio presents built-in challenges because they weren't built or intended to be proper recording studios or mix rooms.

For now I will set aside a discussion about sound isolation or soundproofing as it will be covered in a subsequent article. Know that with professional recording studio design, proper sound isolation must be considered as part of the initial, ground-up construction. In typical home studio room conversions it's nearly impossible to "add on" truly effective sound isolation to existing structures.

The overarching goal when setting up any home recording studio is to provide a viable space where you can produce, record, and mix music while confidently making crucial artistic decisions throughout the process. The only way sound and the spatial effects of stereo or surround productions can be recorded and mixed accurately is by working in as acoustically neutral a room as is possible. Two key considerations for sonic accuracy at the listening position are the proper setup of the monitor loudspeakers and the application of acoustic treatments. You have to be able to predict how your end product will translate to the outside world when played on consumer-grade speakers and/or headphones.

Let’s Start With The Room’s Size and Shape

When selecting a room for your studio, you should try to use a rectangular-shaped room, as they tend to have the best potential for proper bass reproduction. Try to avoid square, round or irregular rooms, as they tend to be more problematic.

Most residential sized rooms are in the range of 3 meters wide by 4 meters long or even smaller (10 feet by 13 feet). Typical residential ceiling height is somewhere around 2.6 meters (8.5 feet). Begin your planning process with precisely measuring the dimensions—length, width, and ceiling height of the room you want to convert into a recording studio.

For easy measuring, I use the Bosch Blaze Pro Laser Distance Measure GLM165, but you can use an ordinary tape measure. Get a friend to help you by holding one end of the tape while you take the measurement at the other, or thumbtack one side of the tape to the wall to make one-person measuring easier..

When planning your furniture and equipment layout, I recommend drawing (try a drawing app like SketchUp) a dimensionally accurate layout of your room. Include all architectural features you cannot easily change: the location of doors, windows, support columns, closets, alcoves, and varying slanted ceilings.

The biggest acoustic problems in small rooms stem from the fact that low frequency wavelengths, the physical length of the sound wave, are much too long to be contained within the room’s dimensions without reflecting off a nearby floors, ceilings or wall boundaries.

For example, a 20Hz waveform is approximately 17 meters (56 feet) long, while a 100Hz waveform takes up about 3.5 meters (11.5 feet).

If you have the option of more than one room, try setting up a pair of monitor speaker on stands so that they project down the longest dimension (length) and start listening to familiar music to get a

“sense” of your particular room’s character and feeling. Listen in one room and then the other to see if one feels more comfortable to you.

Placing Gear In Your Room

A symmetrical layout of the equipment around the listening position promotes better workflow because you are always at or near the listening position while making gear adjustments and DAW tweaks during a mix or recording. It is essential that the intrinsic beauty of symmetry is applied to the positioning of your monitor speakers, the listening position, and the application of acoustic room treatments—absorption panels, bass traps and diffusers. The ultimate goal is to get your studio to function as a system and not a bunch of random pieces of gear thrown into a room.

Symmetry, as an abstract, is easily applied to the layout of your studio. Symmetry can separate a random and haphazard music setup into a reliable “tool” you can trust to evaluate your mixes and performances. Think of your left and right walls as mirror images of one another with your mix position in on the centerline.

Any treatment you put on the wall to your left side should also be placed on the wall on your right. It is important to match the acoustic space around you at the listening position and the space around your monitor speakers.

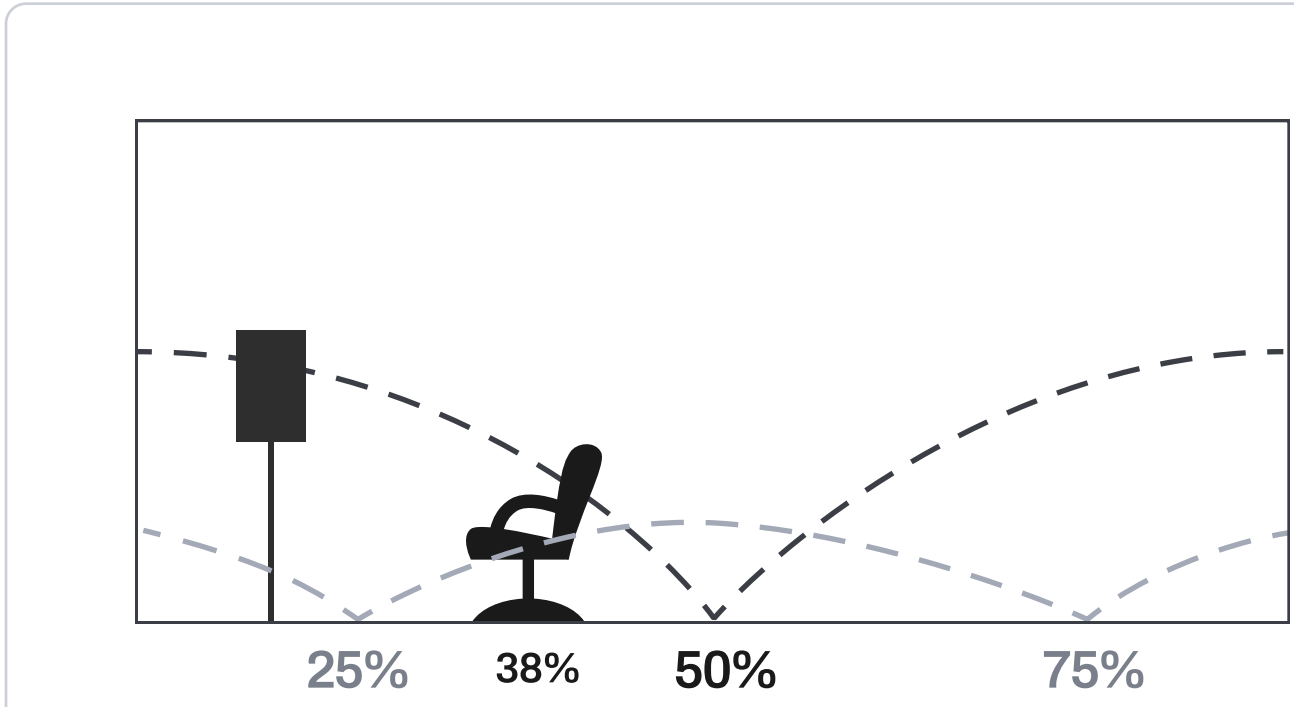
> Some people focus more on sonics. Some people focus more on story. I focus on both sonics and story, but music sometimes, just music itself, can turn into more of a maths problem. I guess everything in life is a math problem, but it can be more about an empirical route to getting the symmetry that you want, and this vibe, sonically.

Frank Ocean.

Speaker Positioning

I recommend placing monitors on stands, instead of on a desk surface, as this allows for easy minor positioning adjustments in the future. The monitors are to be positioned in the front of the room and just in front of the 25% point in the length dimension. At about the 38% point of the room's length—approximately halfway between the 25% location and the 50% point is the ideal listening position lengthwise in the room.

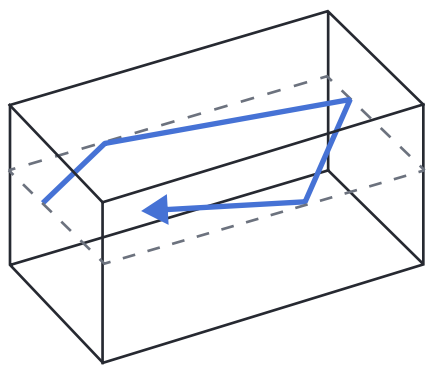
Referred to as the 38% listening position, this location is a good compromise between the severe room modes of vibration. The various peaks (where frequencies are reinforced and sound too loud) versus nulls (where frequencies may cancel) tend to be present at 25%, 50%, and 75% positions in the length dimension of any room.



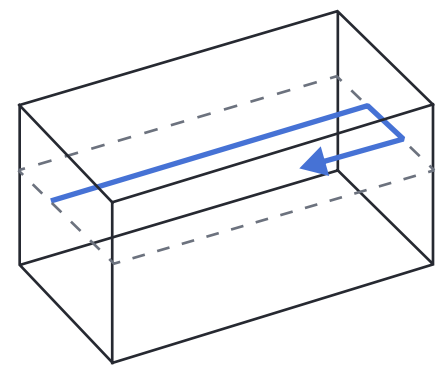
Symmetry is assured by locating the listening position at the 50% point, or centerline, of the width dimension. The intersection of the 38% point in the length dimension and the 50% point in the width dimension is where you would sit—the listening position or "sweet spot".

Room modes based on the physical dimension of the room exist in all three dimensions of the room—the length, width and height. Furthermore, there are three types of room modes. The strongest and most problematic modes are axial room modes cause by two waves traveling in opposite directions and striking two parallel walls.

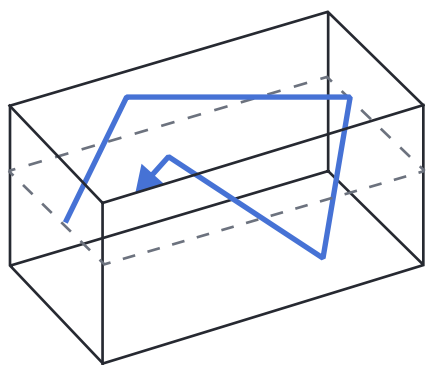
Tangential room modes employ four waves and four walls and are more numerous but have half the energy of axial modes. Lastly, oblique room modes arise from eight waves reflecting off six walls; they are one-fourth the energy of axial modes.



Tangential



Axial



Oblique

After measuring your room's dimensions, you may calculate the 1st Room Mode frequencies present in each of the three dimensions easily using this formula: 1st mode frequency (Hz) = 344 (speed of sound in meters per second) divided by twice the room dimension in meters. So, for a 4 meter long room, the first and lowest mode would be 344/8 = 43Hz. An online room mode calculator can be found at: https://amcoustics.com/tools/amroc

Acoustic Treatment Products

The application of acoustic treatment panels centers around and should focus on the listening position. The listening position is to be as reflection-free as possible. All reflections from the ceiling, floor, and side and back walls should be at least 20dB quieter than the direct sound coming from the loudspeakers. Sometimes called the reflection-free zone, this is accomplished by acoustic absorption panels and bass traps.

Acousticians, experts in room acoustics and treatment, have only three tools when treating rooms: devices that absorb sound, devices with surfaces that reflect sound, and devices with surfaces that diffuse sound.

Rooms must have the proper amount of acoustic absorption at various frequencies to function well. A rule of thumb is that the smaller your room, the more acoustic absorption you will require. The exacting use of absorption has a powerful impact on the subjective performance of a room. No other room treatment will make the most dramatic change in your room's acoustics.

There are two main categories of acoustic absorbers are they can be divided by use and frequency range: velocity absorbers for middle and upper frequencies and *pressure* based absorbers for lower frequencies.

Velocity absorbers

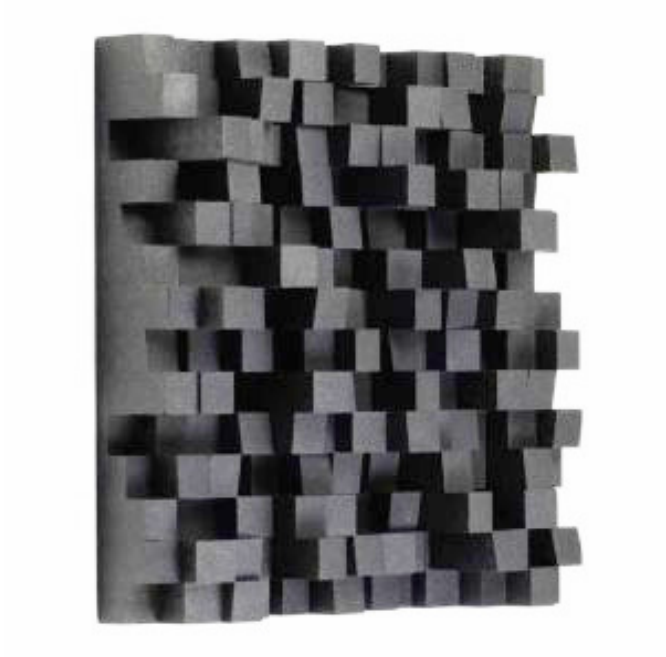
A velocity absorber slows down the speed of sound within fibrous, porous materials such as rigid fiberglass, mineral fiber, cotton/polyester fibers or open-cell polyurethane foam. Sound energy is converted to an innocuous form such as heat (not enough heat to feel any change in the room's temperature however).

Velocity absorbers work best on the middle and high frequencies above 300Hz. You can build your own or purchase commercially made absorption panels from companies like GIK Acoustics, Real Traps, and Auralex through many musical instrument retail stores.

Bass Traps

Bass traps are low frequency absorbers that work below 300Hz. Low frequencies, with their much longer wavelengths, require much more mass and density to be absorbed. Rather then using a velocity absorber, low frequencies are absorbed more efficiently using pressure based absorbers, which are constructed of pliable membranes that bend and flex with the incoming wave energy. Velocity absorbers, like acoustic foam panels, may be used as bass traps, but their required depth may take up too much space in a typical home studio.

Ideally a bass trap would not affect frequencies above 300Hz but many velocity absorption panels are sold as bass traps when they do little to actually absorb bass frequencies yet absorb mid-range and high frequencies excessively.



Diffusers

Diffusers reduce echoes by “jumbling” and randomizing reflections off walls and ceilings to provide the feeling that those surfaces are farther away from your ears. Diffusers can help provide a sense of spaciousness to a small room. Sometimes referred to as quadratic residue diffusers or skyline diffusers, these devices don’t remove energy from the room, but return the sound back into the room it in a randomized, scattered manner that affects the direction and timing of the sound waves.

In professional recording studio control rooms, there are usually diffusers placed on the rear wall behind the listening position. There are no hard and fast rules here but if your rear wall is closer than about 2.5-meters, usually deep bass traps are a better idea for that rear wall.

Conclusion

The considerations for setting up a home studio involve proper room selection, monitor and listening position setup and the application of acoustic treatments. Keep in mind the simple ratios for the listening position and the three types of acoustic treatment and you can achieve an excellent sounding environment.

Once your room is setup and tuned to the best of your ability, room correction software, like Sonarworks Reference 4, will further perfect the accuracy of your room.

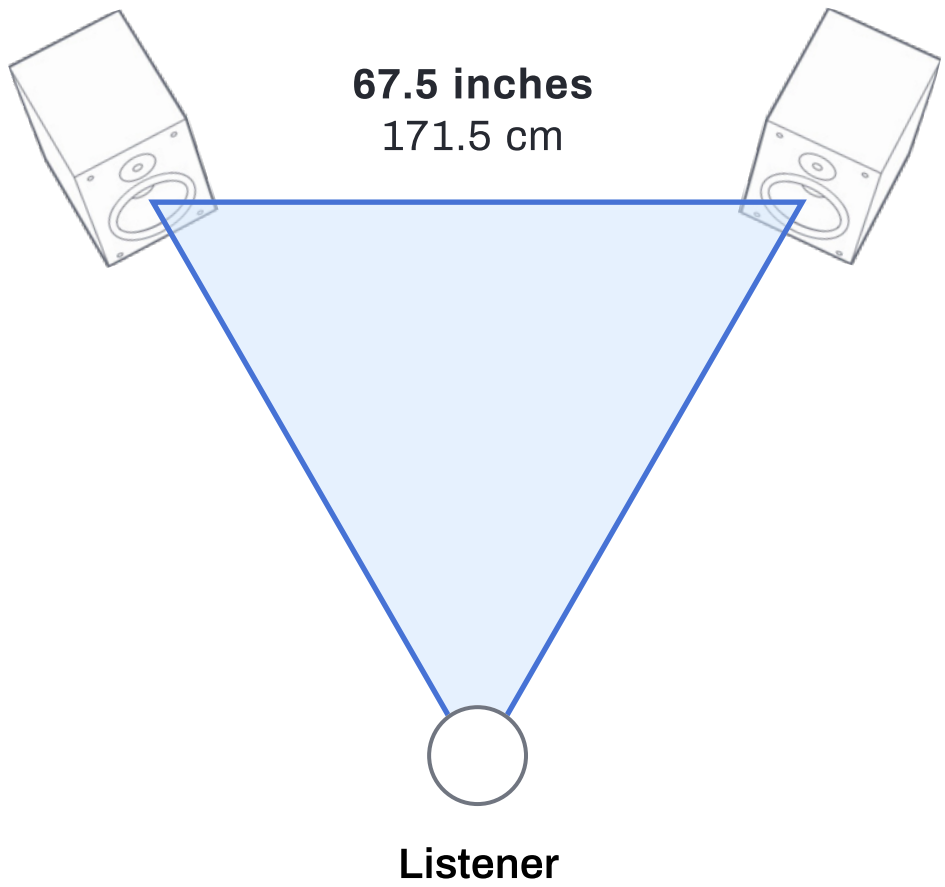
Monitor Placement and Setup

by Eli Krantzberg

Where and how you place your speakers in your studio is critical to getting the most accurate frequency response and stereo imaging from them. Ideally, you want your listening position and the two monitors to form an equilateral triangle. In other words, the distances between any two of the three objects (your head, and each monitors) should be the same. If you don't have a tape measure handy when setting up this triangle, a piece of string or even a guitar cable will do. While there are some recommended measurements for the triangle, it is most important that each side is the same length.

Studio monitors are optimized for on-axis listening, so it is also important to ensure the monitors are pointing directly at, or just behind, your head. High frequencies are more directional than lower frequencies and you won't hear the high frequencies accurately if you are listening to speakers that are pointing off-axis. As for height, ideally, the tweeters should be at the same height as your ears when you are seated, typically about 47-55 inches (120-140 cm) from the floor.

Noted acoustician Carl Tatz recommends nearfield speakers be spaced 67.5 inches (171.5 cm) apart, but even he agrees that this is only a starting point. Most studio desks are about 48 inches (122 cm) deep, and this distance puts the tip of the equilateral triangle just behind the listener's head at the mix position. This geometry makes for a natural stereo image and sound appears to come from the room, rather than the speakers themselves.



Equilateral Triangle
Speaker Set-Up

Speakers versus Walls

Try to place your monitors so that they are away from walls and corners in order to avoid the reflections, which can create an uneven response curve due to comb filtering and low frequency reinforcement or cancellation. Sometimes your placement options are limited and speakers must be placed close to the front wall.

For this reason, many monitors provide onboard EQ settings referred to as Whole-Space (placement away from any walls), Half-Space (for placement near the front wall) and Quarter-Space (for placement near front corners).

Many monitors also provide additional EQ options, which can further tailor the speakers' sound to compensate for deficiencies in the listening environment. Keep symmetry in mind, so the left and right speakers should ideally be equidistant from their respective side walls.

If your speakers have a rear port, keep the speakers away from the wall at least the same distance as the diameter of the port, usually about 5 to 10 centimeters. If you find you do need to place your speakers near the front wall, experiment with a few different distances to see which placement feels most accurate.

Any distance past about 24 inches (60 cm) dramatically reduces bass problems caused by front wall reflections. On the other hand, pro studios often mount their monitors into the front wall, with the face of speakers flush with the wall. This placement eliminates the bass cancellation problems that affect speakers placed in front of a wall.

Subs

Subwoofers are inherently non-directional, but still need to be placed properly to optimize their in-room response. One trick to help find a good location for a sub is to temporarily put the subwoofer in your

listening position and crawl around the room to find where the bass sounds best. Then put your subwoofer there.

Your subwoofer may have a cutoff or crossover frequency control. It should be adjusted to match your particular main monitors. The idea of subs is to take the hard work of creating low frequencies from smaller main speakers and if the crossover is too low, perhaps below 70Hz, some smaller main monitors may still struggle to handle the lower frequencies.

Conversely, subs are not meant to handle anything but bass, so if you set your crossover much above 100Hz, you may actually wind up with a somewhat disjointed audio image as your brain might be able to localize the sound coming from your subwoofer

De-coupling

It may be necessary to de-couple the speakers from the stand or desk surface they are resting on. Otherwise, the desk or stands will vibrate and effectively absorb or amplify certain frequencies. Speaker isolation pads help mitigate vibrations and resonances by absorbing the vibrations before they can transfer to the stand.

Simple and inexpensive isolation pads can be made of dense foam, like the Auralex Mopad, while multi-layer isolators, like Primacoustic's Recoil Stabilizer provide even more isolation. Other more sophisticated isolators, like those from IsoAcoustics, may use non-resonant spring systems and provide isolation as well as height adjustment.

At minimum, moving your speaker off of your desk and onto stands will provide a basic amount of isolation and you won't feel the speaker vibrations through your work surface.

Conclusion

Through careful monitor placement and isolation, you will ensure what you are hearing is the most accurate sound your speaker system can produce. Once your setup is optimized, you can employ electronic room correction, like Sonarworks Reference 4, to really dial in the final touches to your monitors. Also, be sure to check out our article on acoustic treatment techniques to get the most out of your acoustic space.

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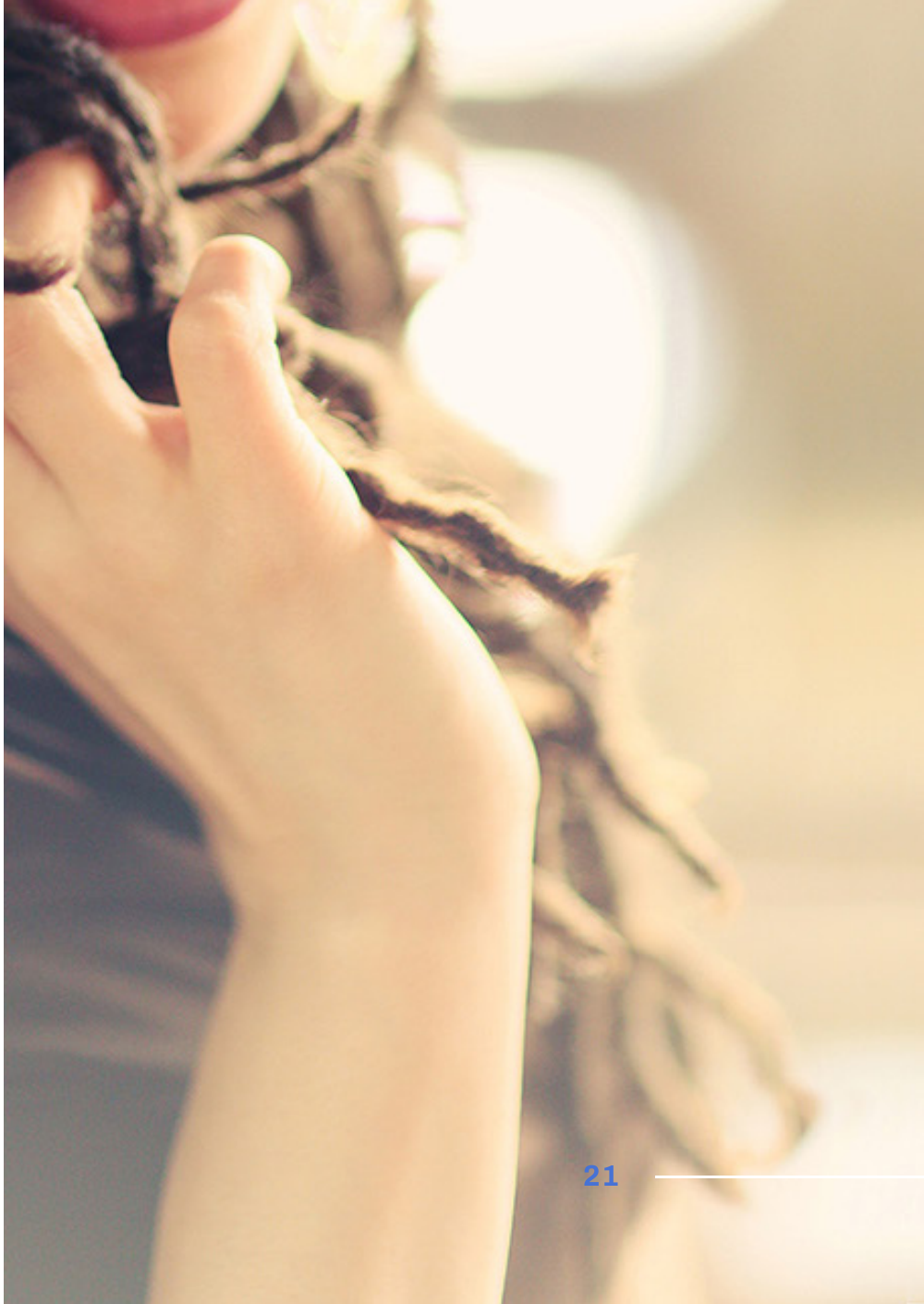
I prefer to sing in the shower because the acoustics make you sound great, baby!

Naima Adedapo.



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Killing First Reflections

By Adam Kagan

One of the most basic, yet often overlooked problem encountered when setting up a studio is locating and killing early reflections that cloud up your stereo imaging and create uneven frequency response problems. We are all aware that the sound we hear from our speakers is a blend of the direct sound from the monitors along with the sound that is reflected by the room and its contents.

These reflections come from nearby walls and ceiling and also from the desk or equipment between the monitors and ourselves. If we don't tame our early reflections, how can we accurately judge the ambience and imaging of our recorded sound? In typical live performance venue, a reasonable time delay difference between the direct sound from a performer and the first reflected sound from a wall or ceiling surface is about 20 milliseconds.

Therefore, in order to accurately hear the recorded audio and it's captured initial reflections, we need to eliminate or greatly reduce the level of any reflections in our studio which occur in the first 20 ms of a sound coming out of our speakers. Studio design with this reflection free zone in mind is an implementation of a well-known studio design strategy called LEDE™ or live-end-dead-end design. Our goal is to create a reflection-free-zone in the front part of the room where we sit.

The rear of the room produces late reflections that create a natural sense of space and while we don't want that rear space to be out of control, the front space is our primary target for treatment. A few listening tests have been created to check your listening area for stereo image accuracy, including the LEDR™ test from Doug Jones and the Gold Stereo Set-up Disc listening tests from David Chesky of Chesky Records.

Hunting for the Reflections

Now we need to find these first reflection points. The simplest way to find the first reflections is to use a small mirror and the help of an assistant. Sit in the listening position while your assistant holds the mirror flat against a wall and slides it around until a reflection of the speaker can be seen in the mirror.

Mark the wall with a piece of tape where the reflection occurred. Repeat this on the opposite wall, ceiling and desk surfaces. We want to kill any first reflections that would reach your ear in 20 milliseconds or less.

In practice, if your rear wall is at least 11 feet (3.5 meters) from your listening position, you don't need to kill the reflections from the back wall. In most home studios and small production rooms, the ceiling and side walls are within 10 feet of your listening position, so those surfaces are the ones we want to treat.

Keep in mind that we want to create a reasonably large sweet spot so that more than one person can sit in the listening position, so we want to kill reflections off a larger area than the exact point that we marked with the mirror.

Killing the Reflections

In professional studios, control room walls are angled in such a way that first reflections are directed away from the listening position, but most project studios are rectangular rooms, so sound absorbing acoustic panels must be placed at all the points of first reflection.

These lightweight panels, which are hung like pictures, are usually made of 1" or 2" fiberglass insulation or mineral wool and are covered in decorative fabric. This article won't get into details of the acoustic properties of these panels, but suffice to say that these panels, when mounted on or very close to a wall, will absorb most frequencies from

about 800 Hz and up. These frequencies are the ones we need to control in order to maintain our stereo image and high frequency definition.

Many companies sell ready made, lightweight acoustic panels in sizes from 12” x 12” up to 2 feet by 4 feet which may be easily hung on a wall. These panels can be purchased from local music stores or may be built as an easy DIY project. Along with acoustic panels on the walls, an acoustic cloud may be hung above the listening position to reduce reflections from the ceiling.

Desktop Effects

Reflections from your desktop or console surface may be impractical to reduce, but you can listen for their effects simply by playing some familiar music and placing a blanket or quilt over your desk surface. Listen for changes in stereo imaging or high frequency response when the blanket is placed and then removed.

Sometimes, simply moving your speakers further away from the listening position or raising their height may change the reflection angle enough to eliminate much of the desk reflections.

Creating a reflection free zone, along with proper speaker positioning will go a long way to creating an accurate listening environment for audio production and enjoyment. Once you have done your due diligence in these acoustic areas, applying correction from Sonarworks Reference 4 will further improve the sound of your monitors and perfect your listening space.

Chapter 1

Key Takeaways

- [ ] Strive for Symmetry in laying out your room.
- [ ] Try to place monitors facing into the length of the room, rather than the shorter width.
- [ ] The ideal listening position is just over one-third of the length of the room from the front wall.
- [ ] Try to place speakers either against the front wall, or about 25% of the length of the room from the front wall.
- [ ] Monitors may be placed on stands or a desk surface, but may benefit from some sort of decoupling.
- [ ] Proper speaker height and setting up the equilateral triangle listening area will provide a realistic soundstage.
- [ ] Locating and treating first reflections will provide an accurate stereo image and proper representation of ambience.
- [ ] Follow manufacturers' recommendations for monitor setup and eq settings and then adjust to your environment.
- [ ] After proper room and speaker setup, further corrections using software like Sonarworks Reference 4 will provide the best possible listening environment.

Chapter 2

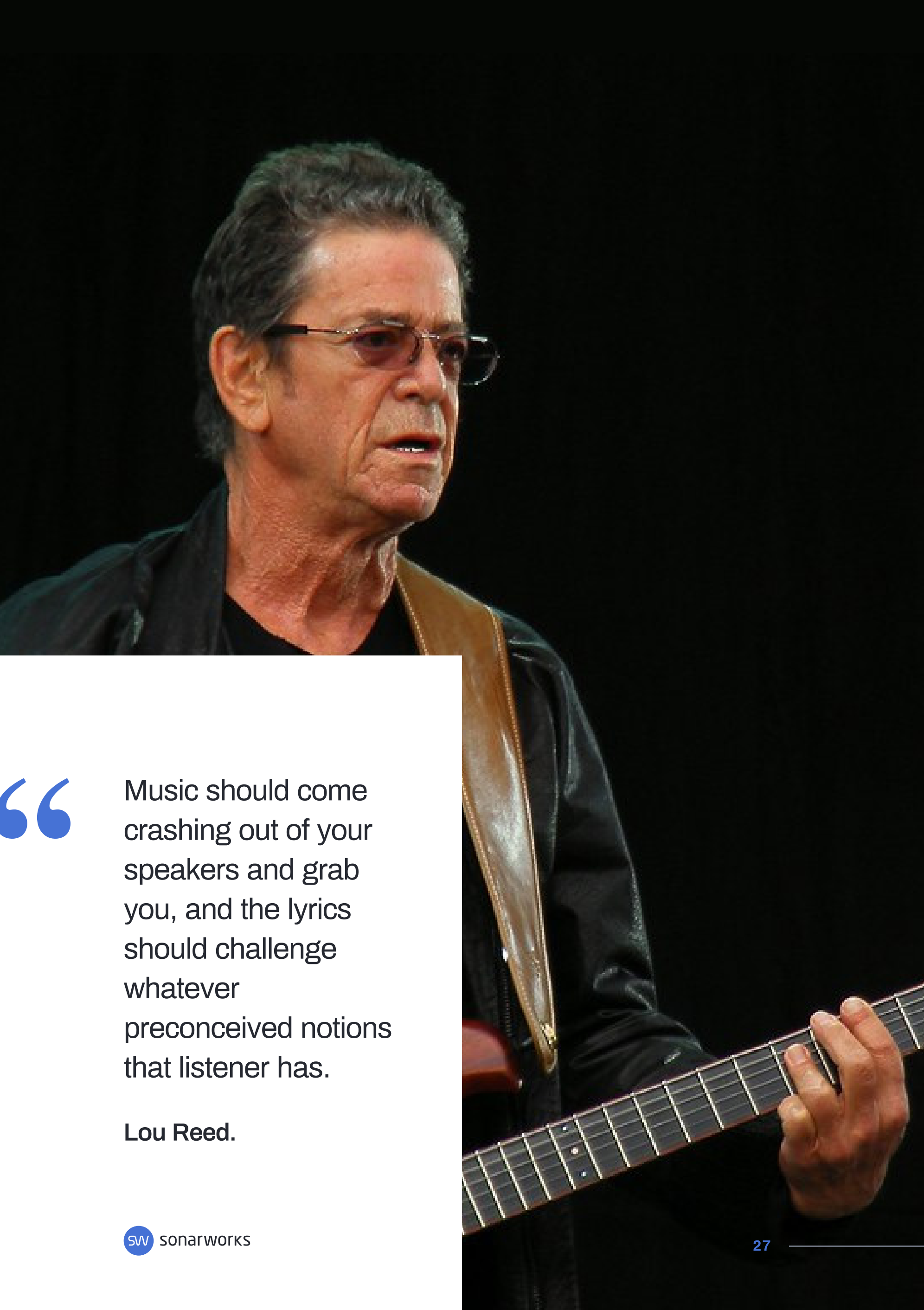
Choosing the Perfect Monitors or Headphones

Monitor speakers and headphones are our window to the sonic world that we create. Choosing monitors that properly represent our world and also inspire us requires only a slight bit of knowledge and some personal taste.

Once we've created a properly tuned acoustic environment choosing a studio monitor becomes simpler. Since a well-tuned room will provide accurate sound from any accurate speaker, we can focus on monitors that provide the features and style that inspire us.

Whether you work on headphones or monitors may be a practical matter or creative choice, and we will explore the benefits of headphones vs monitors, as well as the potential pitfalls of relying on only one type of monitoring system.

Along with choosing the right monitors for your setup, incorporating a monitor controller may provide benefits beyond the capabilities of simply connecting the monitors to the monitor output of your audio interface. This chapter will introduce the important considerations when choosing speakers, headphones and monitor controllers for your specific setup.



> Music should come crashing out of your speakers and grab you, and the lyrics should challenge whatever preconceived notions that listener has.

Lou Reed.

In The Room or In Your Head – Speakers vs Headphones

By Nick Messitte

Headphones versus loudspeakers: which is better for monitoring? At some point most beginners ponder this question—though to be fair, so do most experienced engineers. Glenn Schick, mastering engineer for J Cole, Justin Bieber, and many others, recently made the switch to exclusively mastering on headphones, while plenty of other engineers have gone the opposite route, opting for more accurate monitors as they progress from home studios to dedicated workspaces.

As for the core question of which is better–headphones or loudspeakers–the most honest answer is “It depends.” Monitors exhibit qualities that make them better in some regards and worse in others, and the same is true for headphones. I’m here to help you identify the strengths and limitations of each, so read on to determine which may be best for you.

Loudspeaker strengths

Speakers produce sound waves by pushing air molecules throughout the physical space of your room, and therefore communicate not just the sound of music, but also physical feeling of music. Hearing a kick drum solely with your ears versus experiencing the impact of the kick in your chest are vastly different sensations. Feeling the physical power of the low-end and midrange waves can help you gauge how your mix will translate to clubs, cars, and even home hi-fi systems.

Many people find it easier to achieve proper musical balances on loudspeakers than on headphones. For instance, if you set the level of background vocals using headphones, you might notice the balance doesn't translate well in your car, or even on your studio monitors. This is due, in part, to the natural interaction between speakers and the physical listening space.

As we mentioned earlier, speakers push sound waves around the room, rather than the way headphones direct sound right into your individual ears. Sound waves from speakers interact with objects in the room and undergo tiny shifts in timing and phase, providing our brain with directional and level information that feels natural and organic.

Headphones, on the other hand, isolate the ears so that each ear only hears one speaker and, therefore, only one side of the stereo image. Put another way, when listening to stereo speakers, your left ear hears a bit of the right speaker, but with different reflections, timing and phase from what your right ear hears from the right speaker. Headphones, on the other hand, do not provide any right channel information to the left ear, or vice-versa. This acoustic effect of each ear hearing a bit of the opposite speaker's information is referred to as "crossfeed."

Speaker Limitations

Now let's move on to the downsides of speakers. The most obvious drawback is simply a practical issue: loudspeakers are loud—you need to drive them somewhere around 80dB SPL for an accurate representation of balanced frequencies (Remember the Fletcher-Munson curves?).

If you live in a thin-walled city apartment, you may not be able to run your speakers comfortably loud without annoying the neighbors. The frequency response of your speakers is also affected by the acoustics of your room. The shape of the room, the construction materials,

the placement of your speakers/furniture, and the degree of room treatments—these all have an effect on how your speakers sound. Headphones, on the other hand, are immune to the room's effects.

Speaker quality and accuracy may also, unfortunately, relate to their cost. While professional headphones with a frequency response from 20Hz to 20kHz can cost under a few hundred dollars, most speakers under $1000/pair won't put out much sound below 50Hz, let alone 20 Hz. Many inexpensive speakers purport to reproduce this range, but independent analysis reveals they do not—and furthermore what they do give you below 60 or 70Hz may not be accurate enough for mixing or mastering.

For both headphones and speakers, software like Sonarworks Reference 4 can help flatten most frequency response problems, but it can't account for a small speaker's inability to produce low frequencies, and it can't fix an inexpensive monitor's distortion or phase issues.

The Strengths of Phones

For this discussion of headphones, we are considering professional headphones and not earbuds or typical consumer headphones. Cost may not be the sole indicator of professional versus consumer quality, as many consumer headphones are simply overpriced fashion accessories. Pro headphones should provide excellent sonic qualities and typically will not include features like Bluetooth or noise-cancelling circuitry. Pro headphones may include features like replaceable earpads and cables and various connector options.

Let's highlight an important advantage of headphones straightaway: you can listen to them day or night, at a reasonable volume, without bothering the neighbors. Closed-back phones are virtually silent to people around you, while open-backed headphones won't disturb anyone more than a few feet away from you.

Is there anything that makes headphones better suited than speakers for the musical tasks at hand? The answer depends on the application. Mastering engineers often put on their headphones to QC (quality control check) their final masters because phones will reveal details and forensic errors in the master—clicks, pops, and other incongruities–that may not be obvious on speakers.

The clarity that comes from headphones helps put a spotlight or microscope on tiny elements of the mix. Frequent users of forensic tools like iZotope RX may find that headphones are well suited for finding and repairing clicks, pops and other artifacts.

Headphones also provide benefits to engineers working in less-than-optimal rooms. If your room has acoustic issues (see our blog posts on acoustic problems and treatments), using headphones can mitigate those problems by removing the room's influence on audio perception.

Consider also that open back headphones might not help much in a noisy environment like a coffee shop, while closed back headphones may provide enough isolation that you can spend an afternoon working at the beach.

This brings us to mobile considerations: I often travel from studio to studio, and I have to work in unfamiliar surroundings and often on unfamiliar speakers. If I bring my own set of cans, I have confidence in a familiar and relatively consistent monitoring system, which is definitely a plus.

Liabilities of Phones

Notice I wrote "relatively consistent" above; there's a lot of room for error in that qualifying adverb. If I take my headphones from a pro studio that uses a high-power headphone amp like the Little Labs Monotor to a home studio with an inexpensive interface, I'll likely notice that my headphones sound different on each system.

A couple of issues are at play here. Since headphones can be extremely revealing, they often highlight differences in frequency response, noise floor and overall accuracy of the monitoring chain. Also, each model of headphones has a different power and impedance specifications and each headphone may react to a specific headphone amp or interface in a profoundly different way. Most headphones will work fine with any decent audio interface, while some only perform their best when powered by a dedicated headphone amplifier.

My Audio-Technica ATH-M50xs phones, for example, are not influenced much by most headphone amplifiers, while my Sennheiser HD 650s do sound different when powered by different interfaces or headphone amps. If you travel like I do, you may want to invest in not only a reliable pair of phones, but also a trustworthy headphone amp, like the affordable Schiit Magni.

Also, since headphones play directly into each ear, you lose the beneficial crossfeed effects mentioned earlier. This can affect your perception and mix decisions for left-to-right panning (width), as well as front-to-back depth. As a result, reverbs, delays, and even equalization that sound proper on your headphones may sound less cohesive on loudspeakers.

Indeed, a headphones-only mix could lead to improper decisions during the mixing process. When I create a mix using my Audio-Technica ATH-m50xs, I find my low-end levels often have to be tweaked later. Similarly, if I attempt a mix using only my HD 650s, I may wind up boosting the high frequencies more than necessary. These are my personal observations and experiences, which leads me to the final point regarding headphones:

Choosing headphones is inherently personal, perhaps even more so than choosing monitors. When planar magnetic headphones (like the Audeze LCD-X), became the rage, I bought a pair and found myself disappointed with the experience. I went back and forth with the manufacturer a few times, sending them in for diagnostics, talking

about headphone amps and such. Finally they shrugged and said, “it’s probably the shape of your head—your ear geometry.” Ultimately we must consider the physical limitations of headphones. Phones just don’t push air like speakers do, so you will not feel that guttural, vibrational punch that speakers provide—a punch that aids in musical translation.

> If I can put on my album in a car or on my headphones and listen to the whole thing and love it, that's what I'm going to be happy putting out there.
>
> **Ed Sheeran.**

Conclusion

Since we can’t clearly answer which is better, what’s one to do? Use both! A combination of headphones and speakers could be your friend. Throughout your career, you’ll find a process that works for you—a gameplay loop, if you will. You may build your mix on speakers, check for forensic issues on cans, and continue switching between the two while mixing. Perhaps you’ll work differently, setting up the balances in cans for clarity’s sake and then finishing the mix on your monitors.

It may take some trial and error, but if you devise a routine that utilizes the strengths of both, you’re less prone to the weaknesses of either. And remember that Sonarworks correction software can improve both your headphones and loudspeakers––whichever platform you choose.

Studio Monitor Selection

by Brad Pack

When it comes to creating sonic masterpieces, quality monitoring is one of the most important aspects of your studio. Every single project you work on passes through your studio monitors—every beat you produce, every track you record, every session you mix and every album you master. Your monitors are the epicenter of your sound, so it goes without saying that choosing the right studio monitors is an important decision. In this article, we'll break down everything you need to know about monitors to help you find the perfect solution for your studio.

Passive, powerd and active monitors

Studio monitors are typically broken into three categories: *passive, powered and active*. While powered and active monitors are very similar, there is a slight distinction between the two. This article will describe each system in depth, but for now keep this in mind: Passive monitors require an external power amp and have a built-in, passive crossover.

Powered monitors contain one built-in amplifier and built-in crossovers, while true active monitors contain active crossovers and a dedicated amplifier for each speaker in the cabinet. In practice, you would have to read the monitor's specs to see if a particular monitor is considered powered or active.

Passive monitors tend to be lighter in weight and also less costly than their active counterparts. Passive monitors require an external power amplifier, but they provide the flexibility of choosing an amplifier that you feel compliments your speaker. Think of matching a power amp to your speakers much like experimenting with different

preamps to find the perfect partner for a particular microphone. While it's difficult to describe, typical amplifier descriptions include adjectives like "intense", "relaxed", "dry" or "airy." Like so many things in audio, choosing which amp sounds best in your setup ultimately comes down to personal taste.

Passive monitors utilize non-powered, analog crossovers to direct the low frequencies to the woofer and the high frequencies to the tweeter. These passive crossovers have advantages over active and digital crossovers, including less sonic coloration and manufacturing advantages in that they can often be implemented with fewer and simpler components. (If you're interested in learning about passive crossover design, check out the free VituixCAD software).

The ubiquitous (but discontinued) Yamaha NS-10 studio monitor is perhaps the most well known example of a passive studio monitor. Currently Avantone makes the CLA-10, an extremely close replacement for the original NS-10.

Powered monitors feature a built-in power amplifier that powers all the drivers through a built-in crossover. By providing a dedicated, built-in amplifier and crossover, the performance and efficiency of the speaker system can be tuned and optimized by the manufacturer. Additionally, powered monitors may have some built-in equalization options and may provide more than one connector type for easy interfacing with your studio setup. While this integrated design may be convenient, it comes at a sacrifice to flexibility since you can't audition different amps or replace the amp during a session should there be a technical problem or failure.

The KRK Rockit series is a popular example of powered studio monitor designs.

Active monitors feature a dedicated power amp for each driver. This approach allows for precise (analog or digital) active crossover design, which provides an optimized frequency response. While active monitors typically deliver extremely high quality sound, this

comes at a cost—they're the most expensive design and build. Like powered monitors, active monitors typically have some user controls, like onboard equalization, user presets and may also provide several connection options for easy interfacing with your studio setup.

Active designs are great for mobile setups, as they can be set up quickly and easily with just two cables. Although they lack the ability to mix and match components, active monitors come ready to play, right out of the box, saving you from having to experiment with different configurations.

The ADAM A7X is an example of an affordable, bi-amplified active design.

Near-field vs mid-field vs far-field

Near-field monitors are so designated because they are placed near the listening position—typically just one meter or closer. Since the speakers are very close to the listener, these compact designs minimize acoustic problems caused by untreated room reflections. Many modern studio monitors are near-field designs, with simple 2-way designs and woofers as small as 4 or 5-inches. Near-field monitors are typically the most affordable option, however, due to their small size, some models lack adequate bass response. Nearfield monitors can range from the modestly priced active JBL LSR305 to the high-end passive ProAc Studio SM100.

Mid-field monitors, typically placed on stands behind the desk or console, are designed to be up to four meters from the listening position. Powerful 3-way midfield monitors offer extended dynamic range and low-frequency response. Mid-field monitors work well in larger, acoustically treated rooms but are likely to exacerbate acoustical problems in small, untreated rooms. Common examples of mid-field monitors would be the Focal SM9 or the ADAM S3V. These modern midfield monitors are active, with built-in amplifiers and equalizers, but many engineers trust and prefer passive midfield monitors like the legendary B&W 802.

Far-field monitors, sometimes called “Mains” or “Bigs,” are often built into the control room front wall in high-end pro studios. They tend to be very large; they can play very loud, and are very expensive. In-wall or soffit mounted speakers provide acoustic benefits over stand mounted speakers, since the speaker and room create an integrated acoustic system.

Designing an in-wall system requires acoustical analysis and custom construction, so the aid of an architect or acoustic consultant would be suggested. Far-field monitors in most studios are mainly used to check the low end of a mix or impress visitors, earning them the name “client killers.”

Most engineers rely on near-field or mid-field monitors to do most of their mixing with an occasional playback on the mains for fun and hype. The most well known mains in pro studios are custom designs by the noted acoustician George Augspurger. The exception to using mains as the primary speaker is in mastering studios. Mastering engineers tend to use custom built mains or ultra high end designs like the PMC towers.

If you’re mixing in a small room, stick with near-field monitors. If you have a little more space and have done some acoustic treatment, mid-field monitors offer improved frequency response and fidelity, but, on the other hand, if you’re looking to “wow” the record execs next time they’re in town, check out some of the high-end far-field designs available from companies like Barefoot Sound, and Augspurger.

Two-way vs three-way

Simply put, two-way designs feature two drivers: a woofer for low frequencies and a tweeter for high frequencies. Alternatively, three-way systems feature two crossovers that divide frequencies among three drivers: a woofer for low frequencies, a dedicated midrange driver, and a tweeter for high frequencies. Generally

speaking, three-way designs are capable of producing higher SPLs, produce lower distortion and may have a smoother frequency response than two-way designs. However, three-way monitors usually cost more because they require more components and are much more complicated to design properly. Popular three-way speakers include the Focal Twin6 and the ADAM S3V.

Remember, not all monitors are created equal, and a well-designed two-way system can easily outperform a budget-friendly three-way system. Three-way designs are an excellent option for those who want a balanced frequency response but are mixing in too small of a studio to use mid-field monitors.

Driver size

One of the distinguishing features between different studio monitors is the size of the woofer. Generally speaking, monitors with larger drivers have an extended bass response and a louder output, but many two-way speakers with smaller woofers have a more balanced critical mid-range frequency response.

Larger speakers also push more air, so a larger woofer will feel more powerful even at low volumes, where a small speaker may never move enough air to feel loud enough in even a modest-sized room. Remember from geometry that a 5-inch woofer has a surface area of about 20 square inches, compared to an 8-inch speaker's 200 square inches of area. Obviously the 8-inch speaker will move a lot more air in the room!

Cabinet types

The design of the cabinet has a big impact on the frequency response and output level of a studio monitor. Most woofers utilize a cone design to achieve better bass response and improved output. A cone

driver works by pushing and pulling air to create sound waves. However, all of that movement creates pressure changes inside the cabinet, which can cause distortion. Studio monitors utilize three different designs to eliminate this distortion: sealed enclosures ported closures, or passive radiator designs.

Sealed enclosures are exactly what they sound like—an airtight that completely isolates the rear of the driver. Sealed enclosures offer excellent transient response and are often much smaller than ported designs. However, they offer less bass response than ported designs with lower sensitivity.

Ported enclosures, sometimes called bass reflex designs, feature an open port or a tube for venting air from inside the unit. Ported designs offer higher bass output, extended bass response, and less distortion than sealed enclosure designs. However, ported enclosures have a slow transient response and are more difficult to build correctly, often making them more expensive.

Some studio monitors utilize a passive radiator design to equalize pressure inside the cabinet. From the outside, passive radiator monitors may look like a three-way speaker. However, the extra driver (usually one of the larger speakers) has had the voice coil and magnet removed to create a passive radiator system. This sophisticated design provides the sonic benefits of ported design without the drawbacks of a port or vent.

Subwoofers

Regardless of driver size, most studio monitors don’t extend much below 50 Hz. In order to accurately monitor very low frequencies, many engineers choose to supplement their monitors with an added subwoofer. Be careful, though—using a subwoofer in an untreated or very small room or just too much sub level can cause masking problems, making it difficult to hear crucial midrange frequencies.

Depending on what type of projects you work on, you may not need a subwoofer. If you mainly mix music or bass heavy genres or even audio for post production, subwoofers may be key. But if you're mainly working on jazz, acoustic music, podcasts or even most rock music, you can probably get along fine without a sub.

How to improve your sound

Selecting the right studio monitors can feel overwhelming. It's important that you find something that fits your budget and personal taste while proving the most linear frequency response possible. Without accurate studio monitors, you can't trust what you're hearing, which leads to wasted time, self-doubt and less creativity.

No studio monitor is perfect—at least not without proper room treatment and some help from room tuning software, like Sonarworks Reference 4. With Sonarworks, you can measure the actual response of the monitors in your room and correct the frequency response of your favorite monitors in your favorite space.

> Somehow, magically, I've become an electronic musician, and I have a recording studio that looks like the bridge of the Enterprise.

Moby.

Choosing a Monitor Controller

By Eli Krantzber

Adding a monitor controller to your studio may not be an obvious or sexy choice to bump up your productions, but a good one will enhance your workflow and help get your mixes sounding their best.

Referencing between multiple monitors is a great way to ensure that mixes will translate well when played back on different types of speakers and the volume control on your audio interface may be fine to control a single pair of speakers or headphones but is likely inadequate for multiple speaker options. That is just one example of how a dedicated monitor controller can come in handy.

Feature You May Be Missing

If you are working with a subwoofer, you may consider a monitor controller that can toggle the sub on and off. Many monitor controllers have a dedicated Sub output, which may also include a crossover or low pass filter adjustment. This type of setup allows you tune the transition point between the subs and the mains and also use one subwoofer with more than one pair of speakers.

Along with speaker and subwoofer selection, monitor controllers may provide several additional creative functions. The ability to monitor in mono is useful when mixing; for detecting mono compatibility problems and also for an alternate perspective on mix balances. A DIM switch is useful for switching between loud and soft preset volume levels, to ensure elements in your mix blend properly at different playback levels.

Another nice feature in some monitor controllers is a stepped volume control for repeatable, calibrated speaker settings.

Active or Passive?

An important consideration in choosing a monitor controller is active versus passive circuitry, as any electronics in the audio path will influence the sound. The conventional wisdom is that passive controllers have minimal impact on the sound since there are no active amplifiers in the audio path.

Many sophisticated and some very simple controllers use passive electronics for level control and active components for other functions, like talkback and mono summing. Mackie, as an example, produces an inexpensive monitor controller with a purely passive audio path, like the Big Knob Passive, and also more fully featured, and more expensive units, like the Big Knob Studio+.

If you're mixing on headphones plugged into your monitor controller, crossfeed may be a useful feature. Crossfeed provides some amount of "bleed" between your left and right earphones, simulating the stereo imaging we perceive when listening to speakers in a room. Crossfeed can make headphone mixing feel more natural and even help headphone mixes translate better to speakers, especially when using stereo imaging plugins.

Gozintas

Connectivity is another consideration, particularly if you desire to monitor sources besides your DAW output. Many monitor controllers include a 1/8th inch "aux" input, Bluetooth connectivity for phones and additional inputs for other analog or digital sources. Some even provide proper inputs for turntables.

Additional features, like analog summing or transformer coloration are available along with monitor control in units like the Dangerous D-Box+ and others.

Most monitor controllers have analog inputs, and many units also provide digital input via AES/EBU, S/PDIF, or optical connections. Dedicated monitor controllers usually have better sounding D/A converters than those found in budget interfaces, so connecting the digital out of your interface into the digital input of a monitor controller may be a simple way to improve your sound.

For example, at the high end the Crane Song Avocet IIA uses a 32-bit converter with extremely low jitter specs, while even the modestly priced Presonus Central Station PLUS and Heritage Audio RAM 2000 monitor controllers provide excellent sounding digital input options.

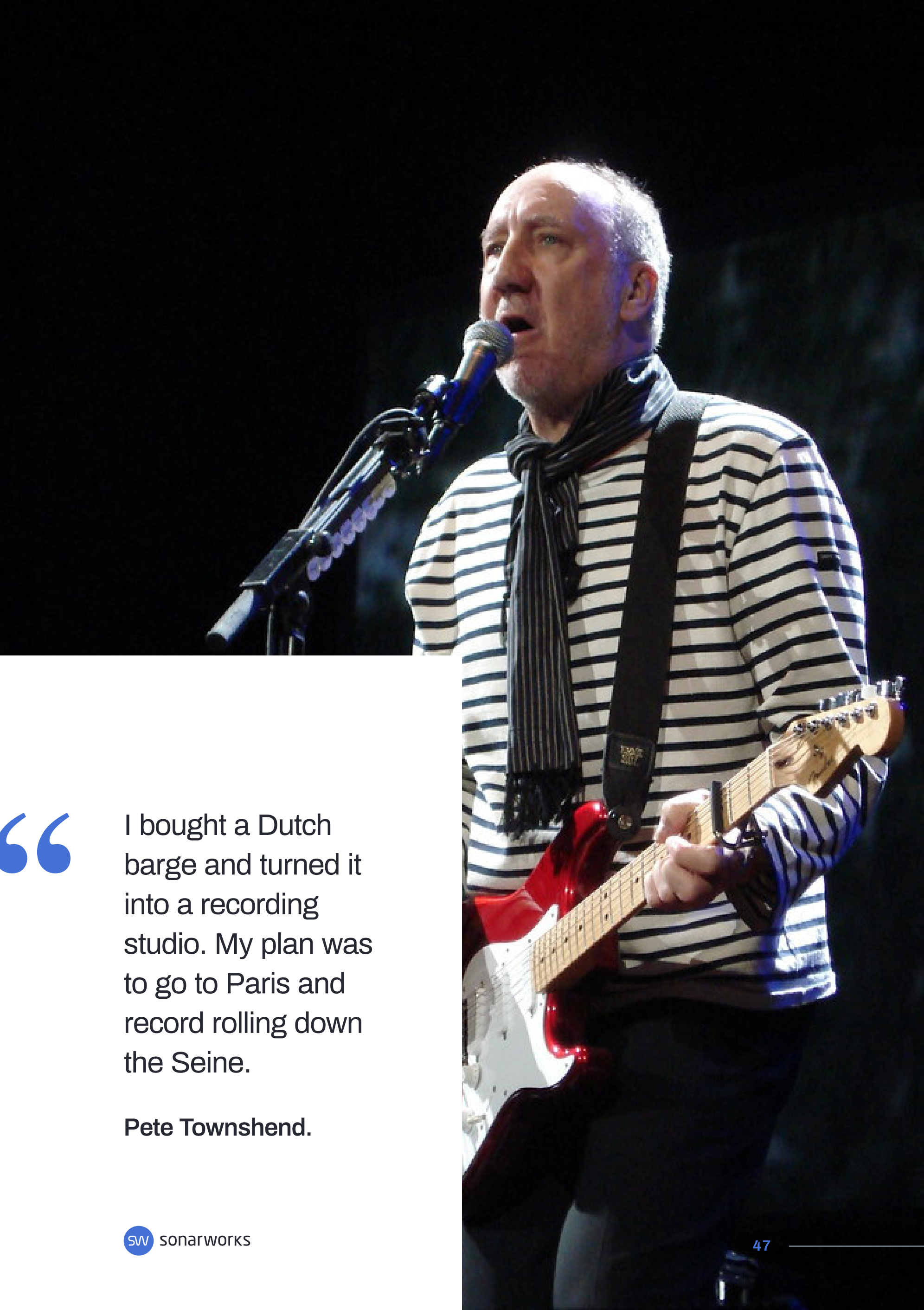
Conclusion

So, while your audio interface may provide some basic monitoring functions, dedicated monitor controllers provide many useful features not typically found in audio interfaces at any price point. Remember that getting your room and monitoring in order are the first steps in accurate mixing and Sonarworks Reference 4 software puts the icing on the cake to any well thought out system.

Chapter 2

Key Takeaways

- [ ] Headphones allow us to work when sound levels would disturb others.
- [ ] Headphones may have extended frequency response over similarly priced monitors.
- [ ] Stereo imaging and phase issues may not be accurately presented by headphones.
- [ ] Studio monitors come in many shapes and sizes and in active or passive flavors.
- [ ] Your needs and space will help dictate the size and style of monitor you choose.
- [ ] Monitor controllers may provide improved sonics and additional features over a typical audio interface.
- [ ] Once the choice of headphone of speaker has been decided, applying corrective software like Sonarworks Reference 4 will ultimately provide a more trustworthy and and accurate sonic picture.



> I bought a Dutch barge and turned it into a recording studio. My plan was to go to Paris and record rolling down the Seine.

Pete Townshend.

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