CHAPTER SAMPLER

Insights into Music Production

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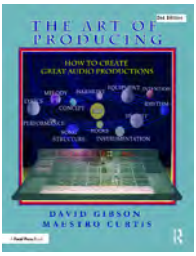

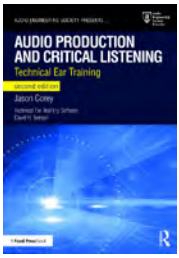

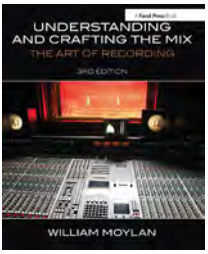

Types of Producers and Productions

Someone produces all records, whether it's an engineer, the band, or a record company staff producer.

During the '40s, '50s, and early '60s, the term *producer* referred to the person who would basically oversee a song or an album. For the most part, the producer's job was simply to keep the band on schedule. However, some producers acted as the eyes and ears for the record company, and sometimes they would also act as cheerleaders, making sure the band was comfortable. Some producers who had developed connections with record executives expanded their jobs to include finding talent and shopping record deals. These individuals called themselves *record producers*.

The job of the producer has now expanded so that he or she is the overseer of quality at every level of the project. But most important, a producer makes sure the overall final product is as perfect as possible. In the old days, the band or recording artist produced without even knowing it, and they never received any credit.

In music production, the goal normally is to produce quality music that will either become a hit or change the world. Today's producers have become the quintessential factors in assuring an album's success. They are often responsible for whether a song, album, or artist will become a hit. Besides overseeing the quality of every component, today's producers often come up with the music. But most importantly they provide an overall energy or vibe to the whole project. It is a cohesiveness that is conceptualized and applied throughout the entire project. To get even more out there, it is an energy or intention that is often carried along on top of the project. It is an invisible essence that people often hear coming through in a song – whether they are aware of it or not. The role a producer plays in a project has become more important than the artist's role, as if it is the producer who makes the artist! What a flip of the script!

Once the producer is a hit, any artist that attaches himself or herself to that producer is likely to be a hit in today's marketplace. In today's world, a successful producer can help make a hit by simply endorsing an artist. This was the case when Kenny Loggins endorsed Michael McDonald. Producers such as Wyclef Jean (Wu-Tang Clan and Lauryn Hill), Kedar Massenburg (D'Angelo and Angie Stone), Bob Ezrin (Pink Floyd), Quincy Jones (everybody), Maurice White (Earth, Wind & Fire, Johnny Mathis, and Barbra Streisand), and Narada Michael Walden (Mariah Carey, Aretha Franklin, and Whitney Houston) have developed such notoriety.

Types of Producers

Producers have evolved into three main types: executive, engineering, and music. However, the job of producer is often misunderstood, and most people really aren't clear about what the job entails. The jobs often overlap and the roles are sometimes quite fuzzy. Producers will often oscillate between the different roles, depending on whichever one is necessary.

Not only do the types of producers overlap, but often the jobs of producer and engineer overlap. Sometimes the engineer or the band might take on some of the functions of producer, and the producer often helps with many aspects that would traditionally be thought of as engineering tasks. For example, producers might help with sampling, sequencing, and looping. Often they get their hands in on a mix. All of these are engineering tasks. In this book I will try to draw the line at the point where producing becomes engineering because there are very good books out there that deal with everything that goes into recording and mixing (including *The Art of Mixing* by David Gibson).

Likewise, engineers commonly function as producers, but no one likes to admit it because then the engineers might ask for more money, royalties, and credits on the album. The truth is that anyone who is making some type of decision regarding the quality of any part or performance in a recording session is really producing.

The producer's job is one of the most important in the recording process. Therefore, it is also the highest-paid job. If Bob Ezrin were to produce the next Pink Floyd album, the record label would probably give him a sizeable advance before he even went into the studio. For the last Pink Floyd album he produced, it is likely that he received seven figures! You know Quincy Jones is set, also. He probably made more than $10,000,000 just from the *Thriller* album alone. It is safe to say that if you get a Top Ten hit as a producer, you are set for life. On the other hand, most engineers don't get any royalties for engineering; they simply get an hourly rate. Eddie Kramer made only about $35 per hour for engineering most of Jimi Hendrix's stuff.

Executive Producer

The executive producer (EP) is responsible for funding, and may also be responsible for organizing a project. He or she might even be responsible for hiring a music or engineering producer for the project.

The individual with the money will often finance a project out of his or her own pocket. The EP is convinced that the artist and product are worthy of investing time and money into, with the sole purpose of reaping the benefits of lucrative record sales and a healthy return on his or her investment. Make no mistake – it is a business! This type of EP may also handle budgets and schedules.

Another type of executive producer is a spokesperson for a record company or a group of investors who fund projects. This type of producer is also responsible for managing budgets and may occasionally schedule the entire process. They generally keep the interests of the record company first and foremost in their minds.

The most common problem arises when whoever is funding the project has no aesthetic sense of the meaning of great art. The worst case is when you have an executive producer who knows little or nothing about music but who wants to start guiding the creative outcome just because he or she is paying for it! Of course, this can become a nightmare, especially when

the producer knows only enough to be dangerous! Not only do these types of producers know diddly about music, they often don't have the diplomatic skills that are so important for effective producing.

This is not to say that EPs might not have hearts. In fact, some might even have very refined values when it comes to great art. It is important to get to know your EP as much as possible. If he or she is available, try to develop a close connection. By getting to know your EP and learn his or her values, you often can create a stronger bond that can aid you during rough times. Also, when you learn where this person's values lie, you know where he or she stands if you ever need to put your foot down.

From the other side of the fence, if you are functioning as the executive producer and you have certain wishes, it is better to outline your concerns in writing at the beginning. It can keep you from having to deal with some nasty confrontations later. And the truth is, as will be discussed later, if you have some refined aesthetic sensibility, paying for a project might be an avenue to obtaining your first job as a producer. Many studio owners use studio time as an enticement to obtain the job. All producers have to start somewhere.

Music Producer

Music producers spend most of their time focusing on the music, arrangement, and execution. A music producer arranges the music and often helps to write some of the parts. Sometimes music producers start out as songwriters who have studied music theory and end up with degrees in music or theory; however, some people are born with the knack for arranging. (The latter is not terribly common, though; most music producers have strong backgrounds in music theory.)

In an interview years ago, the band Rush explained that they had just fired their producer because he couldn't keep up with them musically. (Rush's music has always been on the cutting edge when it comes to music theory.) They said they had just hired a real music producer who could help them arrange the parts and who could keep up with them musically.

A music producer can know very little about the mixing board and studio equipment and still be very successful. In fact, we have met a number of major music producers who were not familiar with many of the technical aspects of the equipment. However, a good producer knows to hire a great recording engineer.

> I know everything there is to know about engineering; just ask my engineer.
>
> —Sonny Limbo (Bertie Higgins, Gladys Knight and the Pips, and Alabama)

During a recording session, music producers often are known to spend most of their time with headphones on out in the studio with the band, working out musical ideas.

Besides simply being able to arrange and rearrange music, a music producer needs to know how to work with musicians who have different levels of expertise. Within a single band there are often musicians at different levels. One of the keys to being a great music producer is having the ability to change someone's music and not upset him or her. As you can well imagine, most people are really touchy about their music, especially when someone is rewritiing or reworking it. It is critical to make suggestions with total respect toward what the musicians

have already created. You need to get to the point where you can rewrite a band's song and have them totally love it. To do this, you must also be able to gauge whether the musicians will be able to play a particular musical part that you come up with.

Although this book will prepare you for the basics of becoming a music producer, you might consider taking some courses in music theory to add to your knowledge. Many famous producers regret not having gone to school to learn music theory from scratch.

Engineering Producer

The engineering producer's primary job is to monitor the quality of every aspect of the project and make sure it comes out as good as possible. They sometimes also help organize the project. The engineering producer often starts out as a recording engineer, and then moves on to actual producing. Alan Parsons of Pink Floyd's *Dark Side of the Moon* fame started out as an engineer. Likewise, Eddie Kramer (of Hendrix and Led Zeppelin fame) started out as an engineer and later moved into producing. Through the years, Eddie has developed many useful skills as a music producer.

If you have a background in recording engineering, it is relatively simple to move into the position of producer. By the time you finish this book, you will have enough knowledge to produce a group.

Associate Producer

An associate producer is an associate of the executive producer and is there to act as the eyes, ears, and mouth of the EP in his absence. Occasionally, a recording engineer is given this position. He then receives credit (and occasionally royalties) as a producer on the project.

Assistant Producer

An assistant producer is often hired by the producer to do all types of tasks, which could include many of the administrative jobs typically done by an executive producer. The assistant might make progress reports to the record company. But most importantly, the assistant producer is involved enough in the project to take over in an emergency. Occasionally, a recording engineer will be elevated to the level of assistant producer, especially if the producer has to leave for short periods of time.

Overlapping Job Roles

As previously mentioned, the lines of demarcation are not set in stone. The executive producer might get his or her two cents in as a music or engineering producer. A music or engineering producer might kick in some money to help finish a project he or she believes in. Occasionally, an assistant producer might fill in as the primary producer. A producer might end up writing the music, completely rearranging it, and may function as a musician and play a part in the project. For example, Bob Ezrin played many of the keyboard parts for Pink Floyd.

Also, musicians in the band will commonly make production comments and suggestions. Today's producer role seems to have taken on a much broader, yet still intricate, responsibility in ensuring the success of a quality musical presentation.

What It Takes and How to Get the Job

When you finish this book, you will know how to produce – and how to do it quite well. However, to get hired as a producer is a whole other matter – you normally don't see ads in newspapers for producers. Some record companies (majors and independents) do have staff producers who report directly to the head of the Artist and Repetoire (A&R), the department that finds and signs groups, but most record producers freelance and are hired by the artists themselves. Or, an artist might convince the record company to use the new producer.

It is not easy to get someone to trust you enough to hire you and pay you to produce his or her project. There are two basic prerequisites:

1. You must believe that you can produce and say that you are a producer. No one is going to hire you as a producer, if you don't say you are a producer! Say out loud now, "I am a producer," and believe in your heart that you are a producer. To prove it, get some business cards made up with the title "producer" under your name. You are now a producer!
2. To become a producer you must have produced something. The first things a potential client will ask are, "Who have you produced before?" and "Do you have a CD?" Therefore, you need to have produced something. A finished product is your best resume. Remember, talk is not enough; the proof is in the pudding! This book will show you how to get your first production done so you will have something to show off.

As we'll discuss later, the number one way to get a job as a producer is to be recommended by someone you have produced. Another way to get the job is for someone to get sick or die. There have been many examples of engineers getting their break when the producer got called away on another project. The band or producer then might ask him to take over simply because he already knew exactly what was going on. Some people are just in the right place at the right time.

When you get down to it, being a producer requires a wide range of skills, knowledge, and expertise, including:

- Good listening skills – a good ear, so to speak. A producer must possess the ability to recognize what sounds good and what feels good musically.
- The ability to organize a large amount of diverse information.
- The ability to facilitate production and work well with people. Producers must be able to make people comfortable, but they must also be capable of eliciting creativity above and beyond their own expectations. As a recording engineer, it is often important to be as transparent as possible – that is, to not get in the way of the creative process. Although this idea remains crucial to a good production, the professional producer gets to the point where he or she can literally guide the band in the creative process and even help hone the band's style.
- An understanding of the job of a producer and the producing process.

It is also helpful (but not absolutely necessary) for a producer to have:

- A thorough background as a musician. Today's music producers are likely to be well-crafted (learned) musicians themselves, but this is not absolutely necessary, as mentioned earlier in this chapter.
- A strong background in music theory.
- Knowledge of the techniques of other producers, whether acquired formally or simply by listening to the production of other albums. Many producers mimic or model themselves after producers whom they idolize or look up to in the same way that athletes or artists do. For example, Michael Jordan looked up to Dr. J.; likewise, Mariah Carey learned from Aretha Franklin and aspired to her greatness and level of quality.

The experienced producer is often diverse and is not limited in his or her ability to facilitate and produce any project, regardless of the style of music.
Even after studying this book and learning the procedures for producing a band, you still must embark on the lifelong process of developing detailed values for each aspect of the music.

Types of Projects

Music Production

We're using this category as a catchall for everything except for rap, hip-hop, jazz, and dance music. These other categories are discussed under their own headings in the following sections. For the most part, rock, alternative rock, hard rock, country, reggae, folk, blues, R&B, and neo-soul are all produced using a similar process (with different values applied, of course). This book explains the two-step process in detail: pre-production and the recording session.

Rap and Hip-Hop Production

The big difference in rap and hip-hop production is that you are commonly expected to come up with the musical parts. You aren't simply critiquing them; you are often writing them. If an artist comes to you and says he's got some lyrics, or even if he just wants some music to flow to, you often end up helping to write the song.

On the local hip-hop scene and in the hip-hop world at large, many young artists are looking for producers. They want someone not only to help organize and put the project together, they often want that person to come up with beats and arrange the parts. Everyone and their brother think they can rap, right? Right! Therefore, there is a huge opportunity out there for doing this kind of work in the hip-hop culture.

Dance Music (Electronica)

The big difference with dance music is that most of it is played in clubs, so the orientation is different. In dance music, normally the artist already will have the parts put together in the computer. It is quite similar to a normal project; however, often the person putting the project together is already proficient on the computer. Frequently you end up showing them arrangement tricks and some cool mixing techniques.

Live Recording

Live recording still can include recording in the studio. The term simply means you are no longer using a multitrack. This process, in which the whole band is recorded live, is commonly done for jazz, big band music, and symphonic and classical music. Therefore, you must get a perfect take and mix of the entire band because there is no way to overdub and fix any part, including the vocals.

Commercial Music or Jingles

As with other projects, a Producer of Commercial Music might help write the music or simply oversee the quality of each component. Music for commercials is often much more "in your face," with a much higher level of intensity. Every single moment must be jam-packed with a certain emotion or meaning. Commercials require an extremely strong hook and a much higher level of energy to grab and keep the listener's attention. Essentially, you are trying to get the song's point across in less than one minute.

Audio for Media Production (Video, Film, and Internet)

Producing audio for media requires a whole different set of goals than music production. Often the music supports the visual information. It can be simply background music that is used as filler or to break up monotony. The music might also be part of an actual concert, featured in a movie. Music used to create a mood or anticipation in a film is called a *stinger*. It can enhance or create tension along with the visuals. Music produced for TV involves its own set of traditions that have been developed for how music works with visuals; these are important to learn and there are many books that address these in detail. This also includes video games.

The Producing Process

The producing process normally takes the form of two different procedures – pre-production and production in the recording studio. Here are the steps in more detail:

1. Connecting with the band. This normally means getting to know the band to make sure you are a good match, which often involves seeing them live, going to a few rehearsals, and ultimately getting them to commit to having you produce them.
2. Figuring out what songs you are going to record.
3. Getting the songs on tape for analysis, and getting the lyrics on paper.
4. Doing your homework. This entails analyzing, critiquing, and refining the 13 aspects of a recorded piece of music: Concept, Intention, Melody, Harmony, Rhythm, Lyrics, Song Structure, Density, Instrumentation, Performance, Quality of Equipment and the Recording, Hooks, and Mix.
5. Scheduling the pre-production meetings.
6. Conducting the pre-production meetings. Critiquing the 11 aspects with the band.
7. Scheduling the recording sessions: basic tracks, overdubs, and mixing.
8. Conducting the recording sessions.
9. Mixing.
10. Remixing.

11 Mastering.
12 Completing pressing, packaging, and cover design.
13 Convincing the record comapy not to change anything.
14 Shopping for a record deal.

Many of these aspects are considered the job of the recording engineer. We'll only be covering those aspects that are the main focus of a producer.

Listening

1.1 Everyday Listening

We are exposed to sound throughout each moment of every day regardless of whether we pay attention to it or not. Sound waves that reach our ears tell us about not only the sources producing the sounds, but also about our physical environment, such as the objects, walls, and other physical structures that may reflect, absorb, or diffuse sound. Unless we find ourselves in an anechoic chamber, reflected sound in our environment tells us much about the physical properties of our location. Our surrounding environment becomes audible in a sense, even if it is not creating sound itself, through patterns of sound reflection and absorption. Just as a light source illuminates objects around it, sound sources allow us to hear the general shape and size of our physical environment. The more we listen to everyday sounds, the more we become aware of subtle echoes, reflections, reverberation, low frequency rumble, flutter echoes, and so on. As our awareness of sound increases, we bring this listening skill back to our audio projects.

The frequency content and tonal balance of sound in our environment gives us some clues about the sound sources and also our proximity to them. A bass-heavy sound might emanate from a large mechanical device (such as a truck engine, airplane, or helicopter) or from natural sources (such as a waterfall, seashore, or thunder). Any echoes or strong reflections that we can hear tell us approximate distances.

Because we are primarily oriented toward visual stimuli, it may take some dedicated and consistent effort to focus our aural awareness. As professional audio engineers know, the effort it takes to focus our aural awareness is well worth the satisfaction in acquiring critical listening skills. The hard work does pay off. Although the concept of critical listening is relatively simple, the challenge lies in the practical application: focusing our attention consistently hour after hour, day after day on an audio project. It takes energy and discipline to listen with focus, but regular, targeted practice hones our awareness and gives us the ability to work more efficiently when tackling recording and mixing challenges.

We can develop critical listening skills everywhere we go, even when we are not actively working on an audio production. For instance, walking by a construction site, we may hear impulsive sounds such as hammering. Echoes—the result of those initial impulses reflecting from nearby building exteriors—may arrive fractions of a second later after the direct sound. The timing, location, and amplitude of echoes provide us with information about nearby buildings, including approximate distances to them. We can compare the timbre of direct and reflected sounds, especially in the case of long echoes. Perhaps some frequency content is being absorbed. Listening in a large music performance space, we notice that sound continues to linger on and slowly fade out after a source has stopped sounding, known as

reverberation. Sound in a concert hall can be enveloping because it seems to be coming from all directions, especially at some distance from sound sources. We can notice the direction of reverberation and be aware of sound coming not only from performers on stage, but also reflected sound coming from all around us.

In another location, such as a carpeted living room, a musical instrument will sound noticeably different compared with the same instrument played in a concert hall. There are a few reasons for this difference. Physical characteristics such as room dimensions and surface treatments determine that a living room's acoustical characteristics will be markedly different than those of a concert hall. The reverberation time will be significantly shorter and early reflections will arrive much sooner in a living room because the volume of a typical living room is much smaller than a concert hall. Floor covering can also influence spectral balance: a carpeted floor will absorb high frequencies and thus sound more dull, whereas a wood floor will reflect high frequencies and sound brighter.

The relatively close proximity of walls in a living room will reflect sound back toward a listener within milliseconds of the arrival of direct sound and at nearly the same amplitude. This small difference in time of arrival and near-equal amplitude of direct and reflected sound will create constructive and destructive interference at our ears. An extreme example of this effect is *comb filtering* (more in Chapter 3), where a sound is mixed with a single delayed version of itself. The effect is most apparent when we mix a sound with a delayed version of itself electrically or digitally (in a mixer). We hear comb filtering all the time in everyday life, but because reflected sound delay times are changing (as we move) and because there are so many delayed reflections arriving at our ears, the effect is smoothed out and we do not get the same deep notches in the spectrum that we do with only a single delayed reflection mixed with the original non-delayed sound.

Active listening is crucial to our work in audio engineering, and we can take advantage of times when we are not specifically working on an audio project to heighten our awareness of the auditory landscape and practice our critical listening skills. Walking down the street, sitting in a café, and attending a live music concert all offer opportunities for us to hone our listening skills and thus improve our work with audio. For further reading of some of these ideas, see Barry Blesser and Linda Salter's 2006 book *Spaces Speak, Are You Listening?*, where they expand upon listening to acoustic spaces in a detailed exploration of aural architecture.

As audio engineers, we are concerned with capturing, mixing, and shaping sound. Whether recording acoustic musical instruments playing in a live acoustic space or creating electronic sounds in a digital medium, one of our goals is to shape sound so that it is most appropriate for reproduction over loudspeakers and headphones and best communicates the intentions of a musical artist. An important aspect of sound recording that an engineer seeks to control is the relative balance of instruments or sound sources, whether through manipulation of recorded audio signals or through microphone placement around instruments and ensembles. Sound source balances in a recording can have a tremendous effect on the musical feel of a composition. Musical and spectral balance is critical to the overall impact of a recording.

Through the process of shaping sound, no matter what equipment is being used or what the end goal is, our main focus is simply to listen. We need to constantly analyze what we hear to assess a track or a mix and to help make decisions about further adjustments to balance and processing. Listening is an active process, challenging us to remain continuously aware of any subtle and not-so-subtle perceived characteristics, changes, and defects in an audio signal.

1.2 What Is Technical Ear Training?

Just as musical ear training or *solfège* is an integral part of musical training, technical ear training is necessary for audio engineers, and it has applications in recording studios, live sound reinforcement, and audio hardware/software development. There are numerous technical references that describe audio engineering theory, yet ear training is equally as important as knowing the functionality of equipment on hand. Letowski, in his article "Development of Technical Listening Skills: Timbre Solfeggio" (1985), originally coined the term *timbre solfeggio* to designate training that has similarities to musical aural training but is focused on spectral balance or timbre. Technical ear training is a type of perceptual learning focused on timbral, dynamic, and spatial attributes of sound, especially with respect to audio recording and production. We can develop heightened listening skills that allow us to rely on auditory perceptions in a more concrete and consistent way. As perceptual psychologist Eleanor Gibson wrote, perceptual learning refers to "an increase in the ability to extract information from the environment, as a result of experience and practice with stimulation coming from it" (Gibson, 1969). Through years of working with audio, engineers generally develop strong critical listening skills. By increasing attention on specific types of sounds and sound processing, and comparing successively smaller differences between sounds, we can learn to differentiate among features of sounds. When two listeners, one expert and one novice, with identical hearing ability are presented with identical audio signals, an expert listener will likely be able to identify specific features of the sound that a novice listener will not. Through focused practice, a novice engineer can eventually learn to identify sounds and sound qualities that were originally indistinguishable.

Along this line, perceptual encoder developers found that their expert listening panel participants could more easily identify familiar distortions than unfamiliar distortions. Once we know what "warbling" or "metallic ringing" sounds like in an MP3-encoded song, the distortion is easier to hear, even if it is quieter relative to the signal (music). Suddenly all of our MP3s become difficult to listen to because we cannot stop hearing the encoder artifacts.

A subset of technical ear training focuses on the timbre of sound. One goal is to become more adept at distinguishing and analyzing a variety of timbres. *Timbre* is typically defined as that characteristic of sound other than pitch or loudness, which allows a listener to distinguish two or more sounds. Timbre is a multidimensional attribute of sound and is determined by factors including:

- Spectral content: frequencies present in a sound.
- Spectral balance: the relative balance of individual frequencies or frequency ranges.
- Amplitude envelope: the attack (or note onset time) and decay times of the overall sound and individual overtones.

A person without specific training in audio or music can distinguish between a trumpet and a violin sound even if both are playing the same pitch at the same loudness—the two instruments just *sound* different.

In normal everyday speech, we use timbre discrimination to identify vowels. Vowels sound the way they do because of formants, or spectral peaks, produced acoustically by the vocal tract. Our ears can distinguish one vowel from another with the first three formants. We give these various vowel sounds (timbres) names that correspond to specific letters. Since we map timbres to labels (vowels) seemingly automatically when we speak or listen to

someone else speaking, we may not realize that we are already doing something that relates to technical ear training. With technical ear training we are simply adding a new set of timbres and associated labels to our inventory.

Classical music aficionados can name the instruments in an orchestra based on sound alone because of timbre, even going so far as to distinguish a C trumpet from a B♭ trumpet or an E♭ clarinet from a B♭ clarinet. Electric guitar players can easily identify the sounds of single coil and humbucker pickups. Techno and house music producers know the sounds of various models of drum machines from the timbres they produce. Popular music, although relatively straightforward in terms of melody and harmony, often uses complex layers of signal processing to produce tension and release. Timbral control from sophisticated signal processing has become one of the main artistic features of electronic pop music. In other words, the recording studio has become a musical instrument as recorded music employs more and more sophisticated treatment of timbre. With all of the audio processing options available, we have to be aware of much finer differences and an infinite number of possible sound colors on our palette.

Sound engineers work with much more subtle differences in timbre that may not be obvious to a casual listener. For instance, in comparing the sound of two different microphone preamplifiers or a 1 dB change in level, a novice listener may hear no difference at all. But it is the experienced engineer's responsibility to hear such subtle details and make decisions based on them.

Professional recording engineers and expert listeners can focus their attention to specific auditory attributes and separate or discriminate them from the rest of a mix. Some musicians and composers have also trained their ears through experience to hear subtle attributes of audio mixes. Here is an anecdote about such a person. One time I was mixing a wind symphony recording, and the composer of the piece was present in the control room. This particular composer has extensive recording experience and has developed a high level of critical listening abilities for audio and sound quality. As we were listening to an edited version of his piece, he happened to notice a misplaced clave hit buried deep in the texture of the wind instrument and percussion sounds. It took me several listens to hear this very quiet clave hit, and of course I was a little embarrassed and frustrated that I could not hear it immediately. Once I heard it for myself, I could pick it out on each subsequent replay. This is exactly the kind of situation that requires us as engineers to develop and maintain the highest level of critical listening abilities.

Technical ear training focuses on the features, characteristics, and sonic artifacts that result from signal processing commonly used in audio engineering, including:

- equalization and filtering
- reverberation and delay
- dynamics processing
- characteristics of the stereo image

Technical ear training also focuses on unwanted or unintended features, characteristics, and sonic artifacts that may be produced through faulty equipment, particular equipment connections, or parameter settings on equipment such as noise, hum or buzz, and unintentional nonlinear distortion. Through concentrated and focused listening, an engineer should be able to identify sonic features that can positively or negatively impact a final audio mix and know how subjective impressions of timbre relate to physical control parameters. The ability to quickly focus on subtle details of sound and make decisions about them is the primary goal of an engineer.

Sound recording has had a profound effect on the enjoyment and evolution of music since the early 20th century. Sound recordings may simply document musical performances: an engineer records microphone signals as clean as possible with no processing or mixing. More commonly, based on record sales at least, engineers play an active role in guiding listeners' attentions by applying intentional and dramatic signal processing, editing, dynamic mixing, panning, and timbral shaping to recordings.

In technical ear training, we focus not only on hearing specific features of sound but also on identifying the types of processing that cause a characteristic to be audible. To hear a difference between an equalizer engaged and bypassed is an important step in the ear training process, but it is even more helpful to know the specific settings on the equalizer. Just as experts in visual art and graphic design can identify subtle shades and hues of color by name, audio professionals should be able to do the same in the auditory domain.

Sound engineers, audio hardware and software designers, and developers of the latest perceptual audio encoders (such as MP3) all rely on critical listening skills to characterize audio signal processing and make final design decisions. Powerful audio measurement tools and research are bringing us closer, but objective measures do not always tell us if something will sound "good" to human ears.

One measure of equipment quality is total harmonic distortion or THD. Usually equipment designers aim to have THD levels as low as possible, but a THD level for one type of distortion may be much more audible than for another type of distortion. Loudspeaker designers and acoustics experts Earl Geddes and Lidia Lee (2003) have pointed out that high levels of measured nonlinear distortion can be less perceptible than low distortion levels, depending on the nature of the distortion and the testing methods employed. The opposite can also be true, in that low levels of measured distortion can be perceived strongly by listeners. Distortion produces new overtones in a signal, but existing frequency components may mask these overtones. If the distortion in question produces overtones that are harmonics of the signal, these new harmonics will blend with any existing harmonics present in the signal. If the distortion produces non-harmonic overtones, these may be more audible because they will not match existing harmonics.

Frequency response, although quantifiable, is another example where subjective preferences can have greater importance than physical measurements. Listeners may prefer a loudspeaker that does not have a flat on-axis frequency response as measured in an anechoic chamber over one that does, because frequency response is only one objective measurement of the total sound produced by a loudspeaker. Sound power and directivity are two parameters that also affect the sound of a speaker in a listening room. Car audio system engineers report that listeners prefer car audio systems with more bass than a home stereo speaker. With listening tests and feedback from consumers, car audio engineers have determined that a car audio system that measures flat may not necessarily be preferred. In audio product design, the final tuning of software algorithms and hardware designs is often done by ear by expert listeners. Thus, physical measurements, although important in equipment design and development, are usually supplemented with subjective listening tests.

Of course, with music recording and production, there is no way to measure or quantify a mix to determine if it is as good as another mix, so we rely on our ears. The work is more art and less science, but we want to be consistent from day to day, and that's where technical ear training can help.

In the next sections I will outline the four main goals of technical ear training:

- to link audio attributes to our perception of sound.
- to increase our ability to discriminate subtle details of sound.

- to increase the speed with which we can recognize when we need to make changes in signal processing, mix balances, or other parameter settings.
- to increase our consistency in making these judgments.

Linking Audio Attributes to Perception: Isomorphic Mapping

Audio professionals understand the need to hear subtle changes in sound. They know the sources of these changes and ways to remedy problems using audio processing and recording techniques. One of my goals in writing this book is to facilitate *isomorphic mapping* of technical and engineering parameters to perceptual attributes. Simply put, we want to link auditory perceptions with physical properties of audio signals.

Sound is ephemeral and intangible and yet, as audio engineers, we are tasked with shaping it to obtain specific results. We rely on visual cues such as level meters, waveform displays, and signal processing parameters to help cope with the intangibility of sound. Isomorphic mapping attaches something concrete and tangible (signal processor settings) to a more abstract concept (our perception of the associated timbre). You probably make this mental connection already without labeling it isomorphic mapping. With experience using audio equipment, we can anticipate what a boost at 1 kHz or a delay of 125 ms will sound like, as we reach for the setting. The more experience we have, the more accurate our anticipations and estimations of sound characteristics.

Audio equipment parameter settings correspond to physical attributes of an audio signal, but what do these objective parameters sound like? A parametric equalizer, for instance, allows control of frequency, gain, and Q. These physical attributes as they are labeled on a device have no natural or obvious correlation to an audio signal's perceptual attributes, and yet engineers engage them to affect a listener's perception of a mix. How do we know what a 6-dB boost at 315 Hz with a Q of 2 sounds like? Without experience using equalizers, we cannot predict the resulting timbre. A novice audio engineer may understand the term "compression ratio" conceptually, but may not know how to adjust the parameter effectively or may not understand how sound is changed when that parameter is adjusted.

What physical characteristics might be responsible for a "bright" or "muddy" sound? Specific frequency boosts, dynamics processing, artificial reverberation, or some combination of all of these? Subjective descriptions are not reliable because they are not consistent from person to person or across situations, and they do not have direct relationships with physical characteristics. A "bright" snare drum sound may mean excessive energy around 4 kHz to 8 kHz, a deficiency around 125 Hz, or something else. Most equalizers do not have subjective quality labels, although Bryan Pardo and members of his Interactive Audio Lab at Northwestern University have been working on equalizer and reverberator interfaces that map language-based descriptors to audio processing parameters (Sabin, Rafii, & Pardo, 2011). Based on user studies, they have linked equalizer descriptors such as "warm" and "tinny" and reverberator descriptors such as "bathroom-like" and "church-like" to objective signal processing parameters.

Psychophysicists have known for many years that sensation is influenced significantly by *change*. Our senses are change detectors and they are most sensitive to a change in our environment, such as a flash of light or a clap of thunder. We tend to ignore stimuli that do not change, such as light levels and air temperatures in our home, or the hum of a refrigerator running. We tend to notice the sound of a fridge, an air handler's continuous rumble, or fan noise only when the noise stops. If you have ever had your eyes tested, you

know that an optometrist relies on switching quickly from one lens to another to find the correct prescription. With audio, we can notice differences more clearly when switching from one headphone or loudspeaker to another. One model may be "darker" (bass-heavy) or "brighter" (treble-heavy) or have more midrange, but as we continue to listen to one of them, we can adapt to the sound, and the coloration becomes less apparent; we get used to the sound and, assuming we are listening through reasonably full-range speakers (that is, not laptop speakers), we start to think of the sound as being flat. Switching from one monitor to another when mixing helps reduce our inclination to adapt to one monitor's qualities (or deficiencies). If we become adapted to one specific monitor, we are compelled to add processing to compensate for its deficiencies. If a monitor is deficient in the high-frequency range, we tend to compensate by adding high-frequency energy to our mixes. Although as Mike Senior clearly describes in his excellent book *Mixing Secrets for the Small Studio* (2011), we can develop a collection of reference recordings to help make our mixing more objective and consistent.

Subjective descriptions of sound can be vague, but we reduce ambiguity if we know the exact meaning of the adjectives we use. We can certainly develop our own vocabulary to describe various qualities of sound, but these descriptors may not match what other engineers develop. Why not use labels that already exist on parametric equalizers? The most precision we can have is to describe equalizer settings in terms of center frequency, Q, and amount of boost or cut.

It is critical to develop a memory of specific frequencies to perceptual attributes of a signal, and what a boost or cut at specific frequencies sounds like. With practice it is possible to estimate the frequency of a deficiency or surplus of energy in the power spectrum of an audio signal and then fine-tune it by ear. Through years of practice, professional audio engineers develop their own personal methods to translate between their perceived auditory sensations and the technical parameters that they can control with the equipment available to them. They also develop a highly tuned awareness of subtle details present in sound recordings. Is there a repeating delay on the snare? How many times does it repeat? Does the electric bass sit within a mix in the right way? Or does it need more or less compression?

Although recording engineers may not have a common language to describe specific auditory stimuli, most have devised their own translations between qualities of sound and available signal processing tools. An audiologist would probably not detect superior hearing abilities in professional engineers when compared to novices. Something else must be going on: professionals probably do not have better hearing in an objective sense, but they are more advanced in their ability to focus on sound and discriminate among various qualities; their awareness of sound and timbre is fine-tuned and consistent.

A recording engineer can have as much command of a recording studio and its associated signal processing capability as a professional musician has command of an instrument. A violinist knows precisely when and where to place her fingers on the strings and can anticipate what effect each bow movement will have on the sound produced. An audio engineer should have this same level of knowledge and sensitivity of sound processing and shaping before reaching for an effects processor parameter, fader position, or microphone model. It is important to know what a 3-dB boost at 4 kHz or an increase in compression ratio is going to sound like even before it is applied to an audio signal. There will always be times when we will not be able to identify a unique combination of signal processing and equipment, but the work progresses more quickly if we are not continuously guessing what signal processing will sound like. Although there is an abundance of plug-ins and hardware

processors available, they mostly fit into one of these three groups of signal processing production tools:

1. Frequency/spectral control—equalizers, filters
2. Level and dynamic range control—compressors/limiters and expanders/gates
3. Spatial control—reverberation, delay

By knowing ahead of time what effect a particular parameter change will have on the sound quality of a recorded signal, we can work more efficiently and effectively. Working at such a level, we are able to respond to sound quality quickly, similar to the speed at which musicians respond to each other in an ensemble.

Perhaps with enough facility and confidence for experimentation, the recording studio really can become a musical instrument that we "play," as producer Brian Eno has written and spoken about. An engineer has direct input and influence on the artistic outcome of any music recording in which she is involved. By adjusting balances, mixing sonic layers, and shaping spectra, an engineer focuses the auditory scene for listeners, guiding them aurally to a musically satisfying experience that expresses the intentions of the musical artist.

Increasing Awareness

The second goal of technical ear training is to increase our awareness of subtle details so that we can discriminate minute changes in physical parameters of sound. An experienced recording engineer or producer can pick out details of sound that may not be apparent to an untrained listener. Over the course of a complex recording project, an engineer might make hundreds, if not thousands, of decisions about sound quality and timbre that contribute to the finished product. Some decisions have a more audible effect than others, but here are a few of the things that engineers consider during a recording project:

- Microphones—the make/model, polar pattern, location, and orientation for each instrument being recorded.
- Preamplifier—the make/model and gain settings for each microphone, usually optimizing microphone signal levels to avoid clipping.
- Signal levels—there can be several gain stages for each track, depending on processing and other equipment in the signal chain, but the goal is to maximize signal-to-noise ratio and minimize analog-to-digital conversion quantization error and distortion/clipping through to the recording medium.
- Spectral/tonal balance and timbral quality—specific equalizer and filter settings for each track. Microphone choice and placement also play a role in spectral balance. Coloration or "warmth," usually the result of distortion from analog tape, transformers, and vacuum tubes, is generally subtler but contributes audibly nonetheless to the tonal balance.
- Dynamic range and dynamics processing—audio signals have a range from loud (*fortissimo*) to soft (*pianissimo*), and this range can be altered through dynamics processing, such as compressors and expanders.
- Spatial characteristics—recording room/hall acoustics and microphone placement within a room, and parameter settings on artificial reverberation, delays, as well as panning and positioning of sound sources within the stereo or surround image.
- Balance—the relative levels of tracks.
- Processing effects—flanger, phaser, chorus, tremolo, distortion/overdrive.

- Noise—takes many forms but in general is any sound that is not intended to be part of a recording. There are two main categories:
    - Electronic: clicks/pops, tape hiss, quantization error, 50- or 60-Hz power supply or ground loop hum/buzz.
    - Acoustical: air-handling noise (which can be in the form of a low rumble and therefore not immediately apparent), external and environmental sounds such as traffic and subways, talking, foot tapping, etc.

These are broad categories of technical parameters that affect the perceived audio quality and timbre of an audio signal. Each of these items can have numerous levels of detail. For example, digital reverberation plug-ins often provide control over parameters such as decay time, predelay time, early reflections, modulation, diffusion, room size, filtering, and decay time multipliers for each frequency band.

Some of these decisions have a relatively insignificant sonic effect, but because they are added together to form a coherent whole, the cumulative effect makes each stage critical to a finished project. Whether it is the quality of each component of a sound system or each decision made at every stage of a recording project, the additive effect is noteworthy and substantial. Choices made early in a project that degrade sound quality often cannot be reversed later in a project. Audio problems cannot be fixed in the mix and, as such, we must be listening intently to each and every decision about signal path and processing that is made. For example, a low-level hum on a microphone signal might seem insignificant until we compress it and raise its level by 12 dB. When listening at such a focused level, we can respond to sound quality and timbre quickly and in the moment, hearing potential problems that may come back to haunt a project at a later stage. To use an analogy, painters use specific paint colors and brush strokes in subtle ways that combine to produce powerful finished images. In a related way, recording engineers focus on specific sonic characteristics that, when taken as a whole, combine, blend, and support one another to create more powerful, meaningful final mixtures of sounds.

Increasing Speed of Detection

The third goal is to increase the speed with which we can identify and decide on appropriate engineering parameters to change. A recording and mixing session can occupy large amounts of time, within which hundreds of subtle and not-so-subtle adjustments are made. The faster we can hone in on any sonic characteristics that may need to be changed, the more effective a given period of time will be. During a recording session, valuable time can be consumed while comparing and changing microphones, and the quicker we can recognize a deficiency or that we have found the ideal sound, the faster we can move on to other tasks.

We hope that increased sensitivity in one area of critical listening (such as equalization) will promote increased awareness and sensitivity in other areas (such as compression and reverberation) and overall improved listening skills. I have no evidence to support the idea, but I can offer an analogy. Years ago, I became interested in font types and basic graphic design principles. Once I started learning about these concepts, I began to look at websites and print much differently than before, noticing alignment, color scheme, and smoothness of images and text. I am certainly no graphic designer, but I began to notice a range of visual design elements differently after only a brief introduction to some of the principles.

Because a significant portion of audio engineering—recording, mixing, mastering, sound design—is a creative art in which there are no correct answers, this book does not provide

advice on the "best" equalization, compression, or reverberation settings for different situations. What may be the perfect equalization for an instrument in one situation may not be suitable for another. What this book attempts to do, however, is guide the development of listening skills so that we can identify when we have the sound we want and when we need to fix up a problem area. A novice engineer working on a mix may have the vague feeling that something is not right or an improvement could be made, but not know what the problem is or how to fix it. An experienced engineer with developed critical listening skills can listen to a mix and know specifically where the problems lie and how they can be corrected. For example, maybe the kick drum has too much energy at 250 Hz, the piano needs more 1 kHz, and the voice has too much 4 kHz. Technical ear training gives us the skills to help solve specific problems such as these.

I think of the standard studio signal processing categories as:

- equalization (parametric, graphic, and filters)
- dynamics—compression/limiting, expansion/gating
- spatial and time-based—reverberation, delay, chorus, flanging
- gain/level

Within each of these categories of signal processing, numerous makes and models are available at various price ranges and levels of quality. If we consider compressors for a moment, we know that most compressor makes/models perform the same basic function—they make loud sounds quieter. Most compressor models have common functionalities that give them similar general sonic characteristics, but the exact way in which they perform gain reduction can vary. Differences in the analog electronics or digital signal processing algorithms among compressors create a variety of sonic results, and each model will have a unique sound. Through the experience of listening, we learn that there are variations in sound quality between different makes and models, and we choose a certain model because of its specific sound quality, the control it affords us, or the potential artifacts it adds. Many analog signal processors have software plug-in versions where the screen image of the plug-in is nearly identical to the faceplate of the hardware device. Sometimes, because the two devices *look* identical, it may be tempting to think that they also *sound* identical. Unfortunately, they do not always sound alike but it is possible to be fooled into thinking the sound is replicated as perfectly as well as the visual representation of the device, especially if we do not have the analog version for comparison. Suffice it to say there is not always a direct translation between analog electronics and the computer code that performs the equivalent digital signal processing, and there are various ways to create models of analog circuits; thus we have differences in sound quality. That may be fine, because we can treat a plug-in for what it is rather than as a model of some historically important piece of gear.

Although each compressor model, for example, has a unique sound, we can transfer knowledge of one model to another and be able to use an unknown model effectively after a short period of listening. Just as pianists must adjust to each new piano that they encounter, engineers must adjust to the subtle and not-so-subtle differences between pieces of equipment that perform a given function.

Increasing Consistency

Finally, the fourth goal of technical ear training is to increase and maintain our consistency from day to day and from project to project. Expert listeners are deemed to be expert in part because their judgments about sound quality and audio attributes are generally very

consistent. If expert listeners participate in a blind listening test that compares and rates loudspeaker sound quality, for example, they tend to rate a given loudspeaker the same each time they take the listening test. It may seem remarkable that a listener can give a loudspeaker the same rating day after day, especially without knowing anything about it other than what it sounds like. On a more basic level, perhaps you are so familiar with the loudspeakers that you use on a regular basis that you could identify them in a blind listening test compared to another unknown loudspeaker model. At some level, you are an expert listener for your particular monitors because you are so familiar with their timbral characteristics. Expert listeners can identify features in the sound of a loudspeaker quickly and accurately. Maybe they hear a resonance around 100 Hz, a dip at 1250 Hz, and another resonance around 8 kHz. By evaluating timbre with this level of accuracy, expert listeners will know when they hear that speaker again because they will recognize those characteristics when they hear them again.

Being consistent also helps us work faster and more confidently. If we can always identify a resonance at 125 Hz and not confuse it with 250 Hz or 63 Hz, then this will help us work more confidently and quickly day in and day out. Be aware that the learning-listening process does not always seem to progress forward and that you may encounter setbacks. Some students report that a few weeks after beginning EQ technical ear training exercises, their consistency deteriorates briefly. It is not clear why this happens, but it seems to be a normal part of the learning and memorization process. Awareness increases as we train, and perhaps we become overconfident too quickly, before we have really solidified our memory for frequencies. Also, be aware that alcohol and sleep can affect this as well. Things do improve with continued practice, but be aware that incorrect frequency resonance identification with equalizers is common even after some initial success in training and practice.

Everyday Ear Training Exercise 1: Everyday Sounds

Our ears are capturing sound all the time, so this opens up endless opportunities for ear training exercises wherever we go. As you go about your everyday activities, try this exercise a few times each day, especially when you are not working on an audio project, to help focus your attention on sound.

What sounds do you hear right now? Describe the timbre and qualities of individual sounds as well as the overall soundscape using these points as guidelines:

- Frequency content—Are sounds wide band (mostly all frequencies) or narrow band (only low frequencies or high frequencies, perhaps)? Are there recognizable pitches or tones, or is it mostly noise-based (random)?
- Temporal qualities—Are there repeating, periodic, or rhythmic sounds? Are there transient sounds? Are there steady-state or continuous sounds?
- Spatial characteristics—Where are the sounds located relative to you, in terms of proximity and angular location or azimuth? Are the locations clear and distinct, or diffuse and ambiguous? If there are recognizable echoes, where are they originating? How wide is the soundscape? How wide are the sound sources?
- Besides the more obvious sounds, are there any continuous, low-level background sounds, such as air-handling noise or lights humming, that we tend to ignore?
- How loud are the sounds, overall and relative to one another?
- What is the character of the acoustic space? Try to use only your ears to characterize the environment. Are there any distinct echoes? What is the reverberation decay time?

- Do you hear any resonances or flutter echoes? In the space above my bathroom sink in my house, there is a resonant frequency within the range of my speaking voice. I discovered it by accident one day when I was talking while over the sink. If I talk with my head above the sink, the words that I speak at the resonant frequency are louder than other words. If you notice an acoustical resonant frequency within the range of your voice, sing it and change the pitch of your voice and notice how your voice seems to get louder at the resonant frequency and quieter at other frequencies. Bathrooms in general can be interesting acoustical spaces because they often have hard reflective surfaces everywhere and relatively long reverberation times.
- If you turn your head, does the timbre of sound change? Can you hear the timbre gradually change while you are moving your head?

Everyday Ear Training Exercise 2: Recorded Music

When you find yourself in an environment where recorded music is playing—but not when you are working on an audio project—try analyzing the timbre and sound quality that you hear. Maybe you are in a store or restaurant, someone in your house is playing some music, or you are walking down the street and hear music. Analyze the sound you hear.

- Describe the tonal or spectral balance of the recording in terms of low-, mid-, and high-frequency ranges. Is there enough bass/mid/high? Too much bass/mid/high?
- Are all of the elements of the mix clearly audible? If they are not, which elements are difficult to hear and which are most prominent?
- If you are familiar with the recording, how is the timbre of the sound affected by the system and environment through which it is presented? Does it sound different than what you remember? If so, how? Does the mix balance seem the same as what you have heard in other listening situations?

Everyday Ear Training Exercise 3: Speech

The next time you hear someone speaking, listen to the tone quality of his or her voice.

- Tone quality—Does the voice sound deep, mellow, shrill, raspy, like that of a child?
- Accent—Can you pick out an accent? Notice differences in vowel sounds from the way you or someone else might pronounce words. Even just within the English-speaking world there are hundreds if not thousands of dialects and accents.
- Pitch variation—Notice the pitch contour of the speech. Unless the person is speaking in a completely monotone voice, there will likely be some variation across a range of fundamental frequencies.
- Foreign language sounds—If you hear someone speaking a language foreign to you, listen for sounds that are different from those you know. Listen for characteristic sounds that are similar to or different from your native language or other languages you may know.

1.3 Shaping Sounds

Not only can music recordings be recognized by their musical melodies, harmonies, and structure, they can also be recognized by the timbres of the instruments created in the recording process. In recorded music, engineers and producers shape sounds to best suit a

musical idea and artistic intention. The molding of timbre has become incredibly important in recorded music, and in his book *The Producer as Composer: Shaping the Sounds of Popular Music* (2005), Virgil Moorefield describes in detail how recording and sound processing equipment contribute to the compositional process. Timbre has become such an important factor in recorded music that timbre alone can be used to identify a song before musical tonality or melody can have time to develop sufficiently. In a study by Glenn Schellenberg et al. (1999) at the University of Toronto, they found that listeners could correctly identify pieces of music when presented with excerpts of only a tenth of a second (100 ms) in length. Popular music radio stations are known to challenge listeners by playing a short excerpt (typically less than half a second) from well-known recordings and invite listeners to call in and identify the song title and artist. Such excerpts are too short to indicate the harmonic, melodic, or rhythmic progression of the music. Listeners rely on the timbre or "mix" of sonic features to make a correct identification. Daniel Levitin, in his book *This Is Your Brain on Music* (2006), also illustrates the importance of timbre in recorded sound and reports that "Paul Simon thinks in terms of timbre; it is the first thing he listens for in his music and the music of others" (page 152).

One effect recording studios have had on music is to help musicians and composers create sonic landscapes that are impossible to realize acoustically. Purely non-acoustic sounds and sound images are most evident in electronic music, in which sounds originate from electronic sources (analog or digital) rather than through a conventional musical instrument's vibrating string, membrane, bar, or column of air. Electronic music often combines recordings or samples of acoustic sounds with electronically generated sound (such as from a synthesizer). The distinction between purely electronic and purely acoustic sounds is not always clear, especially since we can use acoustic recordings as sources for digitally synthesizing completely new sounds.

There is a range of acoustic and electronic sound sources, and we might think about the continuum from acoustic to electronic sound sources within four broad categories:

1. Purely acoustic sounds—generated by conventional acoustic musical instruments or voices.
2. Amplified acoustic sounds—such an electric guitar, electric bass, or electric keyboard (Fender Rhodes or Wurlitzer)—start with a vibrating mechanism (string, tine, or reed) that gets amplified electronically and whose sound is then heard from a loudspeaker.
3. Extensively modified and digitally manipulated acoustic sounds—recorded sounds from which new sounds are created that may have no resemblance to their original acoustic sounds. For example, if we repeat a recording or sample of a single snare drum hit fast enough (i.e., faster than 20 times a second or 20 Hz) we begin to hear it as a pitched, sustained sound rather than the transient sound that it originally was. The possibilities to create new timbres through sonic manipulation are endless, such as with granular and wavetable synthesis techniques.
4. Purely electronic sounds—those generated in the analog or digital domains. A voltage whose amplitude varies over time according to a sine function is called a sine tone. Multiple sine tones at the appropriate frequencies and amplitudes can produce the standard square and triangle waves, as well as any other imaginable timbre. Controlling a tone's attack time (note onset time) and decay time (fade out) transforms it from a steady-state continuous sound to a more musically oriented, time-varying sound. Modulating the frequency or amplitude of a sine tone at rates faster than 20 Hz can create new timbres through what's known as frequency modulation (FM) and amplitude modulation (AM) synthesis respectively.

Of course, we can significantly alter purely acoustic musical instrument recordings with common audio signal processors and plug-ins (EQ, dynamics, and reverb). When we apply spectral, spatial, and dynamic processing to recorded sound, we alter a sound source's original properties, creating new sounds that could not have been produced acoustically. In the process of recording and mixing, we can manipulate any number of parameters, depending on the complexity of a mix and the musical goals of the project. Many of the parameters that are adjusted during a mix are interrelated, such that by altering one track the perception of other tracks is also influenced. The level of each instrument can affect the entire feel or focus of a mix, and an engineer and producer may spend countless hours adjusting levels—down to fractions of a decibel—to create the right balance. For example, a slight increase in the level of an electric bass might impact the perception and musical feel of a kick drum or even the mix as a whole. Each parameter change applied to an audio track, whether it is level (gain), compression, reverberation, or equalization, can have an effect on the perception of other individual instruments and the music as a whole. Because of this interrelation between elements of a mix, an engineer may wish to make small, incremental changes and adjustments, gradually building and sculpting a mix.

At this point in time, it is still not possible to measure all perceived audio qualities with physical measurement tools currently available. For example, the development of perceptual audio coding schemes such as MPEG-1 Layer 3, more commonly known as MP3, required the use of expert listening panels to identify sonic artifacts and deficiencies produced by data reduction processes. Because perceptual audio coding relies on psychoacoustic models to remove components of a sound recording that are deemed inaudible, the only reliable test for this type of processing is the human ear. Small panels of trained listeners are more effective than large samples of the general population because they can provide consistent judgments about sound and they can focus on the subtlest aspects of a sound recording.

Studies, such as those by René Quesnel (2001) and Sean Olive (1994, 2001), provide strong evidence that training people to hear specific attributes of reproduced sound makes a significant difference in their ability to consistently and reliably recognize features of sound, and it also increases the speed with which they can correctly identify these features. Listeners who have completed systematic timbral ear training are able to work with audio more productively and effectively.

1.4 Sound Reproduction System Configurations

Before examining critical listening techniques and philosophies more closely, let's outline and define some common sound reproduction systems. Recording engineers work primarily with sound reproduced over loudspeakers and headphones.

Monaural: Single-Channel Sound Reproduction

A single channel of audio reproduced over a loudspeaker is typically called monaural or just "mono" (see Figure 1.1). It is mono if there is a single audio channel (or signal). Even if there is more than one loudspeaker, it is still considered monaural if all loudspeakers are producing exactly the same audio signal. The earliest sound recording, reproduction, and broadcast systems used only one channel of audio, and although this method is not as common as it once was, we still encounter situations where it is used. Mono sound reproduction creates some restrictions for recording engineers, but it is often this type of system that loudspeaker manufacturers use for subjective evaluation and testing of their products.

Figure 1.1 Monaural or single-channel listening.

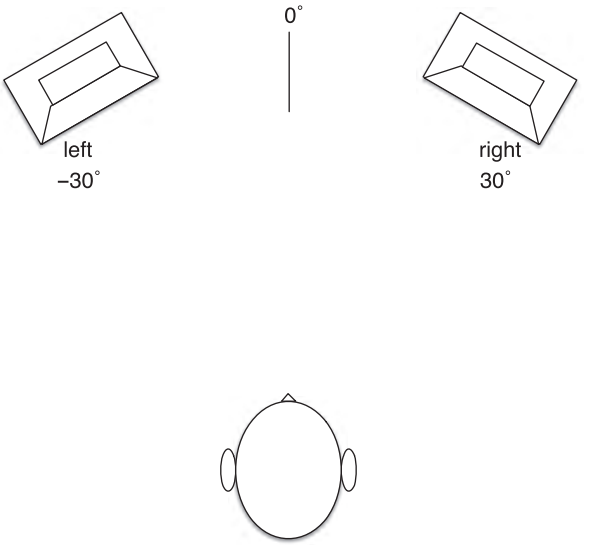

Figure 1.2 Ideal two-channel stereo loudspeaker and listener placement. The listener's head and the two loudspeakers should form an equilateral triangle.

Stereo: Two-Channel Sound Reproduction

Evolving from monaural systems, two-channel reproduction systems, or stereo, allow sound engineers greater freedom in terms of sound source location, panning, width, and spaciousness. Stereo is the primary configuration for sound reproduction, whether using speakers or headphones. Figure 1.2 shows the ideal listener and loudspeaker locations for two-channel stereo.

Headphones

Headphone listening with two-channel audio has advantages and disadvantages with respect to loudspeakers. With modestly priced headphones (relative to the price of equivalent quality

loudspeakers), it is possible to achieve high-quality sound reproduction. Good-quality headphones can offer more clarity and detail than loudspeakers, partly because headphones are not subject to the acoustical effects of listening rooms such as early reflections and room modes. Headphones are also portable and can be easily taken to other locations where loudspeaker characteristics and room acoustics may be unfamiliar to an engineer.

The main disadvantage of headphones is that they create *in-head localization* for mono sound sources. That is, we perceive center-panned, mono sounds as originating somewhere between our ears, inside our heads, because the sound is being transmitted directly into the ears without first bending around or reflecting off the head, torso, and pinnae (outer ears). To avoid in-head localization, audio signals would need to be filtered with what is known as a head-related transfer function or HRTF. Simply put, HRTFs specify filtering that occurs acoustically from sound bouncing off the pinnae, head, and shoulders, as well as interaural time differences and interaural amplitude differences for a given sound source location. Each location in space (elevation and azimuth) has a unique HRTF, and usually many locations in space are sampled when measuring HRTFs. It is also worth noting that each person has a unique HRTF based on the shape of the outer ear, head, and upper torso. HRTF filtering is not an ideal solution because there is no universal HRTF that works equally well for everyone; every pinna is unique and the shape of the pinna determines the precise filtering that occurs. So if we filtered a recording with my HRTF, it probably would not sound as good to other people as it would to me. Also, we are generally not able to localize sounds as accurately with non-individualized HRTFs.

There is no interaural crosstalk with headphones, which may be considered an advantage or a disadvantage, depending on your point of view. We have interaural crosstalk (Figure 1.3) when the sound from the left speaker reaches the right ear and sound from the right speaker reaches the left ear.

One advantage of loudspeaker listening is that there is no in-head localization with the ideal listener/loudspeaker configuration. One disadvantage of crosstalk in loudspeaker listening is that comb filtering is introduced when sound from the left and right speakers meet at each ear and combine acoustically. One advantage of headphone listening is that we can

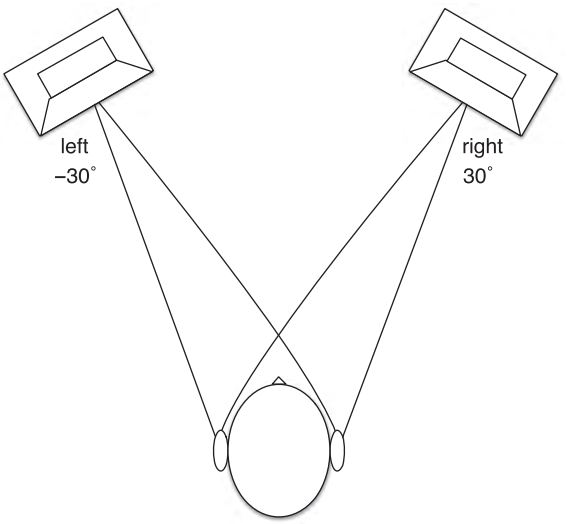

Figure 1.3 Stereo listening with crosstalk. Sound from the left speaker reaches the right ear and sound from the right speaker reaches the left ear.

separate our audio from reflected sound and room modes in our listening room that we hear when listening over loudspeakers.

Goodhertz makes an iOS mobile app called CanOpener (and digital audio workstation plug-in equivalent called CanOpener Studio) that can add crosstalk to headphone listening, to mimic the loudspeaker listening experience. The iOS version of CanOpener can also display listening levels (in dB SPL) during audio playback, for a number of headphone models. Hearing conservation is especially important for sound engineers, as we discuss in the next section, and the ability to keep track of our listening levels on our mobile devices is a welcome feature in a music player.

Headphone Recommendations

The number of headphones on the market has exploded in recent years due to portable music players. Many of them are perfectly suitable for technical ear training, but some are not. Because few retail stores stock high-quality headphones where we can just walk in and listen to them, I have included some suggestions at varying price points below.

Before purchasing headphones, try to listen to as many different models as possible. Use familiar recordings, ideally in linear PCM or lossless format (such as Apple Lossless or FLAC) rather than MP3 or AAC, to audition headphones for their strengths and weaknesses.

Here are some qualities to consider when comparing headphones:

- Stereo width—Do different headphone models present the left-right spread differently? Are some wider or narrower than others?
- Center image—Sounds panned center, such as a vocal, should be tight and focused in the center. If the center image on one headphone model is wide or blurry, it may indicate mismatched drivers.
- Frequency response—Do all frequencies seem to be equally represented? Or does it sound muddy, bright, hollow, edgy, dark?
- Detail—Is one headphone model providing more high-frequency clarity or detail in the reverberation?
- Low-frequency extension—Are you hearing the lowest fundamental frequencies from the bass or kick drum?
- High-frequency extension—Are you hearing the highest overtones, such as from cymbals?

By comparing the sound of different headphones using music recordings that are familiar to us, we can get a better sense of the strengths and weaknesses of each model. There is no perfect headphone, and each model will have a slightly different sound.

Here are some suggestions of headphone models to consider, and the list includes two types of fit: *circumaural* (surrounding the outer ear) and *supra-aural* (resting on the outer ear), and three types of enclosure or back: open, semi-open, and closed.

- AKG K240 (circumaural, semi-open back): This model has been a popular studio-monitoring headphone for many years.
- AKG K701 (circumaural, open back): A step up from the K240 in accuracy but with a similar sonic signature.
- Audio-Technica ATH-M50x (circumaural, closed back): A popular studio-monitoring headphone, recently updated from the ATH-M50.
- Beyerdynamic DT770 Pro (circumaural, closed back): A closed-back design with a comfortable circumaural fit.

- Grado (supra-aural, open back): There are a number of models in the Grado headphone line and all are supra-aural designs, meaning that they rest right on the ear, as opposed to being circumaural, which surround the ear. Grado headphones are an excellent value for the money, especially for the lower-end models, but they are not the most comfortable headphones available.
- Sennheiser HD 600, HD 650, and HD 800 (circumaural, open back): These models tend toward the high end of the price range for headphones but the HD 650 in particular has been lauded by recording engineers and critics for its accurate, warm, and refined sound. They are also circumaural in design and very comfortable to wear.
- Sony MDR 7506 (circumaural, closed back): An industry standard for monitoring by musicians while recording.

Open headphones do not block outside sound and thus might not be appropriate for listening in environments where there is significant background noise. Open headphones are usually a little more accurate than closed-back headphones for detailed listening and mixing, especially in a quiet environment. Closed-back headphones are usually better for musicians who are recording because less of the sound from the headphone spills into the microphones.

My personal favorite headphone is the Sennheiser HD 650. They are not inexpensive headphones by any means, but I have occasionally seen them on sale for quite a bit less than the usual retail price. These headphones have allowed me to hear detail in recordings that I had not heard previously, presumably due to their even frequency response and low levels of distortion. They are also very comfortable. To get a similar level of detail from a pair of loudspeakers, we would have to spend significantly more money. For these reasons, they are my current pick for headphones.

Loudspeaker Recommendations

As with headphones, no two loudspeaker models will sound identical, mainly because of differences in their objective characteristics—frequency response, power response, distortion, crossover frequency, and so on. Manufacturers make compromises in the design of a loudspeaker due to the laws of physics and their price-point target. As such it is difficult to give specific loudspeaker recommendations, but we can talk about some loudspeaker characteristics.

In general, two-way active studio monitors designed for professional audio or home recording markets are probably going to be a better bet than passive loudspeakers designed for the consumer market. There are some excellent passive loudspeakers, but from my experience, active loudspeakers are going to offer a better value for sound quality at a given price. For one thing, active monitors, by definition, have active (or powered) crossover filters with a power amp for each loudspeaker driver (i.e., woofer, tweeter). As such, each power amp can be optimized for its respective driver. Furthermore, in active loudspeakers, distortion can be reduced and the frequency and phase response of the crossover filters can be controlled better. These features result in better sound quality. Also, passive crossover filters can absorb up to 20% of an amplifier's output. Passive consumer-market speakers often have beautiful wood finishes that contribute to a higher cost, and while they may be aesthetically pleasing for our eyes (natural wood grain finish certainly is beautiful), a wood exterior does nothing to improve the sound quality over a basic matte black finish that we find in most studio monitors aimed at the professional audio market. Most loudspeaker cabinets are constructed with medium density fiberboard (MDF) and then, if there is a wood finish, the wood layer is attached to the MDF.

To improve the low-frequency extension of smaller studio monitors, manufacturers usually design them with a ported cabinet (also known as bass reflex), which simply means that there is an opening (or port) in the cabinet. A port allows the cabinet to resonate like a Helmholtz resonator and acoustically amplify some low frequency, usually at or below the cutoff frequency of the loudspeaker without a port. (The most common example of a Helmholtz resonator is created when we blow across the top of an empty bottle and produce a tone whose frequency is dependent on the air volume of the bottle, the bottle's neck length, and the diameter of the neck opening.) The advantage is that we get more low end from small speakers with small woofers. The disadvantage is that the low end might not be as controlled as we need. In other words, the resonant frequency of the port might ring slightly longer than other frequencies, causing muddiness in the low end. Most studio monitors available are ported, and they can perform very well but some have issues in the low end.

Some loudspeakers have sealed cabinets (instead of ported), and this helps avoid low frequency resonance that we get with a port. One trade-off with some sealed cabinets is less low-end extension. Two of the classic studio monitors pictured sitting on console meter bridges in recording studios, Yamaha NS-10 and Auratone, are designed with sealed cabinets. The NS-10 is no longer made, but Auratone has begun manufacturing their one-way (single driver) sealed cabinet again, and other companies such as Avantone also offer similar loudspeakers as the original Auratone. Neumann offers a sealed cabinet in their excellent KH 310 studio monitor.

In general, of the loudspeakers I have heard, I tend to prefer active studio monitors from companies such as ATC, Dynaudio, Focal, Genelec, Meyer Sound, and Neumann.

Surround: Multichannel Sound Reproduction

More than two channels of audio reproduced over loudspeakers is known as multichannel, surround, ambisonic, or more specific notations indicating numbers of channels, such as 5.1, 7.1, 9.1, 22.2, 3/2 channel, and quadraphonic. Surround audio for music-only applications has had limited popularity among listeners despite enthusiasm among recording engineers and is still not as popular as stereo reproduction. On the other hand, surround soundtracks for film and television are common in cinemas and are becoming more common in home systems. There are many suggestions and philosophies on the exact number and layout of loudspeakers for surround reproduction systems, but the most widely accepted configuration among audio researchers is from the International Telecommunications Union (ITU), which recommends a five-channel loudspeaker layout as shown in Figure 1.4. Users of the ITU-recommended configuration generally also make use of an optional subwoofer or low-frequency effects (LFE) channel known as the ".1" channel (pronounced "point one"), which reproduces only low frequencies, typically below 120 Hz.

With multichannel sound systems, there is much more freedom for sound source placement within the 360° horizontal plane than is possible with stereo. There are also more possibilities for convincing simulation of immersion within a virtual acoustic space. Feeding the appropriate signals to the appropriate channels can create a realistic sense of spaciousness and envelopment. As Bradley and Soulodre (1995) have demonstrated, listener envelopment (LEV) in a concert hall, a component of spatial impression, is primarily dependent on having strong lateral reflections arriving at the listener 80 ms or more after the direct sound.

There are also some challenges with respect to sound localization for certain areas within a multichannel listening area. Panning sources to either side (between 30° and 110°) produces sound images that are unstable and difficult to accurately localize. On the other hand, the presence of a center channel allows sounds to be locked into the center of the

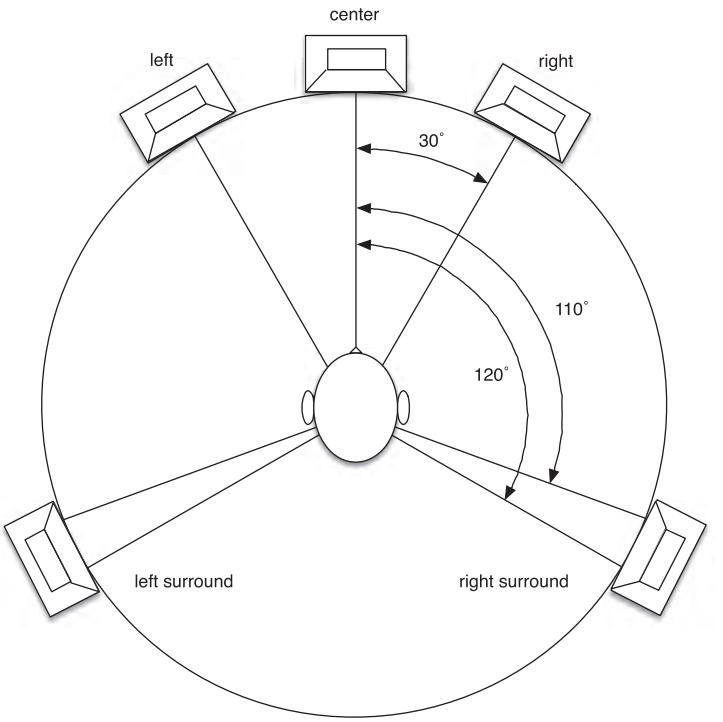

Figure 1.4 Ideal five-channel surround listening placement according to the ITU-R BS.775-1 recommendations (ITU-R, 1994), with the listener equidistant from all five loudspeakers.

front sound image, no matter where a listener is located, which is a possible strength over two-channel stereo. You may have noticed that the perceived location of sound sources panned to the center in a two-channel stereo setup tend to move when we move. If we sit to the left of the ideal listening location with stereo loudspeakers, sounds that are panned to the center will sound like they are coming from the left side, and vice versa for the right side.

Audio Ear Training Exercise

No matter if you are a producer, head engineer, loudspeaker designer, or assistant engineer, you should listen actively when you are involved in any audio project. Practice thinking about and listening for these items on each audio project:

- Timbre: Evaluate the tonal balance of each instrument, voice, or sound, as well as the overall mix. Do any tracks need to be equalized? Are the microphones in the right place for a given application? Is there any proximity effect (low frequency boost) from close microphone placement? Think about general tonal balances first—low-, mid-, high-frequency bands—and then try to get more specific.
- Dynamics: Are sound levels varying too much, or not enough? Can each sound source be heard throughout the piece? Are there any moments when a sound source gets lost or masked by other sounds? Is there any sound source that is overpowering others?

- Overall balance: Does the balance of musical instruments and other sound sources make sense for the music? Or is there too much of one component and not enough of another?
- Distortion/clipping: Is any signal level too high, causing distortion?
- Extraneous noise: Is there a buzz or hum from a bad cable or ground problem? Are there other distracting noises, unrelated to the recording?
- Space: Is the reverb/delay/echo right for the music, or for film/video and game projects, does it suit the visual component?
- Panning: How is the left/right balance of the mix coming out of the loudspeakers? Is it too narrow or too wide? Is it balanced from left to right?

1.5 Sound Levels and Hearing Conservation

Since this is a book about ear training, we must address the topic of hearing conservation. Protecting your hearing is essential not only for your career but also your quality of life. Noise-induced hearing loss—which can result from not only loud noise but also loud music—and associated disorders of tinnitus and hyperacusis are irreversible. Tinnitus refers to "ringing in the ears" when no other sound is present. Tinnitus can sound like hissing, roaring, pulsing, whooshing, chirping, whistling, or clicking.[1] Hyperacusis is a condition that causes a person to be unable to tolerate everyday noise levels without discomfort or pain.[2] Hearing loss, tinnitus, and hyperacusis not only make it difficult or impossible to work in audio, but they also make everyday life more difficult and unpleasant. If you haven't experienced any of these disorders, you may know someone who has, or you may have heard about musicians who suffer from severe hearing loss and now advocate for hearing conservation.

Loud sounds can damage hearing permanently, but how loud do these sounds need to be to cause damage? Governmental agencies around the world have guidelines for noise exposure in working environments, and these guidelines are useful for sound engineers as well. Although we may be working with music instead of noisy factory machines, the effect of high sound level music on our hearing is exactly the same as if it were noise. If it is too loud for too long, we risk damaging our hearing. In the United States, the National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit of 85 dBA for 8 hours per day, and uses a 3 dB time-intensity trade-off. NIOSH recommends standards and best practices based on scientific studies relating noise exposure to hearing loss. You may also be aware of the Occupational Safety and Health Administration (OSHA), which enforces safety and health legislation in the United States. OSHA has slightly less conservative noise level exposure standards, but the NIOSH values are more protective of hearing because they are more conservative. NIOSH recommends the following exposure limits:

- 82 dBA up to 16 hours a day
- 85 dBA up to 8 hours a day
- 88 dBA up to 4 hours a day
- 91 dBA up to 2 hours a day
- 94 dBA up to 1 hour a day
- 97 dBA up to 30 minutes a day
- 100 dBA up to 15 minutes a day

If we follow the recommendations up to higher levels, such as 115 dBA, the recommendation time limit is 28 seconds per day.

How do we find out the sound level of our environment? There are some simple and inexpensive options. Get a basic sound level meter or install a sound level meter app on your smartphone. Smartphone sound level meter apps vary in quality, but there are great options for iOS devices: SPLnFFT Noise Meter (by Fabien Lefebvre), SoundMeter (by Faber Acoustical, LLC), and SPL Meter and SPL Pro (by Andrew Smith). My favorite is the SPLnFFT Noise Meter app because the user interface is clear and easy to read, it has different metering options (VU, FFT, histogram), and it includes a dosimeter that automatically displays your noise exposure averaged over a range of time. The CanOpener app mentioned earlier also includes a dosimeter so that you can manage your noise exposure over time when listening to music on your mobile device over headphones. Stand-alone sound level dosimeter devices are also available that simply clip to your clothing and are useful for more accurate noise level exposure measurements. Smartphone apps are usually calibrated to use the built-in smartphone microphone, and although they may not be precise enough for industrial measurements, they are good enough for estimating your noise exposure. Sound level meters used for industrial noise measurements can cost thousands of dollars and are calibrated to be highly accurate.

If you know or suspect that you are exposing yourself to high levels of sound that could damage your hearing, wear hearing protection. There are a number of hearing protection options available, and I have listed the main types below:

- Foam earplugs—Basic foam earplugs are cheap and effective when placed in the ear canals, often giving 15–30 dB of attenuation.
- Earmuffs and ear defenders—These models fit over the ear like headphones and are highly effective for attenuating 15–30 dB. Both foam earplugs and earmuffs are a great option when you are in a noisy environment or you are working with loud machinery. Concerts are less enjoyable with foam earplugs or earmuffs because of the excessive high-frequency attenuation relative to low frequencies, making us less likely to use them.
- High-fidelity earplugs—There are mid-price level earplugs, such as Etymotic Research's High-Fidelity Earplugs, that attenuate about 20 dB fairly evenly across the audio spectrum. Because these earplugs reduce sound levels evenly and do not sound muffled, we are more likely to use them and therefore protect our hearing.
- Custom earplugs—Sometimes called musicians' earplugs, custom-molded earplugs are a more expensive but better-sounding option. An audiologist takes a mold of each ear canal and earplugs are made from the molds. These custom earplugs are the most enjoyable to use because they make everything sound quieter, fairly evenly across the spectrum. Companies such as Etymotic Research, Sensaphonics, and Westone offer custom-molded musicians' earplugs.

You should not rely on ordinary cotton balls or tissue paper wads stuffed in your ear canals. They are not effective for hearing protection because they only give about 7 dB of attenuation.

As the American Speech-Language-Hearing Association (ASHA) website says: "Don't be fooled by thinking your ears are 'tough' or that you have the ability to 'tune it out'! Noise-induced hearing loss is usually gradual and painless but, unfortunately, permanent. Once destroyed, the hearing nerve and its sensory nerve cells do not repair."[3] If your ears are ringing after attending a concert, you may have suffered some amount of permanent damage to the hair cells in your inner ear. If you have concerns about your hearing, or just want to find out how your ears measure up, make an appointment with an audiologist and get your hearing tested.

My underlying recommendation for hearing conservation is this: be aware of sound levels in your environment, take measures to turn down listening levels if they are too high, and use hearing protection when you are exposed to loud music or noise.

Summary

In this chapter we have explored active listening and its importance in recording projects as well as everyday life. By defining technical ear training, we also identified some goals toward which we will work in the book and software practice modules. We finished by giving a rough overview of the main sound reproduction systems and principles of hearing conservation. In the next chapter we will move on to more specific ideas and exercises focused on equalization.

Notes

1. www.asha.org/public/hearing/Tinnitus/
2. http://hyperacusisresearch.org/
3. www.asha.org/public/hearing/Noise/

The Roles of the Recordist and the Aesthetics of Recording Production

This chapter will establish some context for how the recording process shapes music. Here we will examine the roles of the recordist in creating the recording and its art, and explore some basic concerns of the aesthetics of recording production.

The Functional Roles of the Recordist

The recordist can have many roles in making a recording. There are many steps and phases in recording projects, and the recordist may be involved in any one of those phases, some of the phases, or in all. Many recordists specialize; for instance, one person's work may be dedicated to only mastering, and another may specialize in tracking, but will mix if the project requires it. Some recordists become producers and engage projects from the spark of the idea, nurturing them all the way to release—and perhaps beyond. Today's recordist will often carry the combined roles of audio engineer and producer, sometimes equally and at times weighted in one role over the other.

The recordist may have their role change as the project progresses. It is common for one person to cover many tasks, and it is also common to hand off a task to another recordist at mid-project. Flexibility in being able to cover various roles is invaluable—as is keeping careful documentation of the project, so handing it off to another can be relatively seamless and as efficient as possible.

Recordists do not work in a vacuum. The recordist will directly interact with performers during some phases and not on others. There is very significant interaction in tracking sessions, or direct-to-two-track sessions. Working directly with artists in preproduction is common, and highly desirable preceding tracking sessions.

All artists are rarely present for entire mixing sessions; the presence of lead artists, producers, or other interested parties varies with the project. Often the mix engineer will have some significant interaction with artists and/or the producer during the process of making mix decisions, and also work a significant amount of time alone.

Mastering is often largely solitary. Interaction with clients may often not include direct contact with artists. No matter the extent, how the recordist interacts with clients and artists impacts the project and/or the performance that creates the project.

Facilitating the Creation of Music

Among the recordist's most significant functions is to create a work environment where the magic of making art can happen. No matter what phase of the project, the recordist usually sets the tone for recording projects and can control many things, including a project's pace and how people interact. The recordist is usually largely responsible for guiding recording projects, whether or not the others involved acknowledge this or are even aware of it. Recordists are often responsible for keeping the creative process moving effectively, efficiently, and invisibly, giving guidance to the artists or giving them enough space and support so they are free to be creative.

It has often been said that the recordist should first be a psychologist. While this statement may be somewhat extreme, the recordist needs to be sensitive to interpersonal relations. How they work with performers and others will shape the project as much as their actual recording duties. And sometimes they may be needed to facilitate in helping people get along, working together productively.

The ways people normally treat one another in everyday living, and especially in standard business environments, are often nonproductive (at best) in the recording studio. Recordists should consider how they speak with the artists about the project, and how they interact with the artists socially and during the creative processes. The type of image the recordist presents to the artist will influence the artist's comfort level and ability to trust them as they work together. The recordist will typically strive to keep artists relaxed in the studio environment and focused on the project.

Recordists strive to get creative people to do their best work, while attempting to perform their own tasks at the highest standard. The process of creating art (a music recording) is an emotional roller coaster of ecstasy of what has just been discovered and anguish over not having an equally brilliant idea for "what comes next?" Time and financial constraints further stress artists (clients).

Musicians/creative people are exposed and vulnerable in the recording process. The recordist must be certain to do nothing, and not to allow anything to happen within the session environment, or by anyone else, to make artists feel exposed, unprotected, or, worse, threatened. Musicians must have the freedom to be creative around the recording studio, without feeling that their every move is watched or evaluated. Allow artists to fail privately, even if you witness the off performance, mistake, or idea that didn't "work." At times they will need to feel they are alone. At times they may need to feel they are in their own home rehearsal space, or some other "safe" location. The recordist should be sensitive to the need of the performer to feel they belong in the recording space, and are in a risk-free environment where they can take chances and know there is a safety net (aka, the delete key).

The expressive nature of performing music will often involve taking chances, stretching performance abilities to their limits or beyond, and making mistakes. These necessary activities can potentially embarrass confident (let alone less than confident) performers if they are critically judged at this vulnerable time. Performers need to be confident to perform well. The recordist is attempting to get the performers to exceed the height of their ability. Nothing should be allowed to happen that would diminish the confidence level of the performers and to take away from the trust that the performers must have in the recordist.

While evaluations have an important place in the recording process, judgments—especially those of a negative nature—rarely can be used constructively and are often destructive to the process.

The Roles of the Recordist in the Phases of the Project

There are distinct phases to the recording project, and the recordist has a different function in each of those phases. Exactly what the role will be varies by project, and the needs and wishes of the artists, producer, and others involved. The four primary phases of a typical recording project are: preproduction, tracking, mixing, and mastering.

Preproduction is about planning the project, and making certain the project is ready to move forward in a productive, effective, and efficient way. It includes getting to know the artists and their material. The material may be complete and rehearsed, or in need of adjustments; the album

may be ready, or at any stage of completion. Preproduction brings clarity to the artist's core concept of the project, with the recordist providing detail and a roadmap to realize it. A preproduction demo of a song or two can be useful to bring focus to the project.

This roadmap is a plan from this beginning stage through completion. Not only will it involve the goals, approach, and sound qualities of the finished project, it also involves money, budgeting, and making estimates. Financials will impact many decisions.

A host of logistics bridge preproduction and tracking: timeline for the project, schedules of performers and studios; selecting a tracking studio, selecting a mix studio, and deciding on a mix engineer; determining the content and orderings of sessions and how they will be run; session protocol; and so much more. All logistics relate back to what will best serve the core concept of the project, efficient and effective workflow, and keep people on track and maintain even temperaments. Notice: The recordist has yet to actually start recording.

Tracking is recording. The recordist records the music at this stage. The sound qualities of the final recording, and many of the relationships of those sounds, are impacted by the decisions made here; some of these decisions will not be able to be changed in the future. The plan established in preproduction, of what parts get recorded when and how, is executed in the studio. Any number of approaches can take place here, as parts/performers can be tracked separately or in groups, as complete songs are eventually compiled. This process can be quite involved, as parts are repeated, performances evaluated and repeated, then combined, and so much more.

After the tracks are recorded, the project is sent off for mixing. Before the project is ready to go on, tracks must be prepared for mixing. Tracks should be completely finished before delivery to the mix engineer. The project should no longer need editing, arranging, tuning, etc. Notes about effects and processing to be added and documentation of the contents and specifications of the tracks must also be complete.

The mix is what likely brought you here, to buy this book. The mix engineer selectively combines the elements recorded in tracking to shape much of the sound of the final recording. The mix brings all of the artistic elements into play and balanced according to the needs of the project and to complement the music. This balance can be dynamics, as is readily apparent; it will also be balancing the sound stage in lateral and distance imaging, placing sounds for pitch density and sound qualities, and giving space to the recording. The mix is where the sound qualities of the recording are crafted and the recording receives its performance.

The recordist as mastering engineer is responsible for catching any problems with the project, the result of tracking or mixing. Those problems that can be fixed are, and all of the songs or parts of the project are combined into a single recording. The mastering engineer also gives overall shape to the project, and can fine tune individual songs. Often working in exacting ways but in broad strokes, the mastering engineer subtly tweaks gain, compression, and equalization to craft the overall character of the recording. Mastering is the last step of the project, and completes it.

The dimensions of these phases will be further explored, and woven throughout the remaining chapters.

The Artistic Roles of the Recordist

The recordist must have a clear idea of their role in the creative process for each project. The project may include the composer of the music, one or many performers, a conductor of an ensemble, and/or a specific recording producer. The recordist will need to identify what is expected of them toward the final artistic product, as well as the roles, contributions, and responsibilities of the others involved.

Of the many possibilities, the recordist may be functioning to capture the music as closely dictated by the composer. They may be functioning to capture, as realistically as possible, the performance of an ensemble, as precisely directed by the conductor; they may be functioning to capture the interactions and individual nuances of a group of performers, without altering the performance through the recording process; or the recordist may be functioning to precisely execute a recording producer's instructions (often in ways that transform performances). In all of these cases and many others, the recordist is allowing the artistic vision and decisions of others to be most accurately represented in the recording. The recordist's role then is to facilitate and realize the artistic ideas of others, and not to directly impose their ideas onto the project.

The recordist's role sometimes might be to offer suggestions to the creative artists or even to take an active role in the artistic decision-making processes. The role of the recordist might be active in shaping a performance of an existing work, or in creating a new piece of music. The recordist might be active in determining the sound qualities of the instruments of the recording, or in determining the sound sources themselves. Vastly different levels of participation in the artistic process are often required from one project to the next.

Among the things that are consistent, is that the recordist must be mindful of their place in the process. Their contributions may be needed, but are often not sought. Their ideas may be helpful, but might get in

the way of the artist's creativity. Even when the recordist is asked what they think, the client may not really want to know. It is a delicate dance.

The process of writing a piece of music for a recording is often a collaborative effort, and this process can become even more complicated. Such songwriting may take place with many people (composer, performers, producer) or just a few (performer/composer and recordist/composer). When it takes place in the studio it can be a laborious process that seems never-ending, and is sometimes incredibly gratifying and exciting. The need for creativity is always present, but the spark can be illusive.

In many ways, the recordist functions as a creative artist and can serve the traditional roles of a composer, a conductor, and/or a performer. The recordist also shapes sounds in nontraditional ways. Recordists have unique controls over sound and live performances that allow for an additional musical voice. It is possible to compose with the equipment (instruments) of the recording studio, to shape sounds or performances through the use of recording and mixing techniques, or to create a new musical environment for someone else's musical ideas and performances.

The recording studio can be thought of as a musical instrument or a collection of musical instruments. In this way, the recordist may conduct all of the available sound sources (for example, bringing sounds into and out of the musical texture through mixing); may "perform" the musical ideas through the recording process; may alter or reshape the sounds of the sources, or "interpret" the musical ideas, in ways that are not possible acoustically; and may create (compose) new musical ideas or sounds.

The Recording and Reality: Shaping the Recording Aesthetic

The recordist has many potential roles in shaping the recording aesthetic. The role of the recordist might be to capture a live event as accurately as possible in relation to the dimensions of that real-life experience, or the recordist might seek to alter the artistic elements of sound to enhance the quality of that real-life experience. The recordist may even seek to create a new reality or set of conditions for the existence and relationships of sounds. Reality is simulated, enhanced, or created through the recording process.

The level of similarity between the recording and the live listening experience is central to the aesthetic quality of the recording.

A recording may differ from the live listening experience by (1) the use of the artistic elements of sound in ways that cannot happen in nature,

and (2) the presentation of impossible human performances and compilations of perfect performances. These may subtly enhance the impression of a live performance or sonically represent something that is outside the possibilities of physics and human performance, as potential extremes.

The aesthetic and artistic elements that most influence the life-like qualities of the recording are (1) environmental characteristics and the dimensions of the sound stage, and (2) the relationships of musical balance to the timbres of sound sources.

Sound Stage and Environments

All of our experiences of sound are with sound as it exists in space. We conceptualize sound, especially in the context of music performances, in relation to the spaces in which the sound is heard to exist. The recording process will provide the illusion of space for the music. With extreme realism, or very little, the recording will bring listeners to associate the recording with their reality. The recording will provide the illusion of a performance space or a physical environment for the performance—this is the perceived performance environment.

As we have learned, this perceived performance environment is an illusion of a space wherein the recording can be imagined as existing during its re-performance (playback). The realistic nature of the performance of the recording will play a central role in establishing the relationship of the recording to the live listening experience. The listener will subconsciously scan the recording to establish (1) environmental characteristics, (2) an imaginary stage (sound stage), and (3) a perceived performance environment. This information allows the listener to complete the process of establishing a reality (real or imagined) for the listening experience of the recorded music performance.

These three important characteristics need to be deliberately shaped or captured to precisely determine this aspect of the recording's aesthetic. If not directly engaged, the recording will likely appear deficient in some way, though perhaps subtly.

The imaginary environments will be either the captured reality of the original performance space, an altered or enhanced reality of the original performance space, or new spaces that are created or selected for the performance through signal processing or plug-ins.

In recordings that closely match a live performance, environments of individual sound sources are typically very similar, if they are different at all. If environmental cues differ markedly between instruments, a sense of a live performance can be maintained if fusion of the source and its environment is complete, and there is an impression that they

are one sound quality. Generally, having different environments for different sources will gradually pull the recording out of a "live" experience and into a "created" one, as the number increases or as they become more pronounced.

A live recording will have realistic relationships of sound-source images. Sources will be positioned laterally as if they are in a performance situation, on stage. Image widths will be proportional to one another. Distances will be very similar, with some sources located only slightly in front or behind others. As a recording deviates further from these relationships it will become increasingly "unreal."

Listen

to tracks 52 and 53, then 50 and 51

for the sound-stage dimensions of one mix that simulates the relationships of a live sound stage and a second mix of the same musical balance that significantly alters the sound stage to unnatural proportions and relationships. Finally compare those mixes to two stereo microphone techniques.

The perceived performance environment plays a large role in determining the overall sound quality of the recording, and its illusion/reproduction of the size of the "space" of the recording. The listener's position in relation to the sound stage (the stage-to-listener distance) plays a critical role in the impression of witnessing a live performance. A live listening experience results when the listeners find themself clearly located at a specific location within a clearly perceived overall environment. As recordings move from these relationships, the experience becomes less and less like a live concert.

Musical Balance and Sound Quality

The interrelationships of musical balance and performance intensity are integral parts of live performances, and are easily altered by the recording process.

Recordings that attempt to capture the aesthetics of the live performance will seek to capture the musical balance of the performers as they (or the conductor) intended. The changes in the sound quality of the instruments will be precisely aligned with changes of dynamic levels in the musical balance of the ensemble and to changes in musical expression. It is important to maintain these relationships to keep the character of the live performance.

Recordings that seek to enhance the characteristics of the live performance may contain slight changes in musical balance that were not the result of the performers, but instead are the result of the recording or mixing process. These alterations will be heard as changes in dynamic levels that are not supported by changes in the sound qualities of the

instrument(s). This enhancement might take place in only a few instruments, or it may be used extensively throughout the entire ensemble. This enhancement technique may be quite subtle and difficult to detect, or it may be prominent. A soloist with an orchestra is a common example of when this might occur. These enhance the performance by making it "less live."

Alterations in dynamic levels, and thus musical balance, that are not aligned with changes in performance intensities have become integral parts of music written for recordings. Multitrack mixes frequently exhibit changes in musical balance that were not caused by the performers. These changes in dynamic level, then, are inconsistent with the sound qualities of the instruments in the final recording.

Listen

to tracks 37 and 38

for the sound quality of the performance intensity of the instruments when they were recorded and how these coincide with the dynamics in the two mixes.

The relationship between the musical balance and the timbre of sound sources in many multitrack recordings creates a wealth of contradictions between reality and what is heard. The aesthetics of this type of recording leans toward redefining reality with each new project and is a stark contrast to the aesthetic of trying to capture the reality of the live performance.

The recordist's approach to any project should include a conscious decision on a level of realism. How will the final sound relate to real-life experiences, and how will the characteristics of sound be shaped? What is the listener intended to believe, and how can this be achieved?

The Recording Aesthetic in Relation to the Performance Event

As we know, the recording process will shape music performances in such a way that the sound qualities and relationships of live performances may be altered. How the process alters the live listening experience is central to the aesthetics of the recording.

Production Transparent Recordings

The recording medium is often called upon to be transparent. In these contexts, it is the function of the recording to capture the sound as accurately as possible, to capture the live performance without alteration. This type of aesthetic is common for archival recordings that function to document events. These *production transparent recordings* may or may not be sensitive to the performance environment. At times, these recordings attempt to capture the sound of the music performance

without considering the artistic dimension of the relationship of the music (and musicians) and the performance space (and audience). In other instances, these recordings seek to negate any influence of the performance space on the sound of the recording.

Because these are recordings of live performances, the recordist is not involved with compiling the performance. The performance takes place in real time, and it will not be possible to back up and fix a certain section or idea. The recordist is primarily concerned with the technical aspects of the sound of the recording (critical listening) and the sound qualities of the overall program (at the highest level of perspective).

A limited number of microphones are often used in making this type of recording. Usually two microphones are used in some appropriate stereo-microphone technique, placed fairly close to the ensemble. The microphones generally are sent directly to a two-track (or surround) master, with little or no signal processing. The recordist will exercise little real-time control over the quality of the sound and over the shaping of the performance.

The recording medium can also be transparent in documenting a performance, while placing the music in a complementary relationship with the host environment of the performance. Specific pieces of music are best suited to certain environments and are most effectively perceived from certain listening distances. The artistic message of a specific piece of music will be most effectively communicated in a certain environment and with the listener at an ideal distance from the ensemble.

Spatially Enhanced Production Transparent Recordings

Spatially enhanced production transparent recordings can ensure pieces of music will be perceived as having been performed in an ideal environment, with the listener located at an ideal distance from the ensemble, when listening to the recording. This approach locates the listener at the *ideal seat*, and can be accomplished without altering the performance itself and maintaining transparency of the recording process.

The recordist (often with input from a conductor or producer) will determine the type and amount of influence the acoustic performance environment will have on the final recording. Microphone selection, choice of stereo microphone array, and array placement within the performance environment are the primary determinants of the environment sound that is captured from the performance environment. Artificial reverberation units or other time processors may sensitively enhance the characteristics of the environment. The distance of the listener from the ensemble is determined primarily through microphone placement and through time processing.

This recording aesthetic attempts to present the music in the most suitable setting possible for that particular work and to simulate the listening experience in the concert hall. This recordist seeks to ensure that the sounds will be in the same spatial relationships as the live performance, that the recording process will not alter the balance of the musical parts, and that the quality of each sound source will be captured in a consistent manner. In these *live acoustic recordings*, the recording may seek to reproduce the sound of the performance space—surround-sound recordings can be used for great realism in this approach.

Listen

to tracks 50, 48, and 49

for a stereo microphone technique that does little to alter the character and sound qualities/relationships of the performance, a mix that establishes sounds at unnatural relationships, and a mix that adds a stereo microphone technique to the unnatural relationships in the mix of track 48.

This aesthetic can have the recordist more involved with the decision-making process in some projects than in others. This aesthetic may be used for many types of music, and may be used for live concert recording as well as session recording. While it is common in orchestral and other art music formats, it is equally appropriate for jazz or any other music recordings where the performers are refined in their sensitivity to and control of their relationships to the whole ensemble. In session recordings, some (or much) editing may be a part of this aesthetic. A consistency of sound quality and spatial relationships between all portions of the work will nearly always be sought; this is a stark contrast to many multitrack productions.

Enhanced Performances

The recording medium may *enhance the performance* in widely varying degrees. This aesthetic might appear as a slight extension of the concept of a transparent live recording, with the recording process slightly enhancing certain musical ideas. In contrast, this aesthetic may set another extreme of being a life-like session recording that was recorded out of real time.

This aesthetic simulates a natural listening experience, by capturing or creating many of the inherent characteristics of a live, unaltered performance. The timbre and dynamic relationships, spatial cues, and editing techniques all serve to create the impression that the recording did indeed take place within reality—as an actual, live performance.

When this aesthetic is an extension of the concept of a transparent live recording, sounds are placed in the sound stage in the same relative positions as the instruments were in during the recording. The width

and depth of the sound stage and image sizes are realistic, and the recording will usually have a single environmental characteristic applied to the overall program (a single soloist might be present with a slightly different environment). Dynamic changes are nearly always aligned with timbre (performance intensity) changes, though some microphone highlighting might create a limited number of dynamic changes without timbre changes. The recording process is used to slightly enhance certain musical ideas from the live performance.

This aesthetic may be used for controlled live performances (those that have been rehearsed with the recordist) or in recording sessions, for a wide variety of musical styles. Minimal miking will usually be used, often an overall stereo array with a small number of accent microphones (or stereo pairs). Accent microphones allow this aesthetic to be adaptable to stage recordings of large classical ensembles or for musical theater and opera. The recording is usually mixed directly to a two-track (or surround), with mixing decisions taking place during the rehearsals or during the recording session(s). Recording submixes or submixing related parts of the mix to a few channels as stems to a multitrack recorder or DAW is also common, but many of the decisions related to the sound of the recording are still accomplished during the recording session or rehearsals.

Recording sessions will often be composed of many takes of large and small sections of the work. As the ensemble balance is largely controlled by the performers, and the parts are not singled out (making re-recording of individual parts unavailable), ensemble problems of accuracy and sound quality often create a lengthy recording session and a large set of session takes.

The master ends up being a collection of takes, numbering from just a few to a great many. The editing of these takes becomes an integral part of the recording process. The best takes are selected based on musical and technical qualities. These are then edited together (cut and paste) to compile a *perfect performance* of the work. The master or final version represents the final performance. The goal of this approach is usually to craft the best possible (perfect) performance, interpretation, and presentation of the music.

The aesthetic of slightly enhancing the reality of the performance may also be found in session recordings that simulate natural sound relationships. Although recorded out of real time, the recordings will seek to simulate the experience of live music. Some emphasis of certain musical materials (and/or artistic elements) over others will be unavoidable in the recording process and will diminish the naturalness of the relationships of the sounds. Some recordings may simulate reality only generally, but still have a goal of providing the illusion of a naturally

occurring performance—even with complete control of the multitrack recording (miking, processing, and mixing) process.

Created Performances

Music written for the recording medium may have qualities that are significantly different from live acoustic music. It may be constructed in different ways, and it may contain additional artistic elements. Music written to be recorded, and especially music written during or through the recording process, is often composed and/or performed in layers—its performances created by compiling separately played parts.

The musical materials are often written and recorded one part at a time, or a small group of parts at a time. The recordings use close miking techniques that ensure a separation of parts (and thus allow for precise control of the individual sound source) or will physically isolate the performers/performances from one another. The parts are continuously compiled on separate tracks, with each new musical line added to the musical texture. Players often perform their parts many times; any number of versions may be recorded before the desired result is achieved. The recordist (sometimes with the aid of a producer) may be responsible for listening for performance mistakes, listening for the most interesting and successful performance, keeping track of which portion of which musical part was performed most accurately, on which take, etc., in addition to maintaining impeccable sound quality.

The final piece may be a composite of any number of performances, and it may be a controlled integration of many different musical ideas and personalities. The performances may or may not have taken place at the same studio, or during the same day (or year), and the performers may or may not have met and discussed their musical intentions.

The recording medium can create the illusion of a performance that contains characteristics that cannot exist naturally. This aesthetic has become common since the early/mid-1960s. In this "new" aesthetic, the recording medium's unique sound qualities and creative potential are used. It becomes a musical ensemble with its own set of resources for shaping a performance or creating a musical composition.

Music written to be recorded may exploit environmental characteristics, musical balance and sound-quality contradictions, sound-stage depth and width, sound-source imaging, or its other unique elements to create, define, or enhance its musical materials.

This aesthetic might purposefully create relationships that cannot exist in nature—a whisper of a vocalist might be significantly louder than a cymbal crash. This aesthetic will use the unique qualities of recorded sound in the communication of the work's musical message.

Recordings of this aesthetic might seek to create a new reality for each work or project. Unique relationships of sound are calculated and incorporated into the music. Recordists (engineers and producers) develop personal styles of the ways they shape aspects of balance, imaging, sound stage, and environment, while continuing to explore the expressive potentials of recording and the medium's relationships with reality.

Much of today's popular music falls within either the aesthetic described above or within the aesthetic of using the recording medium to enhance the illusion of a live performance. Many of the artistic considerations of the recording process are very apparent in these two aesthetics.

Altered Realities of Music Performance

The reality of the music performance event itself is also altered by the aesthetics of the recording production. The recording provides an illusion of a live performance, and the content and qualities of the perceived music performance may vary from a slight improvement of our listening realities, to being a live performance that exists in ways that are impossible in our known world.

Recording allows a music performance to be an object that can be precisely polished by the artists, that can exist as an almost indestructible physical object and held in one's hands, and that can be owned by any number of members of the general public.

The reality of a live music performance as an experience witnessed in a fleeting instant in time, and as retained only in the memories of those who experienced the event, is significantly altered by the existence of recordings. A recording is a permanent performance of the piece of music—one that can potentially live well beyond the artist's lifetime.

Additional pressures, ideals, and aesthetics are placed on the artists responsible for any individual recording, as opposed to a live performance. A recording may transform the live listening experience: (1) by creating humanly impossible performances, (2) by providing performance conditions that are inconsistent with reality, (3) by presenting error-free and precisely crafted performances, and (4) by providing a permanent record of a music performance.

A recording is a *permanent performance* of a piece of music. It is a period of time that has been created or captured, and that may be preserved forever. The performance can be revisited (and observed at any level of detail) at any time, and any number of times, and by anybody.

Recordings can often become *definitive performances* of a piece of music. The definitive performance may be thought of as being either that of a

certain artist or of the particular piece of music. An artist's performance/recording of a work might be what is widely accepted as the definitive performance (or reference) of how the work exists in its most suitable form, in relation to performance technique or to the communication of the musical message. A specific recording of a work can also serve as a definitive reference of how a work exists in its most suitable state, in relation to recording practice or to musical considerations.

Recordings not only are a means of creating an art form, they also preserve the artistic ideas of music performance and expression that do not rely on the recording process. Recordings may permanently preserve the music performances of an artist. They may provide historical documentation or archival functions by preserving the music performances of particular artists, ensembles, events, and more—even nature and its sonic landscapes.

The great contradiction of producing a recording that is a permanent record is that the recording often becomes dated. Artists develop and grow. Their musical abilities, levels of understanding, artistic sensibilities, and their musical ideas change. The permanent performance that was previously created (perhaps only a few weeks before) may no longer be representative of the artists' abilities or aesthetic opinions. It can be a snapshot of a point in time.

The recording will often represent the artist's and recordist's idea of a perfect performance of the work. Theoretically, a perfect performance of any piece of music can be produced through the recording process. The definition of the perfect performance may vary considerably between performers, but the concept of the recording itself will be similar. It will be a presentation of what the performers and producer believe to be the most appropriate interpretation of the piece of music, under the most appropriate performance conditions (instruments used, performance space, etc.).

A perfect performance will combine the artists' desired interpretation of the music (and an absence of performance inaccuracies) with an illusion of the drama of a live concert, experienced at the ideal listening location of an ideal performance environment for the ensemble and piece of music. Practical considerations of the recording process might compromise the actual quality of the recording, but the goal of the recording remains constant.

The recording may present musical ideas, containing sound qualities and relationships that are impossible to create in live performance. Musical materials may be presented in ways that are beyond the potentials of human execution. These might be rapid passages performed precisely and flawlessly, dynamics and sound-quality expressions that

change levels quickly and in contradictory ways, or the use of a single human voice to perform many different parts. These are only a few of the possibilities. Humanly impossible performance techniques and relationships are easily created in recording.

The reality of what is humanly possible in a music performance is often inconsistent with the music performance of the recording. The relationships of sound sources, the characteristics of sound sources, the interrelationships of musical ideas and artistic elements, and the perceived physical performance of the musical ideas may be such that they could not take place in nature. The music performance of the recording may be such that it could not be accomplished without recording techniques and technologies. It may be impossible to recreate the music or the performance live, on stage—a situation often cited as one of the reasons why The Beatles stopped touring.

Recordings have greatly influenced our expectations of live music performance. The listening audience of a recording becomes accustomed to a recording as being the perfect performance of a piece of music. The audience may learn the subtleties of a recording quite intimately.

A particular performance of a piece of music is created or captured in a music recording. When an audience member owns a copy of the recording, or when a recording has received much exposure through media, the audience may have heard a recording many, many times. For a great many audience members, the recording becomes the definitive performance of the music. The audience will carry this knowledge of the music recording into a live music concert, and may impose unrealistic expectations onto the performers and the event.

Differences between the live performance and the known recording of a piece of music can cause unfulfilled expectations for the audience. The artists' new and different interpretation of the music, the absence of certain sound qualities from recording production, the inconsistencies of human performance, or any number of other factors might create differences between the live performance and the known recording of a piece of music. A potential exists for audiences to become less involved with the drama and excitement of the live performance of music. Audiences may attend concerts to publicly hear live performers and the music performances they have come to know well as recordings, heard privately many times. Audience members do not always accept the reality that the live performance was not the same as the studio-produced recording. A potential exists for the audience member to be dissatisfied that the definitive performance they know well was not reproduced for them at the live event.

An audience may place unrealistic expectations on the performers. Performers may be expected to perform flawlessly, or with the same version and interpretation of the work as the recording they released. An audience may expect the performing artist to provide the role of reproducing one particular performance of the work. By reacting to this audience, the performer may be restricted from allowing their interpretation of the music to evolve and change according to their growing experience, and may be restricted from creating a more exciting performance. The subtleties of artistic expression that are possible only through the artist and audience interaction, along with other unique qualities of live music performance, may be lost from an event and diminish the musical experience.

It is unrealistic to expect to hear a precise reenactment of a recording in a live concert environment. Many music recordings have been produced in such a way that a live performance of all musical parts, sounds, and relationships is not practical or possible. These are potential negative outgrowths of the audience's familiarity with certain recordings and the new listening habits afforded by readily available music performances.

The general public hears much more recorded music than live music. They are often prone to judging live performances with the expectations of a perfect, recorded performance. Human inaccuracies are sometimes not easily tolerated, and new musical and expressive interpretations of a known piece of music may be heard as simply wrong. Further, people own their own personal copies of performances. A tendency to personalize or to become attached to those performances is common. When the performance is changed, something personal ("their music") has been altered.

Summary

The recording aesthetic is determined by the relationship of the recording to the live listening experience. The recording aesthetic is arrived at through a careful consideration of the musical material, the function of the recording (type of music recording, sound track, and advertisement), and the desired final character of the recording. The recordist's role is defined by their contributions (or lack thereof) to the process of making the creative decisions of the recording, whether making decisions or executing the ideas of others. This includes all phases of the production process: preproduction, tracking, mixing, and mastering.

The recordist's overall control of the many qualities of the final music recording is highly variable. The recordist is responsible for the overall characteristics of the recording and may be in control of (and responsible

for) its most minute details, depending on the recording techniques being used. The recordist might have precise control over shaping or creating a performance, or they may be engaged in capturing the global aspects of a live performance.

The amount and the types of control used in the recording process will determine the degree of influence the recordist has on the final content of the music recording. The recording medium may be used to greatly influence the sounds being captured by the microphones, or the recording medium may shape sound much more subtly. The recording process will be used differently, depending on the aesthetic of the particular project.

The aesthetics of recording production vary with the individual, with the musical material, and with the artistic message and objectives of a certain project.

An aesthetic position or approach may be appropriate for a certain context, or it may not. An approach might enhance the artist's conception of the music, or it may not. An approach may be consistent with other considerations of the project or the music, or it may not. Perhaps consistency is not desired.

The aesthetic approach to recording production creates a conceptual context of the artistic aspects of recording. The intangible aspects of the art can then be appreciated within this context. The recordist must clearly define the aesthetic position of the recording, in order to successfully control and shape it.

How these sounds of recordings shape musical ideas and musical expression will be explored next.

The Art of Production

In the past, almost all commercial music was recorded and mixed by a professional recording engineer under the supervision of a producer and/or artist. With the emergence of the project studio revolution and electronic music, the vast majority of production facilities have become much more personal and cost-effective in nature. Now, with the maturation of the digital revolution, MIDI and digital audio, workspaces are now being owned by individuals, small businesses and artists who are taking the time to become more experienced in the basic guidelines of creative and commercial music and audio production practices.

Within the music production industry, it's a well-known fact that most professionals have to earn their "ears" by logging countless hours behind the console. Although there's absolutely no substitute for this experience, the production abilities and ears of electronic musicians have naturally evolved as equipment quality, media education and overall technology get better and as musicians become more knowledgeable about proper mixing environments and techniques … usually by mixing their own compositions.

In this chapter, we'll be taking a common-sense, basic look into the audio production process (Figure 14.1). The goal here is to gain a better understanding of how the technology of the music studio environment combines with the everyday practice of getting the most out of your production environment, so as to understand the underlying concepts that go into making the process as smooth and professional as possible. In short, just because your studio sits on a desk in the corner of your bedroom, doesn't mean that you can't adopt a professional approach and attitude that can lead to drastically improved results.

One of the most important insights to be gained (beyond an understanding of the technology and tools of the trade) is the fact that there are no rules for the process of recording … it's an artform. This non-rule holds true insofar as inventiveness and freshness tend to play an essential role in keeping the creative process of making music alive and exciting.

Here, I'd also like to bring a basic axiom in audio production into the equation.

"Wherever you may be, there you are".

To me, this means that it's almost always a good idea to start off at the level where you are. If you're a beginner, I'd suggest that you don't dive in and buy everything in the store. I have met special people who have done their extensive research and have gone out to buy the best equipment, in order to get started with the best possible tools. I've found, however, that this approach isn't always the best for everyone to take. Quite often, it's a better idea to start out with an affordable piece of gear that's at your particular skillset level. This'll give you the time to figure out what might be the best production choice or piece of gear for your studio when the time comes to jump to the next level. Making mistakes and taking small steps is often a big part of the process of becoming a Jedi Master.

Speaking of, another part of becoming a Jedi Master is learning to be patient and gentle with yourself at first. When I sat down at my first console, I was totally lost:

- What are all these controls?
- How am I supposed to know what sounds good?
- Should I use EQ or not and, by the way, is this compressor working?
- How is this mix supposed to sound and how do I get started?

All of this is scary stuff, and we've all been there. As with getting to Carnegie Hall and mastering anything worthwhile, it takes practice and commitment … and the former comes with time.

Oh yeah, one last thing … I'm seeing a lot of YouTube videos all over the place telling you how to "Get the perfect bass sound" or whatever. These types of instructional tools are always good and have their place; however, I'd like to add in that art is in the ears (and mind) of the beholder. Learning from others and then using those tools and techniques to develop your own style is also what the "Hokey-Pokey" is all about. Go ahead and YouTube this old song … it's rather fun!

FIGURE 14.1
Workin' it in the basement. (Courtesy of Ableton AG, www.ableton.com.)

THE ART OF PREPARATION

Whenever a producer is asked about the importance of preparation, more often than not they'll most likely place preparation at or near the top of the list for capturing a project's sound, feel and performance. Having a plan (both musically and technically) to get the job done in a timely fashion, with the highest degree of artistic motivation and technical preparedness will definitely help get the project off to a good start. Details like making sure that the instruments are tuned, the cables work and that the DAW is sorted out are important to take care of *before* the red light goes on. Making sure that the musicians are well-practiced, relaxed and rested doesn't hurt either … and don't forget to have water, fruit and food on hand to keep everyone at their best. You'd be surprised how the little things can add to the success of a project … preparation, baby!

At its basic level, here are five life "tools" that can best help guide you toward the completion of a successful project:

- Preparation
- Attention to detail
- A creative and open mind (being open to experimentation, while keeping to your goals)
- A common-sense approach to the overall process
- A good attitude

By far, one of the most important steps to take when approaching a project that involves a number of creative and business stages, decisions and risks is *preparation*. Without a doubt, the best way to avoid production pitfalls and to help get you, your client or your band's project off the ground is to discuss and outline the many factors and decisions that will affect the creation and outcome of that all-important "final product". Just for starters, here are a number of ever basic questions that should be asked long before the big red "REC" button is pressed:

- How much will this production cost?
- How (if at all) are you planning to recoup the production costs?
- Will others share in the costs or financial arrangements?
- Do you want to think about pre-sales and/or crowd-funding to help defray the cost?
- How is it to be distributed to the public? Self-distribution? Digital download? Indy? Record label?
- Do you need a producer or will you self-produce?
- How much practice will you need? Where and when? Shall the dates be put on the calendar?
- Should you record it in a band member's project studio or at a commercial studio?

- If a project studio is used and it works out, should you mix it at the commercial studio? Which one and who will do the mix?
- Will it be self- or professionally mastered? Who will do the mastering?
- Who's going to keep track of the time and budget? Is that the producer's job … or will he or she be strictly in charge of creative and contact decisions?
- Will you need a music lawyer to help with contacts and contracts?
- Who will be in charge of the artwork and the website?
- When should the artist or group's artistic and financial goals be discussed and put down on paper? (Of course, it's always best to discuss budget requirements, possible rewards and written contract stipulations as early as possible in the game!)

These are but a few of the issues that should be addressed before tackling a project. Of course, they'll change from project to project, might change over time and will depend upon the final project's scope and purpose; however, in the final analysis, asking the right questions (or finding someone who can help you ask the right questions) can help keep you focused, on schedule and on budget.

Now that you've answered these questions, here's a list of tasks that are often wise to tackle before going into production:

- Create a mission statement for you/your group and the project. This can help clue your audience in as to what you are trying to communicate through your art and music and can greatly benefit your marketing goals. For example, you might want to answer such questions as: who are you? What are your musical goals? How should the finished project sound? What emotions should it evoke?
- What is the budget for this project? How will it be sold? What are the marketing strategies?
- Start working on the project's artwork, packaging and website ASAP.
- You might think about copyrighting your songs. Form SR is used for the registration of published or unpublished sound recordings or a recorded performance. If you wish to register only the underlying musical composition or dramatic work, Form PA or Short Form PA should be used. Copies of and information on these and other forms can be found at www.copyright.gov/forms. Another way to protect your songs in a more automatic way is by using Creative Commons (www.creativecommons.org), which is a global nonprofit organization that enables sharing and reuse of creativity and knowledge through the provision of free legal tools for sharing and protecting the artist's works.

All of these are just but *a few* of questions that should be asked before tackling a project. Of course, they'll change from one project to the next and will depend on the project's scope and purpose. However, in the final analysis, asking the right questions (or finding someone who can help you ask them) can help keep your project and career on-track.

GETTING THE BEST OUT OF YOUR PROJECT

As I'm sure you're aware, an audio production system (as well as the process itself) is a complex chain of acoustic interactions, interconnected electrical/digital devices and artistic decisions that go together to create a final end product. Again, this chain can only be as strong as its weakest link, as stated in the "GOOD RULE" …

Good musician + good instrument + good performance + good acoustics + good mic + good placement = good sound.

Now is a good time to talk about the various acoustic and technical aspects for getting the most out of your production system. These relate to the parts of the chain that can help make or break your overall sound. Of course, there are a number of guidelines and basic steps that can be taken to get the most out of your room or production system … so let's get to them.

THE ART OF RECORDING

When being used in a book about MIDI, the term "Art of Recording" will almost certainly mean something different than if it were put into practice in a professional recording facility. The goals, methods and tools will differ, in that the instruments will primarily be electronic in nature. There will, however, be times when you'll want to lay down a vocal track, capture an acoustic guitar or maybe even record a live drum set (or smaller kit). The various situations that you might run into might not be as wide-ranging as what you'll find in an all-acoustic setting, but you should also be prepared to get the best sound out of an instrument, vocal technique or toy that might be right for your song.

The road to getting the best sound out of your production can be best traveled by considering a few simple rules:

- Rule 1: there are no rules, only guidelines. And although guidelines can help you achieve a good sound, don't hesitate to experiment in order to get a sound that best suits your needs or personal taste.
- Rule 2: the overall sound of an audio signal is no better than the weakest link in the signal path. If a mic, device or process doesn't sound as good as it could, make the changes to improve it BEFORE you commit it to disk, tape or whatever. More often than not, the concept of "fixing it later in the mix" will often put you in the unfortunate position of having to correct a situation after the fact, rather than getting the best sound and/or performance during the initial session.
- Rule 3: whenever possible, use the "Good Rule": Good musician + good instrument + good performance + good acoustics + good mike + good placement = good sound. This rule refers to the fact that a music track will only be as good as the performer, instrument, mic, mic placement and the

entire signal chain that follows it. If any of these elements falls short of its potential, the track will suffer accordingly. However, if all of these links are the best that they can be, the recording will almost always be something that you can be proud of!

Microphones

It goes without saying that having quality mics around can go a long way towards capturing vocals, instruments or almost anything that will come your way. Never before has there been such a wide range of mic types, configurations and price ranges that are available to the pro, semi-pro or home artist/producer. As I'm sure you're aware, mic types that would've cost thousands of dollars in the past can be had for hundreds or less. As with many things, it's not how much that mic (or mics) will cost that makes the difference, it's how you use it. I could go into all of the possible combinations and possible settings that you might come across, but this is beyond the scope of this book. Many of these pickup scenarios have been covered in many other books (including my own *Modern Recording Techniques*) … so, I'll leave that part up to you to read a book or to surf the Web for videos on good miking practices. Just remember, miking (as with all things audio) is an art. Over time, you'll be able to take other people's opinions and practices and then begin to work in a way that best serves you and your own projects.

The miking of vocals and instruments (both in the studio and onstage) is definitely an art form. It's often a balancing act to get the most out of the Good Rule. Sometimes you'll simply be lucky and have all of the elements; at others, you'll have to work hard to make lemonade out of a situational lemon. The best rule of all is to use common sense and to trust your own instincts.

Obviously, most project studios will want to have a few microphones around to capture vocals, instruments and maybe re-amp a MIDI instrument track to your DAW. The choice of mic type and price range is strictly up to you, as there are lots of dynamic, ribbon and condenser mics to choose from that come under the high-quality, good-bang-for-the-buck category.

The basic facts that I'd like to get across here, is that there are two schools of thought when it comes to choosing the best mics for your production studio:

1. The Allen Sides approach: Allen is an engineer, producer and owner of the Ocean Way Recording family of recording studios, but he's also well-known for his microphone collection that spans some of the most rare and coveted mics in existence. The idea behind his collection is that there will often be a specific mic that works best for a certain instrument or placement application. As we all know, this is all well and good if you're willing to spend a million dollars on your own personal set of mics. Obviously, us mere project and home studio mortals must take a different approach.
2. The general application mic collection: when it comes to suiting your basic needs, it's often best to choose several mics (Figure 14.2) that will fit your overall recording needs. For

example, you might want to start off by getting two good condenser mics of the same model (for stereo miking). These don't need to be overly expensive, but they should be chosen for their overall quality and ability to be used in a wide range of applications (such as vocals, drums, perc and the like). Next, you might want to get a dynamic and/or ribbon pair, just to round out your small, but very effective collection.

A number of books and on-line references can help you to get the best possible mic technique for the voice or instrument application that's at hand.

Although the most important guideline in recording is the above-stated "Good Rule", this doesn't mean that you shouldn't hesitate to experiment in order to get a sound that best suits your needs or personal taste. It's important to realize that the overall sound of an audio signal is no better than the weakest link in the signal path.

The Preamp

Since the output signals of most microphones are at levels far too low to drive the line-level input stage of most recording systems, a mic *preamplifier* must be used to boost its signal to acceptable line levels (often by 30 to 70 dB). In this day and age, most of the mic *pres* (pronounced "preeze") that are designed into an audio interface or production console are capable of providing a professional, high-quality sound. It's not uncommon, however, for an engineer, producer or artist to prefer a preamp which has a personal and "special sound" that can be used in a critical application to produce just the right tone for a particular application. In such a case, an outboard mic preamp might be chosen instead (Figure 14.3) for its characteristic sound, low noise or special distortion specs. These devices might make use of tube, FET and/or integrated circuit technology, and offer advanced features in addition to its common variable input gain, phantom power and high-pass filter controls.

As with most recording tools, the sound, color scheme, retro style, tube or transistor type and budget level are up to the individual, producer and/or artist … it's completely a matter of personal style and taste … and this includes the simple (and most often used) option of choosing to use the high-quality preamps that are already built into your own interface or mixer.

FIGURE 14.2
An initial, well-rounded mic (or pair of mics) can go a long way towards making quality acoustic recordings in the studio. A second pair can then help round out your choices, should the need arise. (Courtesy of Royer Labs; www.royerlabs.com.)

FIGURE 14.3
Universal Audio 4-710d four-channel tone-blending mic preamp with 1176-style compression and professional A/D conversion. (Courtesy of Universal Audio, www.uaudio.com © 2020 Universal Audio, Inc. All rights reserved. Used with permission.)

The Interface

Of course, a device that deserves a lot of consideration when putting together a DAW-based production system is the digital audio interface (Figure 14.4). These devices can have a single, dedicated purpose (of dealing with the conversion of audio) or they might be multifunctional in nature (offering up MIDI, audio and sync capabilities). In either case, their main purpose in the studio is to act as a connectivity bridge between the outside world of analog audio and the computer's inner world of digital audio. Audio interfaces come in all shapes, sizes and functionalities; for example, an audio interface can be:

- Built into a computer (although, more often than not, these devices are often limited in quality and functionality)
- A simple, two-I/O audio device
- Multichannel, offering eight analog I/Os and numerous I/O expansion options
- Fitted with one or more MIDI I/O ports
- One that offers digital I/O, word clock and sync options
- Fitted with a mix and/or controller surface (with or without motorized faders) that provides for hands-on mix and functional control

FIGURE 14.4
UR816C audio interface and laptop in the practice room. (Courtesy of Steinberg Media Technologies GmbH, a division of Yamaha Corporation, www.steinberg.net.)

These devices might have as few as two inputs and two outputs, or it might have as many as 24 (or higher). It might offer a limited number of sample-rate and bit-depth options, or it might be capable of handling rates up to 96 kHz/24 bits or higher and can be connected to the computer via FireWire, USB or Thunderbolt.

When choosing an interface, the following considerations should be taken into account:

- The interface's overall audio quality. This should be your first consideration, as (contrary to popular opinion) no two interfaces will sound the same.
- Will it fit your studio's I/O and functional needs? Does it have expiation options that allow it to grow as your studio needs grow?

In the Production Studio

Getting back to the concept of "The Good Rule" from earlier in this chapter, one of the main goals of the recording process is to capture the best performance, using the best tools that you can. Here are a few guidelines:

- When recording acoustic instruments, it's always a good idea to assess the current situation and then go about using the tools, toys and techniques to capture the performance in the best way possible. This will involve using your best judgment for room placement, mic placement, mic choice and the like.
- Try to be aware of the musician's needs. Do they have any mic choice and/or placement preferences? Is there water and/or snacks? Sometimes it's the little things, a good attitude and general awareness that can go a long way towards capturing the best performance from an artist.
- On the technical side, always be aware of your overall signal gain levels. By this, I mean making sure that your mic preamp levels are adequate, but well under clipping and general distortion levels. This optimum level strategy should then be followed throughout the entire signal chain, ensuring a high-quality, low-noise, low-distortion audio path (Figures 14.5 and 14.6). Speaking of levels, in this day and age of digital DAWs, it's definitely a good idea to keep your recorded track levels well below the distortion limit (–7 or –12 VU is often a good maximum peak level). Most self- and

FIGURE 14.5
Of course, signals that are too low at any part of the signal chain *might* add noise. Signals that are too high anywhere in the chain have a good chance of adding distortion, and signals that fall in the optimal operating range give you the best chance of getting a good, undistorted signal.

FIGURE 14.6
It's extremely important to be aware of your overall gain levels throughout the recording and DAW signal chain flowing from the mic – to the preamp/interface – through the mixing stage – through the DSP and mastering phase (if it's integrated into the project) – and finally through to the main mix out.

system-noise of a DAW recording at 24/48 or higher will be so low as to eliminate the need for recording at "hot" signal levels. Literally, there's no benefit to this in a digital system and the possibility of clipping distortion will only increase.

Documentation

There are few things more frustrating than going back to an archived session and finding that no information exists as to what instrument patch, mic type or outboard effect was used on a session (even one that's DAW-based). The importance of documenting a session within the named tracks, separate written document or within your DAW's notepad apps simply can't be overemphasized. The basic documentation that relates to the who, what, where and when of a recording, mixdown, mastering and duplication session should include such information as:

- Important session calendar dates and locations: notating special session dates, booking rates and billing info can be helpful towards keeping you on schedule and on budget. Additionally, keeping track of locations and studio website information can be helpful when putting your notes into the project's webpage.
- Artists, engineers and support staff who were involved with the project: within a session document, you might include the names, addresses and other pertinent info about the staff and musicians who were involved with the project. Their names and duties can then be placed into the liner and/or Web notes for this project. This (and other session notes) can then be saved into a (docs) folder within the session's song or overall directory.
- Session tempo: although the tempo will probably be programmed into the DAWS's project file, you will probably want to notate the original tempo. Of course, you'll want to notate any changes in tempo that might take place over the course of the overall project's life.
- Session calendar dates and locations.
- Original and edited song tempos, signatures, etc.
- Mic choice and studio placement: taking pictures with your phone or camera can be a big help towards reconstructing parts of a session or overdub, should you have to go back and make any changes. These pics should then

be placed within a (pics) directory within the song or overall session directory. In addition, you could also draw up a studio diagram to help you remember artist, equipment and mic placement within the room.

- Outboard equipment types and their settings: if external hardware instruments or effects devices are used within a production, it's almost always wise to document the name of the device and the various settings that are used within the production. Here, it's usually a good idea to get out your trusty phone or camera and snap pictures of any front-face settings that you might want to remember for later recall.
- Plugin effects and their settings or general descriptions: for the most part, all plugin setting will be saved within the DAW session that you're working on. However, there are definitely times when Murphy's Law comes into play and the plugin was inadvertently deleted or when settings on a new version might not fully support your older plugin. In short, you can't always predict how software plugin will react at a future time … so, at these times, I would recommend that you make a screenshot of the plugin and save the shot within the pics directory.

To ease this process, you might again pull out a camera or camera-phone and start snapping pictures to document the event for prosperity, as well as for technical reasons. It's often a wise idea, for social media reasons, to use your camera or bring along a high-quality video camera to quietly document the setup or actual session for your fans as extra "behind-the-scenes" online video content.

The more information that can be archived with a session (and its backups), the better the chance that you'll be able to duplicate the session in greater detail at some point in the future. Just remember that it's up to us to save and document the music of today for the fans and future playback/mix technologies of tomorrow. Basic session documentation guidelines can be found in the Guidelines & Recommendation section at (search the Web on Grammy/producers-and-engineers).

NAME THAT TRACK

When recording an audio or MIDI track to a DAW, it's always wise to name the track before the Record button is ever pressed. This simple habit lets you do the naming, instead of having the workstation assign an arbitrary track title. For example, giving the track a name of "johnsbass" will probably cause the DAW to name the recorded track as johnsbass 01 and subsequent takes as johnsbass 02, johnsbass 03, etc. If you don't name it at the outset the DAW might give it a name like "track 12001." Obviously, finding the alternative take that's named "johnsjazzbass9" would be easier to find in a crowded audio directory than "track 12009". You might want to keep these names as short as possible (or keep the first few alphanumerics as descriptive as possible), as the track display on most workstations and controller readouts will allow only eight or so characters per name and will drop the remaining ones.

ORGANIZE YOUR COLORS

Almost every workstation will let you assign a color to a track or grouping of tracks from a selectable color palate (Figure 14.7). This handy feature makes it much easier to visually identify and organize your tracks according to instrument groups or types. Should you want, you could create and save a document that lists your favorite instrument groups and assign a color code to each, so as to have a consistent color scheme.

VISUAL GROUPINGS AND SUBFOLDERS

Certain DAWs will allow any number of tracks and/or media track types to be organized into physical track folders (Figure 14.8) that can be collapsed or expanded at will. In this way, tracks can be dragged into a folder that relates to its specific category (e.g., drums, background vocals, strings). The obvious advantage to this is the ability to quickly and visually identify the groups. Most DAWs allow the tracks within the folder to be either expanded or collapsed. Of course, whenever a folder is expanded, all of the tracks will be displayed in the edit window. When collapsed, we might only see the named folder track (which might or might not contain colors that represent the folders that are within it).

Collapsed folders can actually be a very useful tool towards helping to keep the session looking organized. For example, we might have a number of MIDI sequence tracks that are ready to export to their respective audio tracks. Once exported, the MIDI tracks can be deactivated (or simply not routed to an instrument) in the menu and then moved to the MIDI folder within the session. In this way all of the visual clutter of these important and saved tracks can be minimized into a single collapsed folder. The same can be said for software instrument plugins … Once you've exported the tracks to audio (if you prefer to work in this way), you can then deactivate them (thereby keeping the settings, etc., within memory, but eliminating any unnecessary load on the CPU) and then move the instrument tracks to an "INST" folder. If you ever want to view or reactivate any MIDI or INST tracks, simply expand the folder to display all of the individual tracks and you're back in biz – it's that easy!

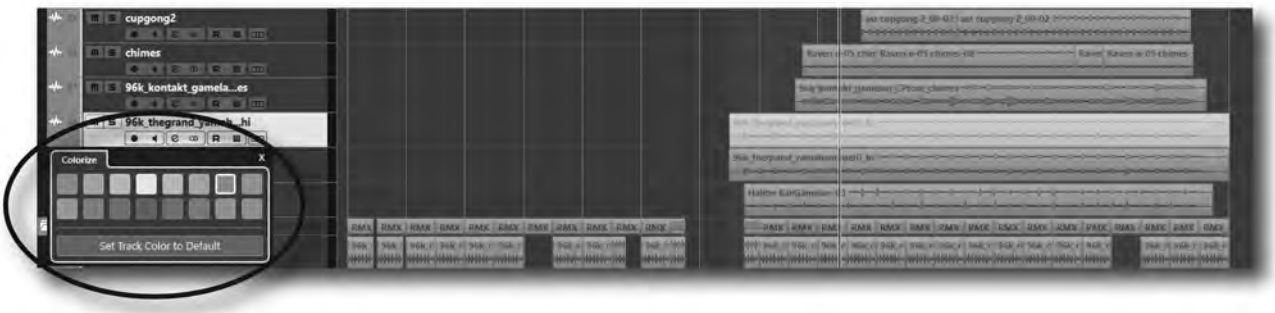

FIGURE 14.7
Color (with the palette shown highlighted) can be a helpful organization tool within a DAW project. (Courtesy of Steinberg Media Technologies GmbH, A Division of Yamaha Corporation; www.steinberg.net.)

FIGURE 14.8
This figure shows an expanded folder track (showing the included tracks) and the collapsed folder tracks (with the tracks hidden within the folder). (Courtesy of Steinberg Media Technologies GmbH, A Division of Yamaha Corporation; www.steinberg.net.)

THE ART OF MIXING

Actually, the topic of the art of mixing could easily fill a book (and there are a number of good ones out there); however, I'd simply like to point out the fact that mixing is indeed an art form – and, as such, is a *very* personal process. I remember the first time that I sat down at a console (an older Neve 1604). I was truly petrified and at a loss as to how to approach the making of a mix. Am I over-equalizing? Does it sound right? Will I ever get used to this sea of knobs? Well, folks, as with all good things, the answers come with practice and dedication. It's a foregone conclusion that over time you'll begin to develop and master your own art and style of mixing.

In short, mixing is:

- First and foremost, the art of active listening.
- The art of making decisions based upon what you hear, and then acting upon these decisions.
- The process of blending art and a knowledge of audio technology and signal flow so as to turn these decisions into a technological reality, thereby creating an artistic vision.
- An art … as such, it's very subjective and individual. There is no right or wrong way and no two people will mix in exactly the same way. The object of the process is to create a mix that "frames" (presents and/or shows off) the music in the best possible light.

Ear Training

Of course, the art of listening requires that you take the time to actually listen. One of the things that a mix engineer will be doing throughout his or her career is actively listening to a mix, often over and over. This allows us to become familiar with the nuances of the song or project. Often, the instant recall aspect of a DAW gives us the ability to keep going back to a mix and improve it ad-infinitum. This is often especially true of artists who mix their own work (the "it's never done until it's perfect" category). Trust me, I'm a pro at going back and revisiting mixes, so to this, I say: go easy on yourself. Music is a process of self-discovery and expression.

In the 21st century, one of the things that we've gotten really good at is having media readily at hand. Quite often, these media are omnipresent and totally disposable. You walk into a store … there's music! A car passes you by … there's loud music! You go practically anywhere … well, you know the deal all too well. My point is that we're used to being passive in the process. Actual mixing requires that we become "active" listeners. As such, it's often a good idea to sit down with your favorite desert island songs, albums, LPs … and play them over your best speaker system. How does it sound when you actively listen to them? Then, you might take the time to listen to them over your favorite headphones. How does this change the experience for you? What can you learn from the music and their mixes?

In the end, just as with learning an instrument or doing anything well, the fact remains that as you mix, mix and mix again … you *will* get better at both your listening and mixing skills. It's a matter of experience combined with the desire to do your best.

Mixing and Balancing Basics

Once all of the tracks of a project have been recorded, assembled and edited, it's time to put the above technology to use to mix the tracks of your project into their final media forms. The goal of this process is to combine audio, MIDI and effects tracks into a pleasing form that makes use of such traditional sound tools as:

- Relative level
- Spatial positioning (the physical panned placement of a sound within a stereo or surround field)
- Equalization (affecting the relative frequency balance of a track)
- Dynamics processing (altering the dynamic range of a track, group or output bus to optimize levels or to alter the dynamics of a track so it fits within a mix)
- Effects processing (adding reverb-, delay- or pitch-related effects to a mix in order to augment or alter the piece in a way that is natural, unnatural or just plain interesting)

In addition, sounds can be built up and placed into a sonic stage through the use of natural, psycho-acoustic and processed signal cues to create a pleasing, interesting and balanced soundscape. It's obviously evident that volume can be used to move sound forward and backward within the sound field and that relative channel levels can be used to position a sound within that field. It's less obvious that changes in timbre (often but not always introduced through EQ), delay and reverb can be used to move sounds within the stereo or surround soundscape. All of this sounds simple enough; however, the dedication that's required to hone your skills within this evolving art is what mixing careers are truly made of.

PREPARATION

Just as preparation is one of the best ways to ensure that a recording session goes well … the idea of preparing for a mix can help make the process go more smoothly and be more enjoyable.

From a mix standpoint, preparing for this all-important stage definitely begins in the recording phase. For example, the phrase "fix it in the mix" stems from the 1980s, when multitrack recording started to hit its full stride. It refers to the idea that if there's a mistake or something that's not quite right in the recording … "don't worry about it; we don't have to make that decision right now. We'll just fix it later in the mix". Although to some degree, this might (or might not) be true, the fact is that this mentality can lead to gaps or just plain sloppiness in the final recording. The real problems, however, happen when multiple "fixes" aren't dealt with that begin to add up over time. If this happens, the mix can take on a not-so-great life as something that needs to be wrestled to the ground, in order to sound right. In my experience, this attention to the details at the outset during the recording phase is what separates the pros from the rest of the pack.

Although each project has a life of its own, here are just a few of the ways to prepare a mix:

- Strive to capture the artist and performance to disk or tape in a way that best reflects everyone's artistic intentions. Indeed, decisions such as EQ, EFX, etc., can be made during the mix … but if the life, spirit and essence of the musical expression isn't captured, often no amount of processing during the mix will help.
- Whenever possible, deal with the musical or technical problem as it occurs … during the recording or production phase.
- During a punch in or comp session (combining multiple takes into a single, best take), take care to match the tracks as carefully as possible. This might involve documenting the mic and instrument that was used, its placement and distance in the room to the artist, as well as any other detail that will ensure that the tracks properly blend.
- Create a rough mix during the recording phase that will often help you get started towards the final mix. This is especially easy (and almost unavoidable) to do in this age of the DAW, as the mix can begin to take shape during production in a way that can be saved and easily recalled within the session file.

There are no rules for approaching a mix; however, there are definitely guidelines. For example, when listening to a mix of a song, it's often best to listen to its overall blend, texture and "feel". A common mistake amongst those who are just beginning their journey into mixing would be to take each instrument in isolation, EQ it and try to sculpt its sound while listening to that track alone. When this is done, it's quite possible to make each instrument sound absolutely perfect on its own, but when combined into the overall mix, the blend will quite likely not work at all. This is because of the subtle interactions that occur when all of the elements are combined. Thus, it's often a good idea to first listen to the tracks within the context of the full song … and then, you can go about making any mix changes that might best serve it.

REMEMBER: the mix always has to support the song … It should bring an energy to the performance that allows the musical strengths and statements to shine through.

Actually, I lied when I said that there are no rules to the art of mixing. There is one big one – watching your overall gain structure within the session. This was discussed a bit throughout this book, but it's worth forewarning you about the perils of setting your record and/or mix faders at levels that could cause distortion. It might be obvious, but the reality of adding just a little bit more here, and a little bit more there will all begin to add up in a mix. Before you know it, your track channels, a hidden plugin, sub groups and your main outs will start to redline. Simply being aware of this natural tendency is your best defense against a distorted mix.

Preparing for a mix can come in many forms, each of which can save a great deal of setup time and frustration and help with the overall outcome of the project. Here are but a few things that might be discussed beforehand:

- Is the project ready to be mixed? Has sufficient time and emotional energy been put into the vocals? Quite often, the vocals are recorded last … leaving one of the most important elements to the last minute, when there might be time and budget restraints. This leads us to recording rule #2 … "Always budget enough time to do the vocals right, without stress".
- Will you be mixing your own project or will someone else be mixing? If it's your own project and it's in-house, then you're probably technically prepared. If the mix will take place elsewhere, then further thought might be put into the overall process. For example, will the other studio happen to have the outboard gear that you might need? Do they have the plugins that you're used to or need for the session? If not, then it's your job to make sure that you bring the installs and authorizations directly to get the session up and running smoothly … or print the effects to another track.
- If you'll be mixing for another artist and/or producer, it's often helpful to fully discuss the project with them beforehand. Is there a particular sonic style that they're after? Should the mix be aggressive or smooth sounding? Is there a particular approach to effects that should be taken?

OK … let's take a moment to walk through a fictitious mix. Remember, there's no right or wrong way to mix as long as you watch your levels along the signal path. There's no doubt that, over time, you'll develop your own sense of style. The important thing is to keep your ears open, care about the process and make it sound as good as you can.

- Let's begin building the mix by setting the output volumes on each of the instruments to a level that's acceptable to your main mixer or console. From a practical standpoint, you might want to set your tracks to unity gain or to some easily identifiable marking.
- The next step would be to begin playing the project and change the fader levels for any instrument or voice until they begin to blend in the mix. Once done, you can play the tracks to see how the overall mix levels hold up over the course of the song.
- Should the mix need to be changed at any point from its initial settings, you *might* turn the automation on for that track and begin building up the mix. You might want to save your mix at various stages of its development under a different name (MySongMix 001, MySongMix 002, etc.). This makes it easier to return to a point where you began to take a different path.
- You might want to group (or link) various instrument sections, so that overall levels can be automated. For example, during the bridge of a song you might want to reduce the volume on several tracks by simply grabbing a single fader … instead of moving each track individually.
- This calls to mind a very important aspect of most types of production (actually it's the basic tenant of life): keep it simple! If there's a trick you can use to make your project go more smoothly, use it. For example, most musicians interact with their equipment in a systematic way. To keep life simple, you might want to explore the possibility of creating a basic mixing template file that has all of the instruments and general assignments already programmed into it.
- Once you've begun to build your mix, you might want to create a rough mix that can be burned to CD or USB stick. Take it out to the car, take it to a friend's studio, put it in your best/worst boom box, have a friend critique it. Take notes and then revisit the mix after a day. You'll be surprised at what you might find out.

HUMAN FACTORS

Given the fact that mixing a song or project is an artform, by its very nature it is a very subjective process. This means that your outlook, health, mood and the very way that you perceive a song will affect your workflow as you approach the mix. Therefore, it's often a good idea to take care of yourselves and your bodies throughout the process.

- Try to be prepared and rested as you start the mix process. Working yourself too hard during the recording phase and then jumping right into the mix just might not be the best approach at that point in time.
- By the same token, over-mixing a song by slaving behind the board for hours and hours (or days and days) on end can definitely affect the way that you perceive a mix. If you've gone all blurry-eyed and your ears are tired (the "I just can't hear anything anymore syndrome") … obviously, the mix could easily suffer. This is definitely a time to point out that you might consider saving your mixes under different version names (i.e., mymix_023), so that you could go back to a previous version, should problems arise. Above all, be patient with yourself.

- You might want to take breaks … sometimes looooooongg ones. If you're not under any major time constraint, you might even consider coming back to the mix a day or even a week later. This can give us a fresh perspective, without ear fatigue or any short-term thoughts that might cloud our perception. If this is an option, you might try it out and see if it helps.

A dear friend within the Grammy organization once said to me: Dave, the one thing that I've found amongst all of the really good engineers, is the fact that they are seeking is that "perfect sound" … it's something that they "hear" in their heads, but are never quite able to reach that Holy Grail. From a personal standpoint, I can say that this is true. I'm always sonically reaching for that killer sound, that's often just beyond reach.

This again brings me back to: "Wherever you may be, there you are!" By this, I mean: we all have to start somewhere. If you're just starting out, your level of mix sophistication will hopefully be different than after you've had several years of intensive mixing experience under your belt. Be patient with yourself and your abilities, while always striving to better yourself … always a fine line to walk.

GETTING TOO CLOSE TO THE MIX

With all of the tools and techniques that are available to us, combined with the time that it takes to see a good recording and mix through to the end, there's one danger that lurks in the minds of all producers and musicians (even more so, if it's your own project) … the fact that we might simply be too close to the mix. I speak from a high degree of experience when I say that by the time I near the finish of a project and have made so many careful adjustments to get that right production and sound, there are definitely times when I have to throw my hands up and say "Is it better or not? Truthfully, there are times that I get so close to 'my' mix and 'my' music that I simply can't tell!" When this happens to you, try not to fret (too much) … it's all part of being in the production club. You might simply need a break, go for a walk or just take some time (maybe a long time) to get away from it … or you might have to just plow through to get it done on time. Just realize that this feeling of being slightly lost in your own "feelings and self-doubt" is totally normal. Here are some thoughts on this:

- Listen to your mixes on another speaker system or another system in another room altogether.
- Leave the room and listen to your mix from outside the open studio door. Many people (including myself) swear by this additional monitoring option.
- Bring a friend in to listen and give his or her thoughts.
- Take a break (this could be an hour or a week) before diving back in. If you don't have to punch the clock, time can be your friend.

I would like to close this section with another important story. Years ago, I was presenting one of my projects at an event in LA in a room that had killer speakers

but really bad acoustics. All the other presenters were multi-Grammy winners; I was the only one who simply had nominations. Towards the end, I went up to the sponsor's wife and told her about my disappointment about how I thought my project sounded, compared to the others. She promptly turned to me and said – "Dave, everyone else came up to me and said the exact same thing. That's why you're here. You're always striving to make your work sound better!" That really struck a nerve. By this, she meant, if I were cocky and said "Dude, I'm the best, I totally rocked and it's perfect" (especially if it's not), I might get respect at the lower ranks, but not from the pros who know better. Moral of the story – do your best and *always* strive to do better, but to this I would add … don't beat yourself up along the way; you're only human. Perception is in the ear of the beholder and getting a mix or master right isn't always easy … especially if it's *your* art that's at stake.

THE ART OF MASTERING

Using its original definition, the mastering process is an art form that uses specialized, high-quality audio gear in conjunction with one or more sets of critical ears to help the artist, producer and/or record label attain a particular sound and feel before the recording is made into a finished manufactured product. A mastering engineer or experienced user's job is to go about the task of shaping and arranging the various cuts of a project into a final form that can be replicated into a final salable product, using three basic stages:

- Level and general balance management
- Song sequencing
- Authoring

Of course, in recent times, the general definitions and tasks of this art have changed. With the recent arrival of do-it-yourself mastering software and with an ever-expanding educational awareness of the subject, many producers and artists have begun to take of this important stage in the production process themselves.

On the subject of DIY mastering, I'm not going to offer an opinion. In fact, I've taken the DIY route myself for at least a decade now. My personal reason for this is that I'm a control freak … I simply haven't found a mastering engineer that trust enough. I've tried out several and wasn't happy with the results … so I began rolling my own.

Before we start delving under the hood of the mastering process itself, I do want to offer up a warning, or at least a thought that you should consider before you take on the self-mastering role. This refers back to the "Wherever you may be, there you are" adage. Quite simply, are you experienced enough or dedicated enough to master your own projects?

Before you give a quick answer, I'll now offer up one big opinion that I have on this subject. I believe that mastering (especially modern-day mastering) is a true artform, in a way that's equal to the recording and mix phases within a project.

As such, I believe that it's something that shouldn't be taken lightly at all. In fact, when I started my own quest into self-mastering, I actually made an agreement with myself to take at least two years to learn the craft. I feel like I've succeeded in the task, as it's gotten me four Grammy nominations; however, I'm the first to reject the idea that I am an actual mastering engineer. I've simply gotten good at mastering my own work. Hanging a mastering shingle out on the door would be an entirely different matter.

Level and General Balance Management

Of course, the final mix is where all of the magic of balancing levels, panning and effects of a song or audio program takes shape … and this is true for each of the songs within an album. Not all mix engineers are always fully aware of what's needed regarding the presence, dynamics and general "feel" in order to present the final mass-market product in its best light. This is where the first stage of the mastering process comes into play, with the finessing of the:

- General presence or lack thereof – this is done through the use of equalizers and other frequency-sculpting tools.
- Dynamics – through careful and judicious use of such dynamic range changers as compressors and limiters.
- General "feel" – that magical element called intuition and experience, which works in conjunction with a surgically designed audio system that allows the mastering engineer to use his or her sonic tools to sculpt the program material into its final form.

The subject of how high to set the levels (or more accurately, relative dynamic levels using compression/limiting) is a subject that can (and has) been the subject of many a heated debate. The major question here is – "Can it ever be too loud?" In actuality, the question that we're really asking is, "How much dynamics can we take out of the music before it begins to lose its sense of life?"

Traditionally, the industry as a whole tends to set the average level of a project at the highest possible value. This is often due to the fact that record companies will always want their music to "stand out" above the rest when played on the TV, radio, mobile phone or on the Web. This is usually accomplished by applying compression to the track or overall project. Again, this is an artistic technique that often requires experience to handle appropriately.

I'm going to stay clear of opinions here, as each project will have its own special needs and "desires", but several years ago, the industry became aware of a top-selling platinum album that was released with virtually no dynamic range at all. All of the peaks and dynamics were lost and it was pretty much a "flat-wall" of sound. This brought to light the argument that maybe, just maybe, there might be limits to how loud (how compressed) a project should be. Of course, everyone wants to be heard in the playlist in an elevator, on the phone, etc., but in reality, some degree of dynamics control is necessary to keep your

mix sounding present and punchy. A good mastering engineer, however, can help you be aware that over-compression can lead to audible artifacts that can "squash" the life out of your hard-earned sound. In fact, light to moderate compression or limiting might also be the best alternative for certain types of music. Alternatively, classical music lovers often spend big bucks to hear a project in its full dynamic glory. In the end, it all depends on the content, the context and the message.

Song Sequencing: The Natural Order of Things

Once the mixdown phase has been finished, the running order in which the songs of a project are to be played, as well as the timing lengths (silence) between the tracks, will often affect the overall flow and feel of a project. The considerations for song order might be thought of as part of the mastering process that's best done by the artist, producer (those who are closest to the project) and/or the mastering engineer. This part is infinitely varied, and can only be garnered from experience and/or having an artistic "feel" for how their order and timing interactions will affect the final listening experience. A number of variables that can directly affect the sequenced order of a project include:

- Running order: which song should start? Which should close? What order feels best and supports the overall mood and intention of the project?
- Transitions: altering the transition times between songs can actually make the difference between an awkward silence that jostles the mood and a transition that upholds the pace and feel of the project. In this online era of streaming songs, this might not be so great of a consideration. However, for those of us who assemble songs into a finished album experience, it can be far more important. With regards to the Red Book CD, this standard calls for 2 seconds of silence as a default setting between tracks. Although this is necessary before the beginning of the first track, after the first track, any amount of silence can be inserted between subsequent tracks. Most editing programs will let you alter the index space timings between tracks from 00 seconds (butt splice) to a longer gap that can help to maintain the appropriate mood.
- Cross-fades: in certain situations, the transition from one song to the next is best served by cross-fading from one track directly to the next. Such a fade could seamlessly intertwine the two pieces, providing the glue that can help convey any number of emotional ties.
- Total length: how many songs will be included on the disc or album? If you've recorded extra songs, should they be included on the album, or be added as extra bonus tracks? Is it worth adding a weaker song, just to add additional time? Will you need to drop songs for the vinyl release? Again, this is generally not an issue for an online digital release, but might easily be an issue for physical release.

Authoring

Once all of the presence, dynamics, timings and general decisions have been made and taken care of, the final task at hand is to author the media into its final form. For use with downloadable music sites, this process might be as simple as providing the distribution service with as high a quality as you can. For example, if the session was done at hi-def rates (24/96 Wav, for example) and the service can accept these rates, it's best to export and upload your song or album at its native hi-definition rate. If it was recorded/mixed at 24/48 or 24/96, then you would export and upload at that rate. If the service requires the use of special coding or certain standards, it's often wise to research the matter more fully or to ask for help from a professional.

METADATA

There is one more stage that is part of the authoring process that should never be overlooked: the need for encoding accurate *metadata* into the sound file(s). Metadata (Figure 14.9) is the descriptive information that should be encoded within the sound file, giving information about the song title, artist, composer, publisher, copyright, genre, release year, song number, lyrics and any other additional comments.

It's important to pay CAREFUL attention to the details and accuracy of your metadata, as this will most likely be the descriptive text by which the song or other media can be found on the Web, over a streaming or other media service provider, as well as your own phone or computer-based media player.

Without accurate metadata, it's safe to say that the chances of anyone finding your song on the Web or media player become literally like finding a needle in a haystack … not good for you or your fans.

The Two-Step (Integrated) Mastering Option

One of the concepts of traditional mastering that has always felt foreign to me lay in the fact that traditional mastering is (by its very nature) a two-step process: mixing and then mastering. The final mix is completed by the artist/engineer/producer and then the masters are sent off to another person to be finalized in a separate stage. I know that the idea is to have a professional who is emotionally detached take your "baby" and make it even better. Personally, I've never been comfortable with this traditional approach. I know this flies in the face of the

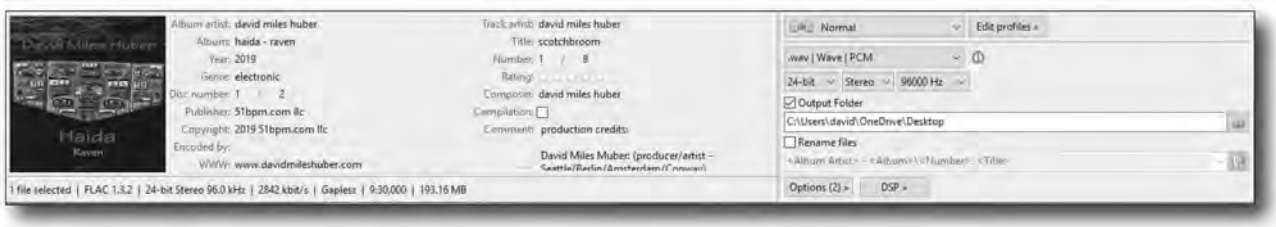

FIGURE 14.9
Embedded metadata file tags can be added to a media file via various media libraries, rippers or editors and then viewed by a media player or file manager.

traditional mastering concept, but I am far more comfortable with a single-step, self-mastering process. This is largely due to the fact that I'm a control freak (people usually say this like it's a bad thing). To me, I feel that including the final mastering process into the DAW's song structure makes much more sense. Here's why:

- It gives me complete and total control over the entire process, with total recall to go back and to change something in the mix or mastering of a song if I want to at any time. This can be a very good thing or it can be a never-ending pitfall, if you're not careful.
- It lets me include the pre- and post-song timings within the session itself. This is done by globally moving all of the sound files in the session to the right beginning time and/or by moving your "out" export marker to a time that gives you the right amount of silence between the tracks. (Note: for certain media codecs, it's often a good idea to add a second or two of silence at the beginning, so that the player can have time to properly play the beginning beat.) Once these timings have been done you can just drop the song (or whatever) into the project cue and that's it.
- Most importantly, the final mastering chain will be included within each song, allowing any appropriate amount of final master EQ, compression and processing to be added to each song.

In short, all of the above options allow us to have complete control and repeatability (recall) of not only the recording and mix, but also the final mastering phase. It can really help should quick changes be needed (something that's really hard to do with the two-step process).

However, I'm also a strong believer that this is not for everybody. If you feel you're not qualified, or don't have the time/interest/equipment to make the journey … then hiring a pro is your best bet. Like I said, it's taken me over two years to feel that I'm qualified to master my own music, and I'd never feel qualified to master other people's mixes … but that's just my personal decision.

THE ART OF BACKING UP

The phrase "nothing lasts forever" is especially true in the digital domain of lost 1s and 0s, damaged media, dead hard drives and lost data … you know, the "Oh @#$%! factor". It's a basic fact of life that you never quite know what lies around the techno corner and, of course, it's extremely important that you protect yourself as much as is humanly possible against the inevitable screw-up. This type of headache can of course be partially or completely averted by backing up your active data, program and media files.

As a general beginning point, it's almost always wise to keep your computer's operating system and program data on a separate hard drive (usually the boot drive) and then store your data, media and session files on a separate drive. Beyond this premise, the basic rules of hard-disk management are extremely personal and will often differ from one computer user to the next (Figure 14.10). Given these differences, I'd still like to offer up some basic guidelines:

FIGURE 14.10
Data and hard-drive management (along with a good backup scheme) are extremely important parts of media production house cleaning.

- It's important to keep your data (of all types) well-organized, using a system that's both logical and easy to follow. For example, program install files, hardware drivers and the like might be placed into their own directories; personal photos, music and other media should be kept in their own, separate place, while sound files and other session-related directories and subdirectories relating to your studio can be placed in their own special place. You get the picture.
- For those sessions that contain MIDI tracks, it's ALWAYS wise to keep these tracks within the session (don't delete them). These tracks might come in very handy during a remix or future mixdown. Moving these tracks to a folder named "MIDI" and then collapsing that folder can help reduce session clutter.
- Both Windows and the Mac OS will often try to save various media and other types of datafiles into pre-determined directories. This might work for most general users, but for more advanced users, you might *consider* placing your precious data into directories that make sense to you and that can be easily and quickly found.
- Session data should likewise be logical and easy to find. Each project should reside in its own directory and each song should likewise reside in its own subdirectory of that session project directory.
- Remember to save various take versions of a mix. If you just added the vocals to a song, go ahead and save the session under a new version name. This acts as an "undo" function that lets you go back to a specific point in a session. The same goes for mixdown versions. If someone likes a particular mix version or effect, go ahead and save the mix under a new name or version number (my greatest song 1 ver15.ses) or (my greatest song 1 ver15 favorite effect.ses). In fact, it's generally wise to save the various versions throughout the course of the mix. These session files are usually small and might save your butt at a later point in time. As a suggestion, you might want to create a "mix back" subdirectory in the session/song folder and move the older session files there, so you don't end up being confused with having 80 backup take names in your session directory.

With regards to actual backup strategies, a number of options exist. In this day and age, hard drives are still the most robust and cost-effective way of backing up your precious data. Here are some options for getting the job done, although you may have better ones that work for your own application and working scale:

- Main data storage drive: in addition to your OS drive, you should consider a second, large-capacity drive that is dedicated to your various data and media files. This will be your data Fort Knox that is divided into referenced directories that can be individually backed up. For example, it might be divided into sound files, music files, personal media, docs and the like. In this way each directory can be individually backed up to another drive, when needed.
- Secondary backup clone drive: this drive should be a copy of your main storage drive. It could also reside in your tower (if you are using one); however, I've found that a single USB portable hard drive (a 5-TB drive, in my case) also works wonders.
- Third, off-site backup clone drive: it has often been said that you're not fully backed-up unless you have a third copy that doesn't reside in your house or studio. In my case, I have another 5-TB portable hard drive that's a complete copy of the main and secondary drives that's placed off site in another safe place. This could be stored in your home (if you work away from home), your parent's house, a friend's house or in a secure bank vault box.
- Cloud storage: of course, this third off-site clone could be saved to the cloud or other storage network. The downfall here would be the time that's required to up- and download the data. On the positive side, you'd be able to access the data from literally anywhere and the data could be shared over multiple computer systems.

Seriously, apart from my family, the most important and non-replaceable thing that I own resides on those drives … and I don't treat this backup responsibility lightly. The frequency with which one should back up depends upon your backup scheme and how important the data is (actually, they're all important). Personally, I'd make sure that the entire system matches up perfectly every three months … less if possible.

THE ART OF DISTRIBUTION, MARKETING AND SALES

We've all known that the business of music has changed. Some think for the better, some for the worse. It all depends on your perspective. In the past, if you were a bedroom producer from the Corn Belt, you wouldn't have much of a chance in hell of getting your music out to the public, as you'd have to go through the process of finding an established record label that would be willing to take a chance on you. Now, as we all know, it's as easy as uploading your mix to an on-line distributor and BOOM, the masses can now find you on all of the major streaming services.

The problem with this new level playing field is that it's largely level. Since everyone is able to find and upload music on the Web … everyone does! This means that it's harder than ever to rise above the noise to get your stuff heard, when you're competing against millions of other artists' downloads and playlists.

Obviously, the old adage of "If you release it, they'll buy it" doesn't work. The downside of the new digital age of self-distribution is that you have to do self-marketing as well. It's always been the case that once the music has been sculpted into its final, marketable form … only then does the real work begin. All of us who have released our own productions have (hopefully) learned this lesson. I am learning, with the help of good friends, that you have to put in the time to do the marketing work. For me, it's always an ongoing learning process, but I'm finally learning to treat marketing as an actual job. Whether it's a full-time or a part-time job is totally up to you. A dear buddy of mine suggested that I set aside three 2-hour work periods each week for marketing research and outreach (such as sending press packs, emails and general correspondence). It seems to be working for me … you might give this option a try.

Distribution

In this age of digital distribution, you might be surprised that there are quite a few ways to approach the distribution of your "product". This can come in such forms as:

- Record label: yes, this is still a viable option for certain artists. In addition to the big two (Sony and Universal Music), there are a large number of independent labels out there that might be right for your music genre. Using this option, you will essentially be giving up a percentage of your gross project income and (possibly) ownership and/or distribution rights in exchange for marketing, brand notoriety and other services. As always, be careful and check things out before signing.
- Direct sales: you've all seen the street musician who's working his or her butt off on a busy street. At their feet is a CD that is for sale for $10. Or the merch table in the corner of a venue that has the band's entire CD catalog for sale, along with poster, tees and the like. These are totally viable and direct options for getting some extra income for your hard-earned work.
- Digital downloads: there are a number of digital download services that allow the fan to go on-line, listen and then buy the artist's music. This might take the form of an open system that lets you own the downloads (in MP3, FLAC or other media format), or it might be a service that still retains ownership of the actual media, but then unlocks and places it in your media library.
- Streaming: using this method, the distribution company retains all rights retain the media for distribution, allowing the user to listen to the media. In this case, there are no download options; however there are numerous options for the user to play and organize the music into personal playlists, which can then be shared.

- Music licensing for film and TV: a number of companies are available that offer on-line services for allowing motion picture, television and other media producers access to music creators on-line. This avenue can range from being modestly to quite lucrative for the artist.

The choice of any or all of these distribution services is completely up to the artist. Except for option one, the artist or producer will retain full ownership of the master and performance. With some care, this might be also available when signing with a label. My advice here would be to make your plans carefully, take your time and then make the best choice that works for you at the time.

Marketing

Once "the product" has been made, the distribution method chosen and the release date set; then comes the truly hard part … getting it in front of the buying public and making the sale. At this point, I will not pretend to be an expert on the subject. In fact, on this subject, I'm just a beginner. However, I do know firsthand how hard this is. Even with projects that have Grammy nominations to their name, the process still takes a lot of hard work, plenty of contacts and a willingness to persevere. Here are a few questions and thoughts that you might want to ask yourself and then act upon:

- What is the initial goal that you want to set out for yourself? What is it that you want the audience to do? Check out the site? Listen to a track? Buy the album?
- Is the goal to get the product out in front of people as much as possible (free to mostly free streaming services) or to make money off of it (physical or downloadable media) … or both?
- What is the marketing plan? Is there a website presence? Is there a social media presence? Make sure that your social media banners point to the product in some way.
- What kind of a story can be shared on social media to create a buzz? Are there videos that can be shared? Share a "making of" video or create content that can help promote the media.
- Can marketing material be gotten to a larger audience through targeted social media promotions?
- Never forget the "power of one". This refers to sending out special emails or messages to your fans, family members, past buyers, etc. You might be surprised about the impact that can be made, one contact at a time.
- Try to get your music on vlogs, blogs and sites that are related to your genre. This outreach works much like the power of one, but the "right" one just might get the word out to hundreds or thousands of new fans.
- It's easy to forget radio, but this can be a powerful medium for getting your work out to the public … especially if they can highlight your work and the music in a more in-depth manner.

All of these things require time, research and good old-fashioned hard work. I'm in the process of learning the fine line of being persistent, without being spammy or obnoxious. Creating a schedule for getting your promotional work done is a good way to get started and to stay on track. It's not easy … but in this industry, you'll never be promised a rose garden.

Finally, there is no one right way to get your foot in whatever door you want to step through. Of course, there are a lot of books and YouTube videos on the subject of marketing. They all have their message, but in the end, you're the one who'll have to walk the long walk.

Sales

Ah yes, the big question in the arts … getting paid. Quite possibly, this is where the going gets even harder.

- For touring bands, playing live and getting direct revenue from merchandizing (merch) has become one of the best ways for artist to strive to make a living.
- Stories of problems with getting paid for artists who opt to work with labels are legendary. The contract clauses have traditionally (but not always) been written in favor of the label and distributors. Hidden fees, recouped recording costs, production costs and archaic damage and returns clauses can actually leave the artist in the hole financially. As with all things, be careful before you or your band sign your art away to another entity.
- Although downloads are becoming less popular with the masses, they can be quite straightforward with regards to getting paid. For example, my favorite way of getting my music out to my audience is through Bandcamp .com. This company allows you to sell your music in MP3 or Hi-Def FLAC (look it up on Wiki) direct to the buyer, whereby the artist or rights-holder gets 85% of the proceeds, and 90% of the proceeds from merch sales. These figures are basically unheard of in traditional music sales schemes.
- KickStarter, IndieGoGo and other crowd-funding options are another way to make money from pre-sales, even before you start work on the actual production. By getting direct support from family, friends and fans, you might be surprised how much funds you might get to support your next project.
- Streaming has definitely become the darling of the music community and for consumers for its ease-of-use and its ability to get the music out to the masses in new and innovative ways. It must be realized, however, that in this case the amount of money that even an established artist can expect to make will be modest. For example, one well-known group published an on-line story about a major release that had a total of about a million streams. From this, they received a total revenue of about $5,000, which ended up being an average per-stream payout of about $0.005. My recommendation here would be to use streaming services in ways that they work best, as a vehicle for getting the word out about your music. In short, don't buy that Tesla just yet.

STUDIO TIPS AND TRICKS

As we near the end of this book, I'd like to take some time to offer some tips that can help make a session go more smoothly, both in the project and in the professional studio environment. Almost all of these straightforward tools have to do with keeping your environment, equipment and general outlook operating at a relatively professional level. So, why would you want to have a professional approach to your production environment, even though you're working out of your bedroom? Obviously, the goal is not to make your productions sound like they were done in a dingy, old bedroom. These days, it's becoming more and more common for tracks on platinum records to be laid down in these environments. But how was the artist able to get such a professional sound? They did it by having a professional attitude towards their productions, their tools and their techniques. Armed with a positive and professional attitude, you'd be amazed at how you can step up your game. OK, let's take some time to look at some tools and techniques that can help make your projects shine.

Household Tips

Producers, musicians, audio professionals and engineers spend a great deal of time in the control room and studio. It only makes sense that this environment should be laid out in a manner that's esthetically, functionally and acoustically pleasing from a feng shui point of view. Creating a good working environment that's conducive to making good music is the goal of every professional and project studio owner. Beyond the basics of creating a well-designed facility from an acoustic and electronic standpoint, a number of basic concepts should be kept in mind when building or designing a recording facility, no matter how grand or humble. Here are a few helpful hints:

- Given the fact that an engineer spends a huge amount of time sitting on his or her bum, it's always wise to invest in both your and your clients' posture and creature comforts by having comfortable, high-quality chairs around for both the production team and the musicians (Figure 14.11).
- Velcro™ or tie-straps can be used to organize studio wiring bundles into groups that can be laid out in a way that reduces clutter, improves organization (color-coded straps can also be used) and makes the overall studio look more professional.
- Most of us are guilty of cluttering up our workspace with unused gear, papers … you know, junk! I know it's hard, but a clean, uncluttered working environment tells your clients a lot about you, your facility and your work habits.
- Keep liquids off your workspace. Just the other day, I spilled a drink on my desk and it blew out a USB-C/Thunderbolt port. Moral of the story, don't put it there in the first place … ARG!
- Unused cables, adapters and miscellaneous stuff can be sorted into plastic storage boxes and stored away to reduce clutter.
- Keep your studio in good electrical shape. A dear friend of mine (who shall totally remain nameless) had a bad habit of cobbling his cables together

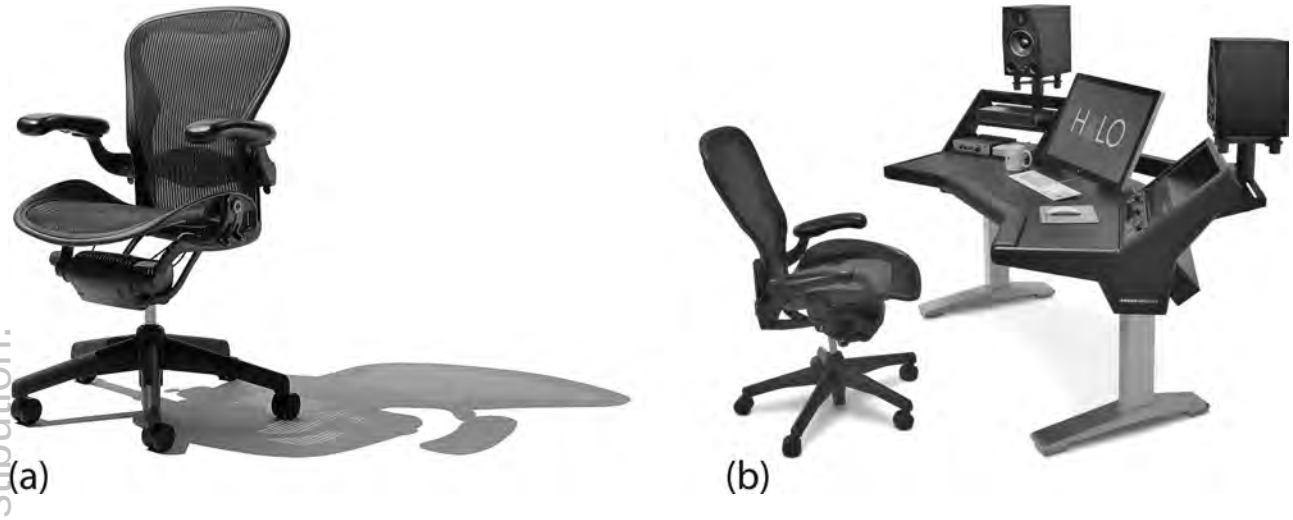

FIGURE 14.11
Functional and comfortable furniture is a must in the studio. (a) The venerable Herman Miller Aeron® chair. (Courtesy of Herman Miller, Inc.; www.hermanmiller.com.) (b) The Argosy Halo desk. (Courtesy of Argosy Console, www.argosyconsole.com.)

out of ancient connectors that had seen better days. That's all well and good, but his soldering skills weren't always the best and you never knew if the connection was going to go bad on you at any moment … and yes, good soldering skills are important to have.

- Important tools and items that are used every day (such as screwdrivers, masking tape or markers) can be stored in a rack-mounted drawer that can be easily accessed without cluttering up your space.
- Portable label printers can also be used to identify cable runs within the studio, identify patch points, I/O strip instrumentation … you name it.

Musician's Tools

By now it's probably painfully obvious to most musicians that producing the music is only the first step toward building a career in the business. It takes hard work, perseverance, blood, sweat, tears and a sense of humor (so we don't all go nuts). For every person who makes it, a large number don't. There are a lot of people waiting in line to get into what is perceived by many to be a glamorous biz. So, how do you get to the front of the line? Well, folks, here are some keys to help you on your own personal journey.

- A ton of self-motivation
- Good networking skills
- A good, positive attitude
- Realize that showing up is huge!

The business of art (the techno-arts of recording and music production being no exception) is one that's generally reserved for self-starters. Even if you get a degree from XYZ college or recording school, there's absolutely no guarantee that anyone will be knocking on the door with a job offer or contract in hand

(if they do, get a lawyer, quick!). It takes a large dose of perseverance, talent and personality to make it. In fact, one of the best ways to get into the biz is to get down on your knees and knight yourself on the shoulder with a sword (figuratively or literally – it doesn't matter) and say: "I am now a _____!" Whatever title that you want to take on, just become it … Shazammm! Make up a business card, start a business, begin contacting artists to work with or make the first step toward becoming the artist you want to be. Of course, you'll need to realize that it's a step-by-step journey that can potentially last a lifetime.

There are many ways to get to the top of your own personal mountain. You could get a diploma from a school of education or the school of hard knocks (it usually ends up being from both), but the goals and the paths are up to you. Like a mentor of mine says: "Failure isn't a bad thing … but not trying is!"

Another part of the success equation lies in your ability to network with other people. Like the venerable expression says: "It's not [only] what you know … it's who you know". Maybe you have an uncle or a friend in the business or a friend who has an uncle – you just never know where help might come from next. This idea of getting to know someone who knows someone else is what makes the business world go around. Don't be afraid to put your best face forward and start meeting people. If you want to play gigs around your region (or beyond), get to know a promoter or venue manager and hang out without being too much in the way. You never know – the music maven who hangs out at your favorite café might know someone who can help get you in the proverbial door. The longer you stick with it, the more people you'll meet, thus making a bigger, stronger, better network than you ever thought would be possible.

Like my own music maven always says, "Showing up is huge!" It's the wise person who realizes that being in the right place at the right time means being at the wrong place hundreds, if not thousands of times. You just never know when lightning is going to strike – just try to be standing in the right field when it does.

Here are some more practical and immediate tips for musicians:

- Build a personal and/or band website: making your own personal site will help to keep the world informed of your gigs, projects, bio and general goings-on.
- Of course, you're aware that getting your music distributed is super-easy and very affordable or free. Services like Distrokid can get your music out to the various on-line download distributors.
- Build a relationship with a music lawyer: many music lawyers are open to building relations that can be kicked into gear at a future time. Take the time to find a solicitor who's right for you. Does he or she understand your personal music style? If you don't have the bucks, is this person willing to work with you and your budget, as your career grows?
- The same questions might be asked of a potential manager, although this symbiotic relationship should be built with care, honesty and safeguards (just one of the many reasons you might want to know a music lawyer).

- Copyright your music: as was said earlier in this chapter, it's often a good idea to protect your music by registering it with the Library of Congress or more simply through the simple use of "Creative Commons". It's easy and inexpensive and can give you peace of mind about knowing that the artistic property that you're sending out into the world is protected.

A WORD ON PROFESSIONALISM

Another subject that should be touched upon is the importance of a healthy professional demeanor, even in your own project studio. Without a doubt, the life and job of a producer or musician aren't always easy. The work often involves long hours and extended concentration with people who, more often than not, are new acquaintances. In short, it can be a difficult to remain focused on both your music and your business. On the flip side, it's one that's often full of new experiences and it lets you be involved with people who feel passionately about their art and chosen profession.

It's been my observation (and that of many I've known) that the best qualities that can be exhibited by anyone in the biz are:

- An open heart
- An innate willingness to experiment
- Openness to new ideas (flexibility)
- An openness to admitting when you're wrong or have made a mistake
- A sense of humor
- Good personal grooming habits
- An even temperament (this often translates as patience)
- A willingness to communicate openly and clearly with others
- An ability to convey and understand the basic nuances of people from all walks of life

The best advice I can possibly give is to be open, be patient and, above all … "be yourself". In addition, be extra patient with yourself, if you don't know something … ask. If you make a mistake (and trust me, you will – we all do), admit it and don't be hard on yourself. It's all part of the process of learning and gaining experience.

Choosing Your Gear

Choose the best gear that you can, given your budget. There are so many types, manufacturers and quality levels for gear out there that it's difficult to make the best choice. What I can say is take your time, don't listen to marketing hype and find the best gear that will work for you … at a price that you can afford. The one thing that I have learned over the years is that everything has its own sound. This also goes for digital gear. For example, different audio

interface models will always sound different. They all have their own character. Obviously, the same goes for speakers … and these two are probably your most important hardware choices. My advice here is to take your time in buying, do as much research as possible and buy from a store that will offer returns or exchanges (if possible). Good luck!

DIY

Here, I'd like to take a moment out to put in a word for self-sufficiency and saving your hard-earned cash. If you have an absorber that needs to be built, you might try building it yourself. If you need a set of cables that need to be assembled, instead of rushing out and paying a small fortune for them, you might consider getting what you need (if you don't have something close already) and putting them together yourself. In fact, I'm going to challenge each of you to learn how to solder. Learning this craft will come in handy throughout your career. If a cable breaks, instead of throwing it out, you could fix it yourself. In addition to soldering, a good understanding of safe and basic construction and electrical contracting skills will also go a long way towards your being able to get the job done, at a fraction of the cost and with twice the amount of personal pride. Go ahead … get a decent soldering iron and start making or fixing some cables for practice. I personally think that basic DIY skills are necessary for any self-respecting project studio owner. Have fun, visit YouTube, be safe and keep your quality control high.

Protect Your Investment

When you've spent several years amassing your studio through hard-earned sweat-equity and bucks, it's only natural that you'll want to take the necessary precautions to protect your investment. Obviously, the first line of defense is to protect your data. This is done through a rigorous and straightforward backup scheme (again, the general rule is that something isn't backed up unless it's saved in three places – preferably with one of the backups being stored off-site).

The next step in taking care of your studio is to protect your hardware and software investments as well, by making sure that they're properly insured. The best way to start this process is by contacting your trusted insurance agent or broker. If you don't have one, now's the time to get to know one. You might get some referrals from friends or people in your area and give them a call, set up some appointments and get several quotes.

If you haven't already done so, sit down and begin listing your equipment, their serial numbers and replacement values. Next you might consider taking pictures or a home movie of your listed studio assets. These steps will help your agent come up with an adequate replacement plan and will come in handy when filing a claim, should an unfortunate event occur. Being prepared isn't just for the Boy or Girl Scouts.

Taking Care of Your Most Valuable Investment ... You!

When buying equipment, make sure to take a breath and assess whether or not your pocketbook can handle the expense of that latest and greatest new toy. Will it fit into your budget? Can it be written off as a tax expense (it's always a good idea to make your business work for you, come tax time)? How can I recoup the cost within my current business plan?

In addition to all of the business and household expenses, I'd urge you (whenever possible) to open a low-to-no-fee savings account with your private banker (if you don't have one, visit your bank and get to know him/her … this always comes in handy in a pinch). The fact is, as an artist, you almost certainly won't be assured a steady income. For this reason alone, it's critical that you deal with your business and personal finances responsibly. If you don't know how to start, sit down and develop a plan with your newly found personal banker.

Update Your Software

Periodic software updates might help to solve some of those annoying problems that you've been dealing with in the studio. Many times the software that's been pressed onto a CD or DVD that came in the box will be out of date by the time it reaches you. For this reason, it's a good idea to check the Web regularly to see if there's a newer update version that can be loaded.

A word of caution, not all updates will be your friend. As with all things, Murphy's Law can creep into an update that can cause problems. Before doing an important update (although they all potentially are), you might consult the Web to see if others have had issues before you. Additionally, never do an update just before an important session or just before hopping on a plane; it's no fun being in a critical situation only to find that your update just crashed the system.

Read, Read, Read...

As electronic musicians, it's important that we stay on top of the new gear, the latest technological advances and new/old production techniques. How can we best do that? For starters, you can get the best results from your gear by reading your manuals. For those of us who hate reading manuals (and I head that list), get on the Web and ask your fave browser a question: Google? How long can a Thunderbolt cable be to run at 40 Gb/s? Or how do I connect my wireless controller app to my DAW?

In addition to the Web, various recording and electronic music mags (available both for free and through paid subscription) can be placed in the bathroom as reading material (something that's always been a personal joy for me). Books can come in really useful. Last, but definitely not least: go to industry-related conferences. It's one of the smartest things you can do to broaden your network beyond your back yard! Keeping on top of the tools, toys and techniques can definitely be fun! Get out there and grab yourself some knowledge that you can put into practice!

IN CONCLUSION

Obviously, the above lists and thoughts are just the beginning of an ever-changing set of tips that can help. The process of producing, recording and mixing in any type of studio environment is an ongoing, lifelong pursuit. Just when you think you've gotten it down, the technology or the nature of the project changes right under your nose and hopefully, you'll learn from this never-ending educational journey. Far more than just the technology, the process of coming up with your own production style and your own way of applying the tools, toys and techniques to a production is what makes us artists, whether you're in front of the proverbial glass and/or behind it. Over time, your own list of studio tips and tricks will grow. Take the time to write them down and pass them on to others on your Web blog and be open to taking the advice of your friends and colleagues. Use the trade mags, conventions and the Web to open yourself up to new insights, to better use the tools of your profession and to find new ways of doing "stuff". Learning is an ongoing, ever-changing process and most importantly: have fun along the way!

Hugs,
DMH