The world of modern music and sound production is multifaceted. It’s an exciting world of creative individuals: musicians, engineers, producers, manufacturers and businesspeople who are experts in such fields as music, acoustics, electronics, production, broadcast media, multimedia, marketing, graphics, law and the day-to-day workings of the business of music. The combined efforts of these talented people work together to create a single end product: marketable music. The process of turning a creative spark into a final product takes commitment, talent, a creative production team, a marketing strategy and, often, money. Over the history of recorded sound, the process of capturing music and transforming it into a marketable product has radically changed. In the past, the process of turning one’s own music into a final product required the use of a commercial recording studio, which was (and still is) equipped with specialized equipment and professional staff. With the introduction of the large-scale integrated (LSI) circuit, mass production and mass marketing—three of the most powerful forces in the Information Age—another option has arrived on the scene: the radical idea that musicians, engineers and/or producers can have their own project studio. Along with this concept comes the realization that almost anyone can afford, construct and learn to master a personal audio production facility. In short, we’re living in the midst of a techno-artistic revolution that puts more power, artistic control and knowledge directly into the hands of creative individuals from all walks of life.

On the techno side, those who are new to the world of modern digital audio and multitrack production, musical instrument digital interface (MIDI), mixing, remixing and their production environments should be aware that years of dedicated practice are often required to develop the skills that are needed to successfully master the art and application of these technologies. A person new to the recording or project studio environment (Figures 1.1 through 1.3) might easily be awestruck by the amount and variety of equipment that’s involved in the process; however, when we become familiar with the tools, toys and techniques of recording technology, a definite order to the studio’s makeup soon begins to appear, with each piece of equipment being designed to play a role in the overall scheme of music and audio production.
The goal of this book is to serve as a guide and reference tool to help you become familiar with the recording and production process. When used in conjunction with mentors, lots of hands-on experience, further reading, Web searching, soul searching and simple common sense, this book, I hope, will help you understand the equipment and day-to-day practices of sound recording and production.
This book, by its very nature, is an overview of recording technology and production. It’s a very in-depth one, but there’s absolutely no way that it can fully devote itself to all of the topics. However, we’re lucky enough to have the Web at our disposal to help us dig deeper into a particular subject that we might not fully understand, or simply want to know more about. Giga-tons of sites can be found that are dedicated to even the most offbeat people, places and things … and search engines can even help you find obscure information on how to fix a self-sealing stem-bolt on a 1905 steam-driven nut cracker. As such, I strongly urge you to use the Web as an additional guide. For example, if there’s a subject that you just don’t get—look it up on www.wikipedia.org or simply “Google” it. Of course, there’s a wealth of info that can be found by searching on the innumerable www.youtube.com videos that relate to any number of hardware systems, software toys and production techniques. Further information relating to this book and the recording industry at large can also be found at www.modrec.com. Digging deeper into the Web will certainly provide you with a different viewpoint or another type of explanation … and having that “AH HA!” lightbulb go off (as well as the “hokey pokey”) IS definitely what it’s all about.

David Miles Huber (www.modrec.com)

Although it’s taken the modern music studio about 90 years to evolve to its current level of technological sophistication, we have moved into an important evolutionary phase in the business of music and music production: the digital age. Truly, this is an amazing time in production history—we live in a time when we can choose between an amazing array of cost-effective and powerful tools for fully realizing our creative and human potential. As always, patience and a nose-to-the-grindstone attitude are needed in order to learn how to use them effectively; in short, it can free you up for the really important stuff: making music and audio productions. In my opinion, these are definitely the good ol’ days!
The commercial music studio (Figures 1.4 and 1.5) is made up of one or more acoustic spaces that are specially designed and tuned for the purpose of capturing the best possible sound on a recording medium. In addition, these facilities

**FIGURE 1.4**

**FIGURE 1.5**
Electronic Arts, Vancouver, Canada. (Courtesy of Walters-Storyk Design Group; designed by Beth Walters and John Storyk, www.wsdg.com. Photo by Robert Wolsch.)
are often structurally isolated in order to keep outside sounds from entering the room and being recorded (as well as to keep inside sounds from leaking out and disturbing the surrounding neighbors). In effect, the most important characteristics that go into the making and everyday workings of such a facility include:

- A professional staff
- Professional equipment
- Professional, yet comfortable working environment
- Optimized acoustic and recording environment
- Optimized control room mixing environment.

Recording studio spaces vary in size, shape and acoustic design (Figures 1.6 and 1.7) and usually reflect the personal taste of the owner or are designed to accommodate the music styles and production needs of clients, as shown by the following examples:

**FIGURE 1.6**  
Floor plan of Sony/Tree’s Music Studio, Nashville, TN.  
(Courtesy of Russ Berger Design Group, Inc., www.rbdg.com.)

**FIGURE 1.7**  
Floor plan of Paisley Park’s Studio A, Chanhassen, MN.  
(Courtesy of Paisley Park Studios.)
A studio that records a wide variety of music (ranging from classical to rock) might have a large main room with smaller, isolated rooms off to the side for unusually loud or soft instruments, vocals, etc.

A studio designed for orchestral film scoring might be larger than other studio types. Such a studio will often have high ceilings to accommodate the large sound buildups that are often generated by a large the number of studio musicians.

A studio used to produce audio for video, film dialogue, vocals and mixdown might consist of only a single, small recording space off the control room for overdub purposes.

In fact, there is no secret formula for determining the perfect studio design. Each studio design has its own sonic character, layout, feel and decor that are based on the personal tastes of its owners, the designer (if any), and the going studio rates (based on the studio’s investment return and the supporting market conditions).

During the 1970s, studios were generally small. Because of the advent of (and overreliance on) artificial effects devices, they tended to be acoustically “dead” in that the absorptive materials tended to suck the life right out of the room. The basic concept was to eliminate as much of the original acoustic environment as possible and replace it with artificial ambience.

Fortunately, since the mid-1980s, many commercial studios that have the physical space have begun to move back to the original design concepts of the 1930s and 1940s, when studios were larger. This increase in size (along with the addition of one or more smaller iso-booths or rooms) has revived the art of capturing the room’s original acoustic ambience along with the actual sound pickup (Figure 1.8). In fact, through improved studio design techniques, we have

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**FIGURE 1.8**

Skywalker Sound scoring stage with orchestra, Marin County, CA. (Courtesy of Skywalker Sound, www.skysound.com.)
learned how to achieve the benefits of both earlier and modern-day recording eras by building a room that absorbs sound in a controlled manner (thereby reducing unwanted leakage from an instrument to other mics in the room) while dispersing reflections in a way that allows the room to retain a well-developed reverberant and sonic personality of its own. This effect of combining direct and natural room acoustics is often used as a tool for “livening up” an instrument (when recorded at a distance), a technique that has become popular when recording live rock drums, string sections, electric guitars, choirs, etc.

**THE CONTROL ROOM**

A recording studio’s control room (Figures 1.9 through 1.11) serves a number of purposes in the recording process. Ideally, the control room is acoustically isolated from the sounds that are produced in the studio, as well as from the surrounding, outer areas. It is optimized to act as a critical listening environment that uses carefully placed and balanced monitor speakers. This room also houses the majority of the studio’s recording, control and effects-related equipment. At the heart of the control room is the recording console.

The recording console (also referred to as the board or desk) can be thought of as an artist’s palette for the recording engineer, producer and artist. The console allows the engineer to combine, control and distribute the input and output signals of most, if not all, of the devices found in the control room. The console’s basic function is to allow for any combination of mixing (variable control over relative amplitude and signal blending between channels), spatial positioning (left/right or surround-sound control over front, center, rear and sub), routing (the ability to send any input signal from a source to a destination) and switching for the multitude of audio input/output signals that are commonly encountered in an audio production facility.
Tape machines might be located towards the rear of a control room, while digital audio workstations (DAWs) are often located at the side of the console or at the functional center if the DAW serves as the room’s main recording/mixing device. Because of the added noise and heat generated by recorders, computers, power supplies, amplifiers and other devices, it’s becoming more common for equipment to be housed in an isolated machine room that has a window and door adjoining the control room for easy access and visibility. In either case, remote-control autolocator devices (which are used for locating tape and media position cue points) and DAW controller surfaces (which are used
for computer-based remote control and mixing functions) are often situated in the control room, near the engineer, for easy access to all recording, mixing and transport functions. Effects devices (used to electronically alter and/or augment the character of a sound) and other signal processors are also often placed nearby for easy accessibility; current designs (often being designed into an effects island or bay that is located directly behind the console). In certain situations, a facility might not have a large recording space at all but simply have a small or midsized iso-room for recording overdubs (this is often the case for rooms that are used in audio-for-visual post-production and/or music remixing).

As with recording studio designs, every control room will usually have its own unique sound, feel, comfort factor and studio booking rate. Commercial control rooms often vary in design and amenities—from a room that’s basic in form and function to one that is lavishly outfitted with the best toys and fully stocked kitchens in the business. Again, the style and layout are a matter of personal choice; however, as you’ll see throughout this book, there are numerous guidelines that can help make the most of a recording space. In addition to the layout, feel and equipment, it’s important to remember that the people (the staff, musicians and you)—not just the equipment—will often play a prominent role in capturing the feel of a performance.

THE CHANGING FACES OF THE MUSIC STUDIO BUSINESS

As we’ve noted, the role of the professional recording studio has begun to change as a result of upsurges in project studios, audio for video and/or film, multimedia and Internet audio. These market forces have made it necessary for certain facilities to rethink their operational business strategies. Often, these changes have met with some degree of success, as is illustrated by the following examples:

- Personal production and home project studios have greatly reduced the need for an artist or producer to have constant and costly access to a professional facility. As a result, many pro studios now cater to artists and project studio owners who might have an occasional need for a larger space or better equipped recording facility (e.g., for string overdubs or an orchestral session). In addition, after an important project has been completed in a private studio, a professional facility might be needed to mix the production down into its final form. Most business-savvy studios are only too happy to capitalize on these new and constantly changing market demands.

- Upsurges in the need for audio for video and film postproduction have created new markets that allow professional recording studios to provide services to the local, national and international broadcast and visual production communities. Creative studios often enter into lasting relationships with audio-for-visual and broadcast production markets, so as to
thrive in the tough business of music, when music production alone might not provide enough income to keep a studio afloat.

- Studios are also taking advantage of Internet audio distribution techniques by offering Web development, distribution and other services as an incentive to their clients.
- A number of studios are also jumping directly into the business of music by offering advisory, business and networking services to artists and bands ... sometimes signing the artists and funding tours in exchange for a piece of the business pie.

These and other aggressive marketing strategies (many of which may be unique to a particular area) are being widely adopted by commercial music and recording facilities to meet the changing market demands of new and changing media. No longer can a studio afford to place all of its eggs in one media basket. Tapping into changes in market forces and meeting them with new solutions is an important factor for making it (or simply keeping afloat) in the business of music production and distribution. Let’s take a moment to say that all-important word again: business. Make no mistake about it—starting, staffing and maintaining a production facility, as well as getting the clients’ music heard, is serious work that requires dedication, stamina, innovation, guts and a definite dose of craziness.

THE PROJECT STUDIO

With the advent of affordable digital audio and analog recording systems, it’s a foregone conclusion that the vast majority of music and audio recording/production systems are being built and designed for personal use. The rise of the project studio (Figures 1.12 and 1.13) has brought about monumental...
changes in the business of music and professional audio, in a way that has affected and altered almost every facet of the audio production community.

One of the greatest benefits of a project or portable production system centers around the idea that an artist can select from a wide range of tools and toys to generate specific sounds—or to get the particular sounds that he or she likes. This technology is often extremely powerful, as the components combine to create a vast palette of sounds and handle a wide range of task-specific functions. Such a system might include one or more keyboard synthesizers, synth modules, samplers, drum machines, a computer (with a digital audio workstation and sequencing package), effects devices and audio mixing capabilities.

Systems like these are constantly being installed in the homes of working and aspiring musicians. Their sizes range from a corner in an artist’s bedroom to a larger system that has been installed within a dedicated project studio. All of these system types can be designed to handle a wide range of applications and have the important advantage of letting the artist produce his or her music in a comfortable, cost-effective, at-home environment whenever the creative mood hits. Such production luxuries, which would have literally cost a fortune 20 years ago, are now within the reach of almost every working and aspiring musician. This revolution has been carried out under the motto “You don’t have to have a million-dollar studio to make good music.” Literally, the modern-day project and portable studio systems offer such a degree of cost-effective power and audio fidelity that they can often match the production quality of a professional recording facility … all it takes is knowledge, care, dedication and patience.

THE PORTABLE STUDIO

Of course, as laptops have grown in power, it has become a simple matter to load them with your favorite DAW software and audio interface, grab your
favorite mics and headphones, put the entire system in your backpack and hit the road running. Such a system is literally powerful enough to let you compose, produce and mix in the studio … or on the beach of a remote seaside island under battery power (Figure 1.14).

**Studio in the palm of your hand**

To take these ever-shrinking analogies to the nth degree, newer handheld recording systems that can literally fit in your pocket can be used to sample and record sounds with professional results, using either their internal high-quality mics or, in some cases, external professional mics under phantom power. Truly, it is a small world after all (Figure 1.15)!

**KNOWLEDGE IS POWER!**

In addition to personal drive and passion, one of the most crucial aspects of putting together a high-quality, cost-effective project studio is definitely knowledge. This all-important ingredient can be gained by:

- Reading about the equipment choices that are available to you on the Web or in the trade magazines
- Visiting and talking with others of like (and dissimilar) minds about their equipment and personal working styles
- Enrolling in a recording course that best fits your needs, working style and budget
- Getting your hands on equipment before you make your final purchases (for example, checking out the tools and toys at your favorite music store)
- Experience … always the best teacher.
The more you take the time to familiarize yourself with the options and possibilities that are available to you, the less likely you are to be unhappy with the way you’ll spent your hard-earned bucks. It is also important to point out that having the right equipment for the job isn’t always enough—obviously, it’s important to take the time to learn how to use your tools to their fullest potential. Whenever possible, read the manual and get your feet wet by taking the various settings, functions and options for a test spin … well before you’re under the time and emotional constraints of being in a session.

**WHATEVER WORKS FOR YOU**

As you begin to research the various types of recording and supporting systems that can be put to use in a project studio, you’ll find that a wide variety of options are available. There are literally hundreds, if not thousands, of choices for recording media, hardware types, software systems, speakers, effects devices … the list goes on. This should automatically tell us that no “one” tool is right for the job. As with everything in art (even the business of an art), there are many personal choices that can combine into the making of a working environment that’s right for you. Whether you:

- Work with a hard-disk or tape-based system
- Choose to use analog or digital (or both)
- Are a Mac or PC kind of person (practically a nonissue these days)
- Use this type of software or that …

it all comes down to the bottom line of how does it sound? How does it move the audience? How can it be sold? In truth, no prospective buyer will turn down a song because it wasn’t recorded on such-n-such a machine using
speakers made by so-n-so—it’s the feel, the emotions and the art that seals the deal.

**MAKING THE PROJECT STUDIO PAY FOR ITSELF**

Beyond the obvious advantage of being able to record when, where and how you want to in your own project studio, there are several additional benefits to working in a personal environment. Here’s a sample of how a project studio can help to subsidize itself, at any number of levels:

- Setting your own schedule and saving money while you’re at it! An obvious advantage of a project studio revolves around the idea that you can create your own music on your own schedule. The expense incurred in using a professional studio requires that you be practiced and ready to roll on a specific date or range of days. Having your own project studio can free you up to lay down practice tracks and/or record when the mood hits, without having to worry about punching the studio’s time clock.

- For those who are in the business of music, media production or the related arts or for those who wish to use their creativity as an outlet for their personal business, it’s possible to write off the equipment, building and utility payments as a tax-deductible expense (see Appendix B, “Tax Tips for Musicians”).

- An individual artist or group might consider preproducing a project in their own studio. These time and expense billings might also be tax-deductible expenses.

- The same artists might consider recording part or all of their production at their own project studio. The money saved (and deducted) could be spent on a better mixdown facility, production, legal issues (such as copyright) and/or marketing.

- The “signed artist/superstar approach” refers to the mega-artist who, instead of blowing the advance royalties on lavish parties in the studio (a sure way never to see any money from your hard work), will spend the bucks on building their own professional-grade project studio (Figure 1.16). After the project has been recorded, the artist will still have a tax-deductible facility that can be operated as a business enterprise. When the next project comes along, the artist will still have a personal facility in which to record and can put the advance bucks in the bank.

**LIVE/ON-LOCATION RECORDING: A DIFFERENT ANIMAL**

Unlike the traditional multitrack recording environment, where overdubs are often used to build up a song over time, *live/on-location recordings* are created on the spot, in real time, often during a single on-stage or in-the-studio performance, with little or no studio postproduction other than mixdown. A live recording might be very simple, possibly being recorded using only a few mics...
that are mixed directly to two or more tracks, or a more elaborate gig might call for a full-fledged multitrack setup, requiring the use of a temporary control room or fully equipped mobile recording van or truck (Figure 1.17) that can record to hard disk and/or tape. A more involved setup will obviously require a great deal of preparation and expertise, including a combined knowledge of the sound reinforcement and live recording techniques that are necessary to capture instruments in a manner that has enough isolation between the tracks so as to yield the highest degree of control over the individual instruments during the mixdown phase, yet still have a live performance feel.
Although the equipment and system setups will be familiar to any studio engineer, live recording differs from its more controlled studio counterpart in that it exists in a world where the motto is “you only get one chance.” When you’re recording an event where the artist is spilling his or her guts to hundreds or even thousands of fans, it’s critical for everything to run smoothly. Live recording usually requires a unique degree of preparedness, redundancy, system setup skills, patience, and, above all, experience.
INTRODUCTION

CHAPTER 1

AUDIO FOR VIDEO AND FILM

In recent decades, audio has become a much more important and integral part of video, film and broadcast production. Prior to the advent of multichannel television sound (MTS), the DVD, Blu-ray and surround sound, broadcast audio was almost an afterthought. With the introduction of these new technologies, audio has matured to being a highly respected part of film and video media production (Figure 1.18). With the common use of surround sound in the creation of movie sound tracks, along with the growing popularity of surround-sound in-home entertainment systems (and an ever-growing number of playback systems for sound, visual media and computer media), the public has come to expect higher levels of audio quality. In this day and age, MIDI, hard-disk recording, timecode, automated mixdowns and advanced processing have become everyday components of the audio environment, requiring that professionals be highly specialized and skilled in order to meet the demanding schedules and production complexities.

MULTIMEDIA

With the integration of text, graphics, MIDI, digital audio and digitized video into almost every facet of the personal computer environment, the field of multimedia audio has become a fast-growing, established industry that represents an important and lucrative source of income for both creative individuals and production facilities alike.

In addition to the use of audio in multimedia products for the Web, education, business and entertainment, most of the robot-zappin’, daredevil-flyin’ addicts who are reading this book are very aware that one of the largest and most lucrative areas of multimedia audio production is the field of scoring, designing and

FIGURE 1.18
Placing effects in an audio-for-film system. (Courtesy of Loud Technologies Inc., www.mackie.com.)
producing audio for computer games (Figure 1.19)—Zaaaaaaapppppppppppp! Like most subcategories within audio production, this field of expertise has its own set of technical and scheduling requirements that can be further researched by reading books on the subject and through educational studies (including the ever-present school of hard knocks).

**THE PEOPLE WHO MAKE IT ALL HAPPEN**

“One of the most satisfying things about being in the professional audio [and music] industry is the sense that you are part of a community.”

*Frank Wells, editor, Pro Sound News*

When you get right down to the important stuff, the recording field is built around pools of talented individuals and service industries who work together for a common goal: producing, selling and enjoying music. As such, it’s the people in the recording industry who make the business of music happen. Recording studios and other businesses in the industry aren’t only known for the equipment that they have but are often judged by the quality, knowledge, vision and combined personalities of their staff. The following sections describe but a few of the ways in which a person can be involved in this multifaceted industry. In reality, the types and descriptions of a job in this techno-artistic industry are only limited by the imagination. New ways of expressing a passion for music production and sales are being created every day … and if you see a new opportunity, the best way to make it happen is to roll up your sleeves and “just do it.”
Introduction

CHAPTER 1

The artist

The strength of a recorded performance begins and ends with the artist. All of the technology in the world is of little use without the existence of the central ingredients of human creativity, emotion and individual technique. Just as the overall sonic quality of a recording is no better than its weakest link, it is the performer’s job to see that the ingredient of all music—its inner soul—is laid out for all to experience and hear. After all is said and done, a carefully planned and well-produced recording project is simply a gilded framework for the music’s original drive, intention and emotion.

Studio musicians and arrangers

A project often requires additional musicians to add extra spice and depth to the artist’s recorded performance. For example:

- An entire group of studio musicians might be called on to provide the best possible musical support for a high-profile artist or vocalist.
- A project might require musical ensembles (such as a choir, string section or background vocals) for a particular part or to give a piece a fuller sound.
- If a large ensemble is required, it might be necessary to call in a professional music contractor to coordinate all of the musicians and make the financial arrangements. The project might also require a music arranger, who can notate and possibly conduct the various musical parts.
- A member of a group might not be available or be up to the overall musical standards that are required by a project. In such situations, it’s not uncommon for a professional studio musician to be called in.

The producer

Beyond the scheduling and budgetary aspects of coordinating a recording project, it is the job of a producer to help the artist and record company create the best possible recorded performance and final product that reflects the artist’s vision. A producer can be hired for a project to fulfill a number of possible duties or might even be given complete control over aspects of a project’s artistry, finances and program content. More likely, however, a producer will act collaboratively with an artist or group to guide them through the recording process to get the best possible final product. This type of producer will often:

- Assist in the selection of songs.
- Help to focus the artistic goals and performance in a way that best conveys the music to the targeted audience.
- Help to translate that performance into a final, salable product (with the technical and artistic help of an engineer and mastering engineer).

A producer can also be chosen for his or her ability to understand the process of creating a final recorded project from several perspectives: business, business connections (often, an extremely important ingredient), musical input, creative
insight and mastery of the recording process. Because engineers spend much of their working time with musicians and industry professionals with the intention of making their clients sound good, it’s not uncommon for an engineer to take on the role of producer or coproducer (by default or by mutual agreement). Conversely, as producers become increasingly more knowledgeable about recording technology, it’s increasingly common to find them on the other side of the glass, sitting behind the controls of a console.

**The engineer**

The job of an engineer can best be described as an interpreter in a technologically artistic field. He or she must be able to express the artist’s music and the producer’s concepts and intent through the medium of recording technology. This job is actually best classified as an art form, because both music and recording are totally subjective in nature and rely on the tastes and experiences of those involved. During a recording session, one or more engineers can be used on a project to:

- Conceptualize the best technological approach for capturing a performance or music experience.
- Document the process for other engineers or future production use.
- Place the musicians in the desired studio positions.
- Choose and place the microphones.
- Set levels and balances on the recording console or DAW mixing interface.
- Record the performance onto hard disk or tape.
- Overdub additional musical parts into the session that might be needed at a later time.
- Mix the project into a final master recording in any number of media and mono, stereo, and surround-sound formats.
- Help in meeting the needs for archiving and/or storing the project.

In short, engineers use their talent and artful knowledge of recording media technology to convey the best possible finished sound for the intended media, the client and the buying public.

**Assistant engineer**

Many studios often train future engineers (or build up a low-wage staff) by allowing them to work as assistants who can offer help to staff and visiting freelance engineers. The assistant engineer might do microphone and headphone setups, run tape machines or the DAW setup, help with session documentation, do session breakdowns and (in certain cases) perform rough mixes and balance settings for the engineer on the console. With the proliferation of freelance engineers (engineers who are not employed by the studio but are retained by the artist, producer or record company to work on a particular project), the role of the assistant engineer has become even more important. It’s often his or her role to guide freelance engineers through the technical
aspects and quirks that are peculiar to the studio … and to generally babysit the place.

Traditionally, this has been a no- or low-wage job that can expose a “newbie” to a wide range of experiences and situations. With hard work and luck, many assistants have worked their way into the hot seat whenever an engineer quits or is unexpectedly ill. As in life, there are no guarantees in this position—you just never know what surprises are waiting around the next corner.

**Maintenance engineer**

The maintenance engineer’s job is to see that the equipment in the studio is maintained in top condition and regularly aligned and repaired when necessary. Of course, with the proliferation of project studios, cheaper mass-produced equipment, shrinking project budgets and smaller staffs, most studios will not have a maintenance engineer on staff. Larger organizations (those with more than one studio) might employ a full-time staff maintenance engineer, whereas freelance maintenance engineers and technical service companies are often called in to service smaller commercial studios in both major and nonmajor markets.

**Mastering engineer**

Often a final master recording will need to be tweaked in terms of level, equalization (EQ) and dynamics so as to present the final “master” recording in the best possible sonic and marketable light. If the project calls for it, this job will fall to a mastering engineer, whose job it is to listen to and process the recording in a specialized, fine-tuned monitoring environment. In fact, mastering is also a techno-artistic field. Beauty is definitely in the ear of the beholding client and one mastering engineer might easily have a completely different approach to the sound and overall feel to a project than the next bloke. However, make no mistake about it—the mastering of a project can have a profound impact on the final sound of a project, and the task of finding the right mastering engineer for the job should never be taken lightly. Further info on mastering can be found in Chapter 18.

**The DJ**

Let’s not forget one of the more important links for getting the musical word out to the buying public: the disc jockey (DJ). Actually, the role of disc jockey can take on many modern-day forms:

- **On the air:** The DJ of the airwaves is still a very powerful voice for getting the word out about a particular musical product.
- **On the floor:** This DJ form often reinforces the messages from the airwaves or helps to promote the musical word in the mainstream and counter-cultural music environment.
- **On the Web:** Probably one of the more up-and-coming voices for getting the promotional word out to a large number of specially targeted audiences.
With the integration of video into the online and on-stage scene, the video jockey (VJ) has begun to cast a shadow across the virtual canvas of the music scene (Figure 1.20). Mixing videos and imagery in real time on stage and producing music videos for the Web is a relative must for many an aspiring artist and band.

STUDIO MANAGEMENT

Running a business in the field of music requires the special talents of businesspeople who are knowledgeable about the inner workings of promotion, the music studio, the music business and, above all, people. It requires constant attention to quirky details that would probably be totally foreign to someone outside the “biz.” Studio management tasks include:

- **Management:** The studio manager, who might or might not be the owner, is responsible for managerial and marketing decisions.
- **Bookings:** This staff person keeps track of most of the details relating to studio usage and billing.
- **Competent secretarial staff:** These assistants keep everyone happy and everything running as smoothly as possible.

Note, however, that any or all of these functions often vary from studio to studio. These and other equally important roles are required in order to successfully operate a commercial production facility on a day-to-day basis.

MUSIC LAW

It’s never good for an artist, band or production facility to underestimate the importance of a good music lawyer. When entering into important business relationships, it’s always a good idea to have a professional ally who can help you, your band or your company navigate the potentially treacherous waters of a poorly or vaguely written contract. Such a professional can serve a wide range of purposes, ranging from the primary duties of looking after their clients’ interests and ensuring that they don’t sign their careers away by entering into a life of indentured, nonprofit servitude, all the way to introducing an artist to the best possible music label.

Music lawyers, like many in this business, can be involved in the working of a business or career in many ways; hence, various fee structures are used. For example, a new artist might meet up with a friend who knows about a bright, young, freshly graduated music lawyer who has passed the bar exam. By
developing a relationship early on, there are any number of potentials for building trust, making special deals that are beneficial to both parties, etc. On the other hand, a more established lawyer could help solicit and shop a song, band or artist more effectively in a major music, TV or film market. As with most facets of the biz … answers to these questions are often situational and require intuition, careful reference checking and the building of trust over time. Again, it’s important to remember that a good music lawyer is often the unsung hero of many a successful career.

**WOMEN AND MINORITIES IN THE INDUSTRY**

Ever since its inception, males have dominated the recording industry. I remember many a session in which the only women on the scene were female artists, secretaries or studio groupies. Fortunately, over the years, women have begun to play a more prominent role, both in front of and behind the glass … and in every facet of studio production and the business of music as a whole (Figures 1.21). Fortunately, since the 1990s, most of the resistance to including new and fresh blood into the biz has been greatly diminished.

**BEHIND THE SCENES**

In addition to the positions listed earlier, there are scores of professionals who serve as a backbone for keeping the business of music alive and functioning. Without the many different facets of music business—technology, production, distribution and law—the biz of music would be very, very different. A small sampling of the additional professional fields that help make it happen includes:

- Artist management
- Artist booking agents
- A&R (artist and repertoire)
- Manufacturing
- Music and print publishing
- Distribution
- Web development
- Graphic arts and layout
- Equipment design
- Audio company marketing
- Studio management
- Live sound tour management
- Acoustics
- Audio instruction
- Club management

No matter who you are, where you’re from or what your race, gender, sexual or planetary orientation is, remember this universal truth: If your heart is in it and you’re willing to work hard enough, you’ll make it (whatever you perceive “it” to be).
Career Development

- Sound system installation for nightclubs, airports, homes, etc.
- ... and a lot more!

This incomplete listing serves as a reminder that the business of making music is full of diverse possibilities and extends far beyond the notion that in order to make it in the biz you’ll have to sell your soul or be someone you’re not. In short, there are many paths that can be taken in this techno-artistic business. Once you’ve found the one that best suits your own personal style, you can then begin the lifelong task of gaining knowledge and experience and pulling together a network of those who are currently working in the field.

It’s also important to realize that finding the career niche that’s right for you might not happen overnight. You might try your hand at one aspect of production, only to find that your passion is in another field. This isn’t a bad thing. As the saying goes, “Wherever you may be, there you are!” Finding the path that’s best for you is a lifelong ongoing quest … the general idea is to enjoy the ride.

CAREER DEVELOPMENT

It’s a sure bet that those who are interested in getting into the business of audio will quickly find out that it can be a tough nut to crack. For every person who makes it, a large number won’t. In short, there are a lot of people who are 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’s the key:

- A ton of self-motivation
- Good networking skills
- An ongoing and open willingness to learn and experiment.

The business of art (the techno-art of recording and music 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 your dream studio will be knocking on the door with an offer in hand (in fact, they won’t). 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, “knight” yourself on the shoulder with a sword (figuratively or literally) and say: “I am now a _______!” Fill in the blank with whatever you want to be (engineer, artist, producer, etc.) and simply become it … right there on the spot … Shazammm! Make up a business card, start a business and begin contacting artists to work with (or make the first step toward becoming the creative person you want to be). There are many ways to get to the top of your own personal

ANCIENT PROVERB

Being “in the right place at the right time” means being in the wrong (or right) place at the wrong time a thousand times!
mountain. For example, you could get a diploma from a school of education or from 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 always said: “Failure isn’t a bad thing … but not trying is!”

The other half 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 work at XYZ Studios, hang out without being in the way. You never know, the engineer might need some help or might know someone who can help get you into the proverbial door. The longer you stick with it, the more people you’ll meet, thus creating a bigger and stronger network than you thought could be possible.

So, when do you start this grand adventure? When do you start building your career? The obvious answer is RIGHT NOW. If you’re in school, you have already started the process. If you’re just hanging out with like-minded biz folks and or joined a local or national organization, that, too, is an equally strong start. Whatever you do, don’t wait until you graduate or until some magic date in the future, because waiting until then will just put you that much further behind.

Here are a few other tips on how to get started:

- Choose a mentor (sometimes they fall out of the sky, sometimes you have to develop the relationship).
- Contact companies in your area that might be looking for interns.
- Use your school counselors for intern placement.
- Pick the areas you want to live in (if that is a factor).
- Pick the companies and area that you’re interested in and target them.
- Visit or send resumes or electronic press kits (EPKs) to companies or studios that interest you.
- Send out lots of resumes.
- Make a personal Web page and a MySpace or Facebook page.
- Follow up with a phone call.
- Visit these companies just to hang out and see what they are like.
- Follow up with another phone call.

In short, make yourself visible. Try not to be afraid when sending out a resume, demo link or CD of your work or when asking for a job. The worst thing they can do is say “No.” You might even keep in mind that “No” could actually mean “No, not right now.” You might ask to see if this is the case. If so, they might take your persistence into account before saying “No” two or three times. By picking a market and particular area, blanketing that area with resumes or EPKs and knocking on doors, you just never know what might happen. If nothing materializes, just remember the self-motivation factor. I know it’s not easy, but
pick yourself up (again), reevaluate your strategies and start pounding the streets (again). Just remember, “Failing at something isn’t a bad thing … not trying is!”

**THE RECORDING PROCESS**

In this age of pro studios, project studios, digital audio workstations, groove tools and personal choices, it’s easy to understand how the “different strokes for different folks” adage applies to recording in that the differences between people and the tools they use allow the process of recording to be approached in many different ways. The cost-effective environment of the project studio has also brought music and audio production to a much wider audience, thus making the process much more personal. If we momentarily set aside the monumental process of creating music in its various styles and forms, the process of capturing sound onto a recorded medium will generally occur in eight distinct steps:

- Preparation
- Recording
- Overdubbing
- Mixdown
- Mastering
- Song sequence editing
- Product manufacturing
- Marketing and sales.

**Preparation**

One of the most important aspects of the recording process occurs *before* the artist and production team step into the studio: preparation. Questions like the following must be addressed long before going into the studio:

- What is the goal?
- What is the budget?
- What are the estimated studio costs?
- Will there be enough time to work on vocals, mixing, and other important issues before running out of money?
- How much will it cost to manufacture the CDs and/or records?
- What are the advertising costs?
- How will the music be distributed and sold? And to whom?
- Is the group practiced enough?
- If the project doesn’t have a producer, who will speak for the group when the going gets rough?
- Are the instruments, voices and attitudes ready for the task ahead?
- Are there any legal issues to consider?
- How and when will the website be up and running?

These questions and a whole lot more will have to be addressed before it comes time to press the big red record button.
2 Recording

The first phase in multitrack production is the recording process. In this phase, one or more sound sources are picked up by a microphone or are recorded directly (as often occurs when recording electric or electronic instruments) to one or more of the isolated tracks of a recording system. Of course, multitrack and hard-disk recording technologies have added an amazing degree of flexibility to the process by allowing multiple sound sources to be captured onto and played back from isolated tracks in a disk- or tape-based environment. Because the recorded tracks are isolated from each other—with disk-based DAWs offering an almost unlimited track count and tape capabilities usually being offered in track groups of eight (e.g., 8, 16, 24, 32, 48)—any number of instruments can be recorded and rerecorded without affecting other instruments. In addition, recorded tracks can be altered, added and edited at any time in order to augment the production.

Beyond the concept of capturing the best performance and sound to a recorded media, one of the key ideas within multitrack production is isolation. By recording a single instrument to a dedicated track (or group of tracks), it’s possible to vary the level, spatial positioning (such as left/right or surround panning), EQ and signal processing and routing without affecting the level or tonal qualities of other instruments that are recorded onto an adjacent track or tracks (Figure 1.22). This isolation allows leakage from nearby instruments or mic pickups to be reduced to such an insignificant level that individual tracks can be rerecorded and/or processed at a later time (during mixdown) without affecting the overall mix.
The basic tracks of a session can, of course, be built up in any number of ways. For example, the foundation of a session might be recorded in a traditional fashion, involving such acoustic instruments as drums, guitar, piano and a scratch vocal (used as a rough guide throughout the session until the final vocals can be laid down). Alternatively, these tracks might be made up of basic electronic music loops, samples or synth tracks that will need to be transferred to tape or imported into a digital audio workstation (DAW). The combinations of working styles, studio miking, isolation and instrument arrangements are—literally—limitless and, whenever possible, are best discussed or worked out in the preparation stages.

From a technical standpoint, the microphones for each instrument are selected either by experience or by experimentation and are then connected to the desired console or audio interface inputs. Once done, the mic type and track selection should be noted on a track sheet or piece of paper for easy input and track assignment in the studio or for choosing the same mic during a subsequent overdub session.

Some engineers find it convenient to standardize on a system that uses the same console mic input and tape/DAW track number for an instrument type at every session. For example, an engineer might consistently plug their favorite kick drum mic into input #1 and record it onto track #1, the snare mic onto #2, and so on. That way, the engineer instinctively knows which track belongs to a particular instrument without having to think too much about it. When recording to a DAW, track names, groupings and favorite identifying track colors can also be selected so as to easily identify the instrument or grouped type.

Once the instruments, baffle (a sound-isolating panel) and mics have been roughly placed and headphones that are equipped with enough extra cord to allow free movement have been distributed to each player, the engineer can now get down to business by using a setup sheet to label each input strip on the console with the name of the corresponding instrument. Label strips (which are often provided just below each channel input fader) can be marked with an erasable felt marker, or the age-old tactic of rolling out and marking a piece of paper masking tape could be used. (Ideally, the masking tape should be the type that doesn’t leave a tacky residue on the console surface.) When recording to a DAW, tracks names should be typed in at this time, which will be displayed on the screen and above the track strips on certain controller readout displays.

At this time, the mic/line channels can be assigned to their respective tracks. Make sure you fully document the assignments and other session info on the song or project’s track sheet (Figure 1.23). If a DAW is to be used, make sure each input track in the session is named for easy reference and track identification.

After all of the assignments and labeling have been completed, the engineer then can begin the process of setting levels for each instrument and mic input by asking each musician to play solo or by asking for a complete run-through
of the song and listening one input at a time (using the solo function). By placing each of the channel and master output faders at their unity (0 dB) setting and starting with the EQ settings at the flat position, the engineer can then check each of the track meter readings and adjust the mic preamp gains to their optimum level while listening for potential preamp overload. If necessary, a gain pad can be inserted into the path in order to help eliminate distortion.

After these levels have been set, a rough headphone mix can be made so that the musicians can hear themselves. Mic choice and/or placements can be changed or EQ settings can be adjusted, if necessary, to obtain the sound the producer wants on each instrument, and dynamic limiting or compression can be carefully inserted and adjusted for those channels that require dynamic attention. It’s important to keep in mind that it’s easier to change the dynamics of a track later during mixdown (particularly if the session is being recorded digitally) than to undo any changes that have been made during the recording phase.

Once this is done, the engineer and producer can listen for extraneous sounds (such as buzzes or hum from guitar amplifiers or squeaks from drum pedals) and eliminate them. Soloing the individual tracks can ease the process of selectively listening for such unwanted sounds and for getting the best sound from
The recording process begins with setting up the instruments. Each instrument should be placed in a location that minimizes interference from other tracks. If multiple mics are used, they should be carefully balanced and adjusted to ensure that each instrument is recorded cleanly. After setting the mics, the musicians should perform a few practice rundowns to test the overall sound of the instruments together. This is a good opportunity to make any necessary adjustments to the soundboard or digital audio workstation (DAW) settings. During the practice session, the engineer can also check the headphone mix and make any necessary adjustments to ensure that the musicians hear themselves clearly.

During the practice rundown, the engineer can also make final adjustments to the recording levels and the headphone monitor mix. He or she can check the headphone mix either by putting on a pair of phones connected to the cue system or by routing the mix to the monitor loudspeakers. If the musicians can’t hear themselves properly, the mix should be changed to satisfy their monitoring needs (fortunately, this can be done without regard to the recorded track levels). If several cue systems are available, multiple headphone mixes can be built up to satisfy those with different balance needs. During a loud session, the musicians might ask you to turn up their level (or the overall headphone mix), so they can hear themselves above the ambient room leakage. It’s important to note that high sound-pressure levels can cause the pitch of instruments to sound flat, so musicians might have trouble tuning or even singing with their headphones on. To avoid these problems, tuning shouldn’t be done while listening through phones. The musicians should play their instruments at levels that they’re accustomed to and adjust their headphone levels accordingly. For example, they might put only one cup over an ear, leaving the other ear free to hear the natural room sound.

The importance of proper headphone levels and a good cue balance can’t be stressed enough, because they can either help or hinder a musician’s overall performance. The same situation exists in the control room with respect to high monitor-speaker levels: Some instruments might sound out of tune, even when they aren’t, and ear fatigue can easily impair your ability to properly judge sounds and their relative balance.

During the practice rundown, it’s also a good idea to ask the musician(s) to play through the entire song so you’ll know where the breaks, bridges and any other point of particular importance might be. Making notes and even writing down or entering the timing numbers (into a DAW as session markers or a recorder’s transport autolocator) can help speed up the process of finding a section during a take or overdub. You can also pinpoint the loud sections at this time, so as to avoid any overloads. If compression or limiting is used, you
might keep an ear open to ensure that the instruments don’t trigger an undue amount of gain reduction. (If the tracks are recorded digitally, you might consider applying gain reduction during mixdown.) Even though an engineer might ask each musician to play as loudly as possible, they’ll often play even louder when performing together. This fact may require further changes in the mic preamp gain, recording level and compression/limiting thresholds. Soloing each mic and listening for leakage can also help to check for separation and leakage between the instruments. If necessary, the relative positions of mics, instruments and baffles can be changed at this time.

### 3 Overdubbing

Once the basic tracks have been laid down, additional instrument and/or vocal parts can be added in a process known as **overdubbing**. During this phase, additional tracks are added by monitoring the previously recorded tape tracks (usually over headphones) while simultaneously recording new, doubled or augmented instruments and/or vocals onto one or more available tracks of a DAW or recorder (Figure 1.24). During the overdub (OD) phase, individual parts are added to an existing project until the song or soundtrack is complete. If the artist makes a mistake, no problem! Simply recue the DAW or rewind the tape back to where the instrument begins and repeat the process until you’ve captured the best possible take. If a take goes *almost* perfectly except for a bad line or a few flubbed notes, it’s possible to go back and rerecord the offending segment onto the same or a different track in a process known as **punching in**. If the musician lays down his or her part properly and the engineer dropped in and out of record at the correct times (either manually or under automation), the listener won’t even know that the part was recorded in multiple takes … such is the magic of the recording process!

![FIGURE 1.24](image)

Overdubbing allows instruments and/or vocals to be added at a later time to existing tracks on a multitrack recording medium.
In an overdub session, the same procedure is followed for mic selection, placement, EQ, and level as they occurred during a recording session (now you're beginning to see the need for good documentation). If only one instrument is to be overdubbed, the problem of having other instrument tracks leak into the new track won’t exist. However, care should be taken to ensure that the headphones aren’t too loud or improperly placed on the artist’s head, because excessive leakage from the headphone mix can occur.

The natural ambience of the session should be taken into account during an overdub. If the original tracks were made from a natural, roomy ensemble, it could be distracting to hear an added track that was obviously laid down in a different (usually deader) room environment.

If the recorder to be used is analog, it should be placed in the master sync mode to ensure that the previously recorded tracks will play back in sync from the record head (see Chapter 5 for more info). The master sync mode is set either at the recorder or using its autolocator/remote control. Usually, the tape machine can automatically switch between monitoring the source (signals being fed to the recorder or console) and tape/sync (signals coming from the playback or record/sync heads). When recording to a DAW or tape, the control room monitor mix should prominently feature the instruments that’s being recorded, so mistakes can be easily heard. During the initial rundown, the headphone cue mix can be adjusted to fit the musician’s personal taste.

**Mixdown**

When all of the tracks of a project have been recorded, assembled and edited, the time has come to individually **mix** the songs into their final media forms (Figure 1.25). The mixdown process occurs by routing the various tracks of a DAW or tape-based recorder through a hardware or DAW virtual mixing console to alter the overall session’s program with respect to:

![Figure 1.25](image-url)
Introduction  CHAPTER 1

- Relative level
- Spatial positioning (the physical 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 that it “fits” better 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).

Once ready, the console can be placed into the mixdown mode (or each input module can be switched to the line or tape position) and the fader label strips can be labeled with their respective instrument names. Channel and group faders should be set to unity gain (0 dB) and the master output faders should likewise be set with the monitor section being switched to feed the mixdown signal to the appropriate speakers. If a DAW is being used to create the final mix, a basic array of effects can be programmed into the session mixer and, if available, a controller surface can be used to facilitate the mix by giving you hands-on control. Note that when a DAW’s own virtual mixer is used, it’s possible to virtually mix down or “export” the mix to a specified mono, stereo or surround soundfile without the need for an external hardware console.

The engineer can then set up a rough mix of the song by adjusting the levels and the spatial pan positions. The producer then listens to this mix and might ask the engineer to make specific changes. The instruments are often soloed one by one or in groups, allowing any necessary EQ changes to be made. The engineer, producer, and possibly the group can then begin the cooperative process of “building” the mix into its final form. Compression and limiting can be used on individual instruments as required, either to make them sound fuller, more consistent in level, or to prevent them from overloading the mix when raised to the desired level. At this point, the console’s automation features, if available, can be used. Once the mix begins to take shape, reverb and other effects types can be added to shape and add ambience in order to give close-miked sounds a more “live,” spacious feeling, as well as to help blend the instruments.

If the hardware recording console isn’t automation assisted, the fader settings will have to be changed during the mix in real time. This means that the engineer will have to memorize the various fader moves (often noting the transport counter to keep track of transition times). If more changes are needed than the engineer can handle alone, the assistant, producer or artist (who probably knows the transition times better than anyone) can help by controlling certain faders or letting you know when a transition is coming up. It’s usually best, however, if the producer is given as few tasks as possible, so that he or she can concentrate fully on the music rather than the physical mechanics of the mix. The engineer then listens to the mix from a technical standpoint to detect any sounds or noises that shouldn’t be present. If noises are recorded on tracks that
aren’t used during a section of a song, these tracks can be muted until needed. After the engineer practices the song enough to determine and learn all the changes, the mix can be recorded and faded at the end. The engineer might not want to fade the song during mixdown, because it will usually be performed after being transferred to a DAW (which can perform a fade much more smoothly than even the smoothest hand). Of course, if automation is available or if the mix is performed using a DAW, all of these moves can be performed much more easily and with full repeatability by using the software’s own mix automation.

It’s usually important for levels to be as consistent as possible between the various takes and songs, and it’s often wise to monitor at consistent, moderate listening levels. This is due to the variations in our ear’s frequency response at different sound-pressure levels, which could result in inconsistencies between song balances. Ideally, the control room monitor level should be the same as might be heard at home, over the radio or in the car (between 70 and 90 dB SPL), although certain music styles will “want” to be listened to at higher levels. Once the final mix or completed project master is made, you’ll undoubtedly want to listen to the mix over different speaker systems (ranging from the smallest to the biggest/baddest you can find). It’s usually wise to run off a few copies for the producer and band members to listen to at home and in their cars. In addition, the mix should be tested for mono–stereo/surround compatibility to see if any changes in instrumental balances have occurred. If there are any changes in frequency balances or if phase becomes a problem when the mix is played in mono, the original mix might have to be modified.

Mastering

Once done, the final, edited mixdown of a project might be sent to a mastering engineer so that fine-tuning adjustments can be made to the overall recording with respect to:

- Relative level balancing between songs within the project
- Dynamic level (altering the dynamics of a song so as to maximize its level for the intended media or to tighten up the dynamic balance, overall or within certain frequency bands)
- Equalization
- Overall level.

In essence, it’s the job of a qualified mastering engineer to smooth over any level and spectral imbalances within a project and to present the final, recorded product in the best possible light for its intended media form. Commonly, the producer and/or artist will be faced with the question of whether to hire a qualified or well-known mastering engineer to put the finishing touches on a master recording, or master the project themselves into a final product (using the producer’s, engineer’s or artist’s talents). These questions should be thoroughly discussed in the preplanning phase, allowing for an on-the-spot change of plans. Who knows—you just might try mastering the project yourself. If it
doesn’t work out, you can always work with a trusted mastering engineer to present your masterpiece into its best possible form.

6 **Song sequence editing**

With the advent of the DAW, the relatively cumbersome process of sequencing music tracks in the analog domain using magnetic tape has given way to the faster, easier and more flexible process of editing the final masters from hard disk. Using this system, all of the songs can be loaded from their final media form to hard disk or exported as individual mixdown files and then loaded into a workstation, digital audio editor or CD burning program for assembly into a final, edited form.

Whenever the various soundfiles of a project are loaded into a DAW, audio editor or certain CD burning programs, each song or program segment can be tailored in a number of ways:

- The start and end points can be located and defined for each song.
- Each song can then be individually processed using EQ, overall level, dynamics, etc.
- The proper fades and silence gaps can be entered into the edit session.
- The completed master can then be transferred to a CD-R or final mastered media.

Whenever a basic CD burning program is used to create a final master (or the datafile for mass producing any number of CD-R discs), each soundfile will need to be loaded into the playlist in its final processed and edited form. Most of these programs will let you enter gaps of silence (index marker gaps) between each song in seconds and possibly subdivisions of a second, while leaving a 2-second gap at the very beginning of the program (which is necessary as part of the Red Book CD-Audio standard).

When sequencign a project, the length of time between the end of one song and the beginning of the next can be constant, or the timings can vary according to the musical relationship between the songs. Decreasing the time between them can make a song seem to blend into the next (if they’re similar in mood) or could create a sharp contrast with the preceding song (if the moods are dissimilar). Longer times between songs help the listeners get out of the mood of the previous song and prepare them for hearing something that might be quite different.

It’s always a good idea to make at least one master copy of the final mix soundfiles and session data from the original files as a backup (just in case the record company, producer or artist wants to make changes at a later date). This simple precaution could save you a lot of time and frustration.

**ANALOG SEQUENCE EDITING**

Although the process of assembling a final master in the analog domain occurs less frequently than in the digital realm, it’s still done. During this process, the
engineer edits the original mixes out from their respective reels and begins the process of splicing them together into a final sequence on a master reel set. At this time, the level test tones (which were laid down at the beginning of the mixdown session) should be placed at the beginning of side one. Once this is done, the mix master in/out edits should be tightened (to eliminate any noise and silence gaps) by listening to the intro and outro at high volume levels, while the heads are in contact with the tape (this might require that you place the transport into the edit mode). The tape can then be moved back and forth (a process known as “jogging” or “rocking” the tape) to the exact point where the music begins (intro) and after it ends (outro). Once the in (or out) point is positioned over the playback head, the exact position is marked with a grease pencil. If there’s no noise directly in front of this spot, it’s a good practice to cut the tape half an inch before the grease pencil mark as a safety precaution against editing out part of the first sound. If there is noise ahead of the first sound, the tape should be cut at the mark and a leader inserted at that point. Paper (rather than plastic) leader tape is used because plastic will often cause static electricity pops.

The tail of the song might need to be monitored at even higher volume levels because it’s usually a fade-out or an overhang from the last note and is, therefore, much softer than the beginning of the song. The tape is marked and cut just after the last sound dies out to eliminate any low-level noises and tape hiss. Of course, the length of time between the end of the song and the beginning of the next can be constant in a sequenced project, or the timings can vary according to the musical relationship between the songs.

Product manufacturing

Last but never least in the production chain is the process of manufacturing the master recording into a final, salable product. Whether the final product is a compact disc or digital download, this process should be carefully overseen to ensure that the final product doesn’t compromise all of the blood, sweat, tears and bucks that have gone into the creation of a project. These manufacturing phases should be carefully scrutinized, checked, and rechecked:

- Creating a manufacture master
- Art layout and printing
- Product packaging.

Whenever possible, ask for a proof copy of the final duplicated product and artwork before it is mass produced. Receiving 10,000 copies of your hard-earned project that aren’t what you wanted is as bad as being handed an accordion in hell. Further info on this topic can found in Chapter 19.

Marketing and sales

Although this section is mentioned last, it is by far one of the most important areas to be dealt with when contemplating the time, talent and financial effort
involved in creating a recorded product. For starters, the following questions (and more) should all be answered long before the Record button is pressed and the first downbeat is played:

- Who is my audience?
- Will the project be distributed by a record company, or will I try to sell it myself?
- What should the final product look and sound like?
- What’s my budget and how much is this going to cost me?

In this short section, I won’t even attempt to cover this extremely important and complex topic, because these subjects have been fully discussed in a number of well-crafted books and searchable online articles.

**THE TRANSDUCER**

Quite simply, a *transducer* is any device that changes one form of energy into another, corresponding form of energy. For example, a guitar is a transducer in that it takes the vibrations of picked or strummed strings (the medium), amplifies them through a body of wood, and converts these vibrations into corresponding sound-pressure waves, which are then perceived as sound (Figure 1.26).

A microphone is another example of a transducer. Here, sound-pressure waves (the medium) act on the mic’s diaphragm and are converted into corresponding electrical voltages. The electrical signal from the microphone can then be amplified (not a process of transduction because the medium stays in its electrical form) and fed to a recording device. The recorder is a device that changes electrical voltages into analogous magnetic flux signals on magnetic tape or into representative digital data that can be encoded onto tape, hard disk or other type of disc. On playback, the stored magnetic signals or digital data are converted back to their original electrical form, amplified and then fed to a speaker system. The speakers convert the electrical signal back...
into a mechanical motion (by way of magnetic induction), which, in turn, recreates the original air-pressure variations that were picked up by the microphone ... and ta-da ... we have sound!

As can be seen from Table 1.1, transducers can be found practically everywhere in the audio environment. In general, transducers (and the media they use) are often the weakest link in the audio system chain. Given our current technology, the process of changing the energy in one medium into a corresponding form of energy in another medium can’t be accomplished perfectly (although digital coding gets very close). Noise, distortion and (often) coloration of the sound are introduced to some degree and, unfortunately, these effects can only be minimized, not eliminated. Differences in design are another major factor that

<table>
<thead>
<tr>
<th>Transducer</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ear</td>
<td>Sound waves in air</td>
<td>Nerve impulses in the brain</td>
</tr>
<tr>
<td>Microphone</td>
<td>Sound waves in air</td>
<td>Electrical signals in wires</td>
</tr>
<tr>
<td>Record head</td>
<td>Electrical signals in wires</td>
<td>Magnetic flux on tape</td>
</tr>
<tr>
<td>Playback head</td>
<td>Magnetic flux on tape</td>
<td>Electrical signals in wires</td>
</tr>
<tr>
<td>Phonograph cartridge</td>
<td>Grooves cut in disk surface</td>
<td>Electrical signals in wires</td>
</tr>
<tr>
<td>Speaker</td>
<td>Electrical signals in wires</td>
<td>Sound waves in air</td>
</tr>
</tbody>
</table>

FIGURE 1.27
Example of an all-digital production studio. (Courtesy of Digidesign, a division of Avid Technology, Inc., www.digidesign.com.)
can affect sound quality. Even a slight design variation between two micro-
phones, speaker systems, digital audio converters, guitar pickups or other trans-
ducers can cause them to sound quite different. This factor, combined with the
complexity of music and acoustics, helps makes the field of recording the sub-
jective and personal art form that it is.

It’s interesting to note that fewer transducers are used in an all or largely digital
recording system (Figure 1.27). In this situation, the acoustic waveforms that
are picked up by a microphone are converted into electrical signals and then
converted into digital form by an analog-to-digital (A/D) converter. The A/D
converter changes these continuous electrical waveforms into corresponding
discrete numeric values that represent the waveform’s instantaneous, analogous
voltage levels. Arguably, digital information has the distinct advantage over
analog in that data can be transferred between electrical, magnetic and optical
media with little or no degradation in quality. Because the information contin-
ues to be stored in its original, discrete binary form, no transduction process is
involved (i.e., only the medium changes, while the data representing the actual
information doesn’t change). Does this mean that digital’s better? It’s just
another way of expressing sound through a medium, which, in the end, is just
one of the many possible artistic and technological choices in the making and
recording of sound and music.