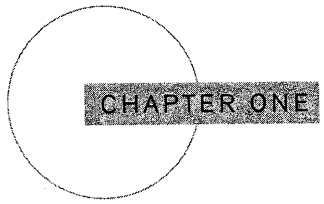

CAUSES

from M. Katz, Capturing Sound: How Technology Has Changed Music, 2004.

Anytown, U.S.A., 1905: a family and several neighbors stand in the parlor of a modest home, staring with equal parts curiosity and skepticism at one of the technological marvels of the day. Staring back at them is the unblinking eye of a megaphone-shaped brass horn. It protrudes about two feet from a small wooden cabinet with a crank on one side and a felt-covered metal plate on top. The marvel is a phonograph, or "talking machine," as it was commonly called.[1]

The gentleman of the house takes a heavy black disc, grooved on one side and smooth on the other, and places it over the spindle with the label facing up. He turns the crank several times, gingerly sets the needle on the outermost groove, and hurries back to his chair. Everyone stares at the phonograph in eager anticipation. The disc spins quickly, and above the whooshing and crackling the machine begins to sing. It sounds to them like actual voices and instruments, albeit in miniature. It is hard to believe that little more than a needle and a record can bring the performers to life, just as if they were right there in the parlor.

After three minutes of rapt attention, the small audience breaks into spontaneous, unselfconscious applause and calls for more. Before the man can replay the record, a small child runs to the machine, peering under the table and jumping up to look into the horn. Everyone laughs when it becomes clear that the boy is looking for the musicians! After each record is played several times, the crowd disperses, with everyone wondering if wonders will never cease.[2]

This quaint vignette may seem unremarkable, but it reveals a revolution in the making. Those gathered around the phonograph were experiencing music in ways unimaginable not so many years before. They were hearing performers they could not see and music they could not normally bring into their homes. They could listen to the same pieces over and again without change. And *they* ultimately decided what they were to hear, and when, where, and with whom. All of this was made possible by the distinctive characteristics of sound recording technology. This is a crucial point, for as I explained in the introduction, if we understand the nature of recording, we can understand how users have adapted to, compensated for, and exploited the technology. It is in these actions that we discover the influence of recording; it is here that we find phonograph effects.

Each of the following seven sections examines a distinctive and defining trait of sound recording technology. This chapter is intentionally broad, moving quickly and often between written and oral musical cultures, East and West, popular and classical, the late nineteenth century and the early twenty-first. Such breadth is imperative, for the impact of recording is strongly shaped by the time, place, and context in which the technology is used. As we will see, phonograph effects are not simply technological phenomena.

TANGIBILITY

Before even setting needle to groove, the operator of the phonograph in that Anytown parlor encountered one of the most remarkable characteristics of recorded sound: its tangibility. Taking the disc out of its paper sleeve, he held the frozen sound in his hands, felt the heft of the shellac, saw the play of light on the disc's lined, black surface. He was holding a radically new type of musical object, for whereas scores prescribe or describe music, and instruments generate music, recordings preserve actual sounds.

This tangibility has allowed extraordinary changes in the way music

can be experienced. Prior to the invention of the phonograph, Karl Marx observed what must have seemed to be an unchangeable truth about music. "The service a singer performs for me," he noted, "satisfies my aesthetic need, but what I consume exists only in an action inseparable from the singer, and as soon as the singing is over, so too is my consumption."[3] When sound is recorded and preserved in a physical medium, however, the listener's consumption need not end when the singing is over, for the music can be separated from the performer and be replayed without the artist's consent. Indeed, the portability and repeatability of recorded sound—two of the technology's crucial attributes to be discussed in this chapter—derive from its tangibility. Yet tangibility is not simply a "meta-trait." In itself the material preservation of sound—"the stockpiling of music," in Jacques Attali's arresting phrase—deeply influences the consumption and production of music.[4] To illustrate this point I want to explore briefly the impact of recording's tangibility as revealed in, first, record collecting and, second, the physical characteristics of cassettes and compact discs.

As Evan Eisenberg has pointed out, "For the listening public at large, in every century but this one [now two], there was no such thing as collecting music."[5] Certainly, enthusiasts sought out instruments, manuscripts, program books, autographs, and the like. Record collecting, however, represents a new relationship with music, for these collectors seek neither the means to create sound nor mementos of it, but sound itself.

This new relationship is most vividly illuminated in its pathological extremes. Record collecting has long been described (affectionately, for the most part) as an illness or addiction. In 1924 the British magazine *Gramophone* playfully warned of "gramomania," alerting readers to its "insidious approach, its baneful effects, its ability to destroy human delights."[6] Two years later, on the other side of the Atlantic, the *Phonograph Monthly Review* asked readers to recount their most dire sacrifices in the name of grooved shellac. One contestant, with the self-deprecating pseudonym "Adam Pfuhl," spun a woeful tale of spending all the money for his family's Christmas presents on records; another told of literally selling his shirt to support his habit.[7] Appropriately—or perhaps not—the winning contestants received gift certificates for records. Nick Hornby's 1995 novel *High Fidelity* demonstrates that the disease is far from eradicated. Rob, the owner of a second-hand record shop and a passionate collector of pop music discs, sympathetically observes the habits of his more obsessive customers:

> You can spot the vinyl addicts because after a while they get fed up with the rack they are flicking through, march over to a completely different section of the shop, pull a sleeve out from the middle somewhere, and come over to the counter; this is because they . . . suddenly sicken themselves with the amount of time they have wasted looking for something they don't really want. I know that feeling well: . . . it is a prickly, clammy, panicky sensation, and you go out of the shop reeling. You walk much more quickly afterward, trying to recapture the part of the day that has escaped.[8]

In the world of hip-hop, hunting for LPs is known as "digging in the crates," a reference to the way in which discs are typically stored and displayed in second-hand stores and thrift shops. As we will see in chapter 6, digging is a way of life among hip-hop DJs, for their creativity is judged in part on their ability to find rare, unusual, and catchy tracks. The 1992 rap song "Diggin' in the Crates," by Showbiz and A.G., makes it clear that this activity is as addictive as any form of collecting: "Buying old records is a habit/You know I've got to have it."[9] The darker side of this addiction comes out in Pearl Jam's 1994 rocker "Spin the Black Circle," in which a phonograph stylus is like a hypodermic needle and the act of playing an LP parallels the ritual of shooting up heroin.[10]

Such addictions are directly connected to the materiality of recorded music, for it is often the physical artifacts themselves, more than the sound of the music, that collectors find meaningful. In speaking of his records, *High Fidelity*'s Rob explains: "This is my life, and it's nice to be able to wade in it, immerse your arms in it, touch it."[11] To be sure, record collecting involves more than music. Collecting is about the thrill of the hunt, the accumulation of expertise, the display of wealth, the synesthetic allure of touching and seeing sound, the creation and cataloging of memories, and the pleasures (and dangers) of ritual. Record collecting represents a relationship with music that helps us, in some part small or large, to articulate and, indeed, shape who we are.[12]

The relative affordability of these musical objects is also significant, and

has affected all types of listeners, whether the sweaty-palmed disc junkie or the casual consumer. Recordings are often (though not always) cheaper than tickets for concerts of the same fare, and their affordability may affect listeners' access to music. As the next chapter will show, the inexpensive disc was hailed as one of the keys to helping America become a more "musical" nation in the first decades of the twentieth century, for cheap records of the classics meant that access to "good music" need not be the exclusive domain of the rich. And one of the crucial issues in the debate over file-sharing—which I explore in the book's final chapter—is that these sound files are being collected by the millions free of charge, much to the delight of many listeners and to the outrage of the recording industry. But as we will see, MP3s and the like are a special case, for they are not tangible in the way traditional media are.

To understand the full significance of the tangibility of recorded sound, we must know something about the specific physical characteristics of the various media, and the differences among them. Consider, for example, the cassette tape. Developed in 1963 by the Dutch company Philips, the small plastic cassette was markedly different from its predecessor, the long-playing record. Perhaps most important was that its physical characteristics made recording and duplication much easier and cheaper than had been possible in the LP era. As Peter Manuel asserts in his 1993 book *Cassette Culture,* these attributes have led to enormous changes in music and musical life. One compelling case in point, the focus of Manuel's research, is North Indian popular music. Before 1978 cassettes were rare in India (LPs being dominant), and a single entity, the Gramophone Company of India (GCI), controlled the nation's recorded music. GCI's monopoly led to an extreme concentration of performers and styles. Most of its releases were of a particular type of love song, an adaptation of the classical *ghazal* form, updated for use in films; moreover, nearly all of the tens of thousands of songs—which even to fans tended to sound similar—were recorded by just a handful of long-lived singers. The resulting homogenization of Indian popular music is hard to comprehend. Imagine that for the past fifty years popular music in the United States has consisted of several thousand slight variations on "I Will Always Love You" (featured in the movie *The Bodyguard*), all sung by Whitney Houston. (Now imagine that you don't like Whitney Houston.) When one critic quoted by Manuel complained of

"the crushing power of the monotony of musical soundscape" in India, we should not take this to be hyperbole.[13]

In the 1980s, with relaxed government regulation on their importation, cassettes quickly came to account for 95 percent of all commercial recordings in India.[14] The arrival of the cassette utterly changed the pop scene. The less complex, cheaper medium allowed smaller labels and even individuals to create and distribute recordings, ending GCI's stranglehold on the market. This diversification brought new perspectives, giving rise to new stars, even new musical genres. And it was precisely the physical characteristics of the cassette, tangibly different from the LP, that helped prepare the ground for this revolution.

We may see a parallel phenomenon with the compact disc, though the early years of the CD suggested a return to the "one-way, monopolistic, homogenizing tendencies" of the LP that Manuel has pointed out.[15] Yet in the 1990s it became much easier and cheaper to create CDs, and today most personal computers come with CD burners, making any home with a PC a potential pressing plant. With the advancement of CD production technology, many performers have decided to go into business for themselves. When the San Francisco Symphony could not get a contract with one of the major labels, they created their own; alternative pop musician Ani DiFranco, never interested in working with one of the majors, established Righteous Babe Records; and cellist David Finckel and pianist Wu Han created ArtistLed, "Classical Music's first Internet recording company," in order to "produce recordings in an environment free from constraints."[16]

We must be careful, however, not to assume that ease of production necessarily leads to diversification. Remarkably, the cassette seems to have had very nearly the opposite effect on the gamelan tradition of Java. Traditionally, each gamelan is a unique and matched collection of largely brass and bronze percussion instruments, with each ensemble having its own distinctive tuning. Although gamelan recordings date to the early twentieth century, it was not until cassettes came ashore in the late 1960s that gamelan recordings circulated widely across the island, and this was precisely because they were so simple to produce and disseminate. One striking effect of the new medium was that it seemed to facilitate a certain standardization within the world of gamelan performance practice. In his fieldwork in Java, ethnomusicologist Anderson Sutton observed

gamelan teachers changing the patterns and structures of certain pieces to match what they had heard on cassettes by prominent ensembles.[17] It has also been reported that when new gamelans are made nowadays they are often tuned to match a frequently recorded gamelan.[18]

Thus, whereas the advent of the cassette led to musical diversification in North India, it has encouraged musical homogenization in Java. One reason for this difference is fairly clear: where the Indian music industry was monopolized by a single, giant corporate entity, no such market concentration existed in Java. The contrast between these "cassette cultures" illustrates a point I have already made, but one that bears repeating: phonograph effects are not dictated solely by the traits of the technology, but arise out of broader contexts, whether economic, cultural, or aesthetic. Yet despite their differences, both cassette cultures illustrate how a very basic difference between recordings and live performance can have a profound impact on music and the way we interact with it.

PORTABILITY

When music becomes a thing it gains an unprecedented freedom to travel. Of course, live and recorded music are both portable, but in different ways. The portability of live music depends on the size of instruments and the number of musicians needed to perform a work. Minstrels and marching bands move easily; orchestras and anvil choruses less so. With recording, however, all music is more or less equally portable, from harmonica solos to the massive works of Mahler.

Furthermore, when music is recorded and replayed, it is removed from its original setting, losing its unique spatial and temporal identity. This loss was the subject of Walter Benjamin's famous 1936 essay "The Work of Art in the Age of Mechanical Reproduction." While the visual arts concerned Benjamin most, his ideas are relevant here. "Even the most perfect reproduction of a work of art," he maintained, "is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be."[19] Reproductions, therefore, lack what Benjamin called the "aura" of the artwork. From Benjamin's standpoint this absence is to be lamented. He speaks of the *withering* of the aura, the *depreciation* of the artwork, the *loss* of authenticity, and the *shattering* of tradition. Benjamin, however, missed half of the equation. True, mass-reproduced art does lack temporal and physical uniqueness, yet reproductions, no longer bound to the circumstances of their creation, may encourage new experiences and generate new traditions, wherever they happen to be.

Consider the *picó* of modern-day Cartagena, Colombia.[20] A picó is a large, elaborately designed sound system used to supply music for dance parties. Owners take great pride in their fancifully adorned picós, which they often tote through their communities in the back of pick-up trucks, competing with one another for the loudest, most extravagant system. While the picó is native to Cartagena, the music they play is not. The records, having arrived with traveling sailors, are mostly of African and Afro-Caribbean genres whose sound and language are foreign to coastal Colombia. Listeners do not typically understand the lyrics, and any dances originally connected with those genres are severed from the music. Yet the music is deeply meaningful to Cartagenos, and is central to the pleasures and experiences of picó culture. As the picó demonstrates, while recorded music is often decoupled from its origins in space and time, this "loss" begets a contextual promiscuity that allows music to accrue new, rich, and unexpected meanings.

Globetrotting recordings have also been deeply meaningful to composers, and have changed, even started, many careers. For the bandleader and composer Alton Adams (1889–1987), hearing 78s of John Philip Sousa was a formative experience. As a young man living in the Virgin Islands, he had no other access to this music. "How well do I recall," he wrote late in his life, "the many hours spent in rhapsodic ecstasy, listening outside the residence of a devotee of the art to the recordings of beautiful music—orchestral and band selections, operatic arias, and so forth, but particularly . . . the marches of Sousa. . . . After each of these musical experiences, stretched on my bed, I would then imaginatively conduct a Sousa's band in one of my own compositions."[21] Adams, a black composer living in a black society, was influenced by the recordings of a white musician. Darius Milhaud, a white European, found great value in the discs of black jazz musicians. "Thanks to the phonograph," he wrote in 1924, "I will be able to play the discs of black music—recorded and published by blacks—that I brought back from the United States. It is truly very precious to be able to study the folklore of all the world thanks to this machine."[22] Records,

and with them musical influence, traveled not only from north to south and west to east, but from east to west as well. Hearing discs of Balinese gamelan music in 1929 proved decisive to the career of Canadian Colin McPhee, leading to his move to Bali in 1931 and immersion in its music and culture.[23] Steve Reich's exposure to recordings of African music in the 1950s made a similar impression, and indirectly led to his visit to Ghana and to his 1971 work *Drumming*.[24]

Even when recordings aren't winging their way across continents, they can move easily within our daily lives, detaching music from its traditional times, venues, and rituals. While hardly noteworthy today, such possibilities were once considered radical. In 1923 British writer Orlo Williams made what would today seem an oddly superfluous argument: that it should be perfectly acceptable to listen to recorded music at any time of the day. He offered a scenario involving a wealthy bachelor, and intercut his description with the imagined responses of a hidebound reader.

> He comes down to breakfast at half-past nine: he skims the headlines of his paper over the kidneys and reads the feuilleton over his marmalade. Then, if I am right, he lights a large but mild cigar, sinks into an armchair, and rings for the butler to set the gramophone going. "My dear fellow . . ." you say in expostulation, "how absurd . . . how could anybody . . . I mean . . . can't you see?" I apologise. Imagination, yours at any rate, boggles at the thought: yet what I see in alluring clearness, is a gentleman tastefully attired, smoking in an easy but not too soft a chair, while at ten o'clock on a sunny morning, he listens to the voice of Caruso issuing from a little cupboard in a mahogany cabinet.

It seems hard to believe that anyone would be shocked by such a scene. Yet because it had never been customary, morning music—especially opera—must have disrupted the fabric of daily life. "Here," Williams explained, "we touch one of the ingrained superstitions of the Englishman, that music, except for the purpose of scales and exercises, is not decent at such an early part of the day." But its "indecency," he argued, was merely a function of its previous impracticality. There should be no reason, he concluded, to avoid listening to music in certain ways simply because they only recently became possible.[25] Today, of course, the morning listener raises no eyebrows; in fact, listening to the radio or recordings during breakfast is for some as ingrained a habit as breakfasting in silence must have been for people of earlier eras.

The portability of recordings has also allowed listeners to determine not only when and where they hear music, but with whom they listen. Solitary listening, widespread today, has been an important manifestation of this possibility. The practice, however, has not always been common. In the 1923 article just cited, Orlo Williams wondered how one might react upon walking in on a friend who is listening to recorded music . . . alone. His answer illustrates the puzzlement that may once have met solitary listening.

> You would think it odd, would you not? You would endeavour to dissemble your surprise: you would look twice to see whether some other person were not hidden in some corner of the room, and if you found no such one would painfully blush, as if you had discovered your friend sniffing cocaine, emptying a bottle of whisky, or plaiting straws in his hair. People, we think, should not do things "to themselves," however much they may enjoy doing them in company: they may not even talk to themselves without incurring grave suspicion. And I fear that if I were discovered listening to the Fifth Symphony without a chaperon to guarantee my sanity, my friends would fall away with grievous shaking of the head.[26]

Even if a bit melodramatic, Williams's remarks remind us that before the advent of recording, listening to music had always been a communal activity. In prephonographic times it had been for the most part neither practical nor possible to hear music alone. Listening was a culturally significant activity, for music accompanied central communal events, including birth or death rites, weddings, and religious festivals. Solitary listening, then, contradicted centuries of tradition. Nevertheless, the practice came to be accepted. In 1931, one writer touted its advantages: "Alone with the phonograph, all the unpleasant externals are removed: the interpreter has been disposed of; the audience has been disposed of; the uncomfortable concert hall has been disposed of. You are alone with the composer and his music. Surely no more ideal circumstances could be imagined."[27] Today, solitary listeners are everywhere, in living rooms, dorm rooms, bathrooms, offices, cars, and anywhere they might take a portable player. But there is still something strange about seeing people in public places, plugged into the earphones of the players they tote around as an emphysemic might

carry an oxygen tank. (For many, in fact, music is as necessary as oxygen.) Journalist Paul Fahri wonderfully captured that strangeness, evoking images from the classic horror movie *Night of the Living Dead:* "It is so familiar now that we don't see or hear it anymore. It is the look and sound of the Walkman dead: the head cocked at a slight angle, the mouth gently lolling. From about the skull comes a tinny low buzzing sound, like metallic bees. The eyes flicker with consciousness, but they don't *see.* They're somewhere else."[28] Perhaps we should not wonder that solitary listening was once considered unusual, but rather that it should have come to be so widely, unremarkably practiced. The same is true for the act of listening to music far removed from one's home or culture or of experiencing music whenever and with whomever one wishes. In each case, the portability of recording has made the once unimaginable commonplace.

(IN)VISIBILITY

Imagine that it is 1916 and you are shopping for records. Upon entering a store you are invited to take what is called "The Edison Realism Test." You are led to a quiet spot where you find a phonograph, a chair, and a scrapbook, and are handed a sheet of paper with a set of six instructions. First, you are to choose the type of music you would like to hear. Next you are asked to sit facing *away* from the phonograph while looking at a scrapbook of concert reviews and photographs of musicians (all Edison recording artists, naturally). Then you are directed to remember the last time you witnessed a performance of the music you have chosen to hear. "Picture the scene," you are told, until "it is clearly . . . in mind." Once this mental image is firmly in place, you are to say, "I am ready," at which point the demonstrator plays your chosen record. The final instruction is wonderfully complicated: "About forty-five seconds after the music begins, close your eyes and keep them closed for a minute or more. Then open your eyes for fifteen seconds but do not gaze at your surroundings. After this, close your eyes again and keep them closed until the end of the selection." If you follow these directions exactly, you will supposedly get "the same emotional re-action experienced when you last heard the same kind of voice or instrument." If for some reason you do not, it is because "you have not wholly shaken off the influence of your surroundings," in which case you are to repeat the test until successful.[29] What is fascinating about the Edison Realism Test—essentially a set of instructions for how to listen to a phonograph—is the importance given to the visual dimension of the musical experience. Listeners must go to great lengths not only to conjure up the correct mental imagery, but also to avoid all possible conflicting stimuli. The assumption behind the test is clear: in order for recorded music to be comprehensible, listeners must visualize a performance. Seeing was indeed believing. In fact, this had always been true, as Richard Leppert makes clear in *The Sight of Sound:* "Precisely because musical sound is abstract, intangible, and ethereal—lost as soon as it is gained—the visual experience of its production is crucial . . . for locating and communicating the place of music and musical sound within society and culture."[30]

The Edison Realism Test reveals another little-appreciated fact about recorded music: that listeners and performers cannot see one another.[31] Although unremarkable today, this was once a source of great anxiety. As an English music critic explained in 1923, some listeners "cannot bear to hear a remarkably life-like human voice issuing from a box. They desire the physical presence. For want of it, the gramophone distresses them."[32] This anxiety is understandable, for voices are typically accompanied by bodies—in fact, "hearing voices" without seeing their source is a sure sign of an unwell mind.

Various strategies were employed in the attempt to restore the missing visual dimension to the phonographic experience. The Stereophone and the Illustrated Song Machine, both introduced in 1905, consisted of similar mechanisms that, when attached to cylinder-playing phonographs, rotated images in time with the music. As an article in a trade journal crowed, the Illustrated Song Machine "is just what the public has wanted since the first automatic machine [i.e., phonograph] was placed on the market, and the listener drew a mind's picture as the words and music were repeated to him."[33] In 1929 a British phonograph enthusiast reported on the miniature stages he had constructed to look at while listening to his favorite operas. He meticulously fashioned scaled-down sets and wooden cutouts of characters in various costumes, all of which he changed with every new scene.[34] In the United States, music educator Albert Wier devised what he called the "projecting phonograph" in 1936, for use in music classes. Wier created slide shows, in which main themes or motives, graphic analy-

ses, translations of texts, and images of musicians or opera sets were projected in time with recordings. In the absence of these rather extravagant remedies, listeners simply stared at their phonographs—a practice that was, as one observer noted in 1923, "an unthinking inheritance from the days when we had no phonographs, and when we naturally had to look at the performer."[35]

When musicians record, their invisibility to listeners removes an important channel of communication, for performers express themselves not only through the sound of their voices or instruments but with their faces and bodies. In concert, these gestures color the audience's understanding of the music. As Igor Stravinsky rightly explained, "The sight of the gestures and movements of the various parts of the body producing the music is fundamentally necessary if it is to be grasped in all its fullness."[36] The violinist Itzhak Perlman, for example, is effective in concert in part because his face registers and reinforces every expressive nuance in the music. Perlman himself once remarked that "people only half listen to you when you play—the other half is watching."[37] The visual aspect of performance is especially important for pop musicians. What would pop be without the wriggling and jiggling, the leaping and strutting, the leather and skin, the smoke and fire? It would merely be sound, and so much the poorer for it.

The power of the visual is further demonstrated when the audio and visual channels are at odds with each other. Consider the violinist Jascha Heifetz, known for his rigid posture, skyward stare, and blank expression when performing. A 1925 article remarked on his deportment: "Cold, calm, dispassionate, he stands on the platform and performs miracles of dexterity, displays his beauties of tone; but do we not feel slightly chilled, anxious perhaps for less mastery and more humanity?" Yet the author also noted that Heifetz sounded rather different on disc: "These impressions are to some extent corrected by Heifetz's records. There is certainly a hint of passion, of tenderness."[38] In other words, with the visual channel off, Heifetz no longer seemed emotionless. Heifetz's playing provides a musical analogue to what is known as the McGurk Effect. In a 1976 experiment, psychologists Harry McGurk and John MacDonald showed subjects a video of a young woman speaking certain syllables, while what they heard were sounds of *different* syllables dubbed onto the tape. The results were striking: the subjects, who could readily identify the syllables being spoken when *not* looking at the video, consistently misidentified the sounds when the video presented conflicting information.[39] The psychologists' conclusion, which Heifetz had demonstrated long before, is that what we hear is deeply influenced by what we see.

For quite a different example, take the case of Milli Vanilli, a 1980s pop duo. Their popularity stemmed in large part from their good looks and provocative dancing. They fell from stardom, however, when it was revealed in 1990 that all along they had lip-synched to the recordings of two unknown performers.[40] That the real singers, a pair of middle-aged men, were not deemed glamorous enough to be put before the public suggests how crucial a group's look is to its success.

Yet as the Heifetz example reveals, the *absence* of the visual can have its own appeal. A 1912 article in the *Musical Courier* praised the recorded medium for stripping away all that the author considered unnecessary to the musical experience. "In listening to the Talking Machine," he explained, "the hearer must of necessity concentrate upon the tonal performance and does not have his attention diverted to extraneous matters, such as scenery, costumes, [and] acting . . . that keep him from directing his faculties to the music itself."[41] Theodor Adorno agreed, and argued that opera—the most visual of musical genres—is in fact best heard on recordings, that is, without seeing the costumes and sets. In his 1969 article "Opera and the Long-Playing Record," Adorno explained that contemporary stagings detracted from the musical experience, whereas, "shorn of phony hoopla, the LP simultaneously frees itself from the capriciousness of fake opera festivals. It allows for the optimal presentation of music, enabling it to recapture some of the force and intensity that had been worn threadbare in the opera houses."[42]

A musicology graduate student once told me that, for him, the experience of sacred music on disc was powerful precisely because he could not see the musicians; hearing such bodiless music made him feel closer to God. This effect is not new to recording; it is the same achieved by the age-old practice in Christian churches of placing the organist and sometimes the choir out of the sight of the congregation. The removal of visual cues, certainly no accident, separates body from sound, heightening the sense that the music comes not from humans but from heaven. In prephonographic

times such unseen music was the exception, used for specific purposes. Today, however, given the ubiquity of recorded music, such sightless hearing is closer to the rule. However listeners have responded—whether by compensating for it or exploiting it—the invisibility of performance is a fundamental part of the modern musical experience.

Ironically, this invisibility can have observable consequences. Conductor Nikolaus Harnoncourt suggested that recording artists must somehow compensate for the missing visual dimension. "If you don't *see* the musician—and this is the case with all recordings—you have to add something which makes the process of music making somehow visible in the imagination of the listener."[43] As I will argue in chapter 4, it is precisely this missing dimension that encouraged classical violinists to "add something" to their playing—in their case, an intense vibrato that helped communicate a sense of physical and expressive immediacy. Sometimes, however, musicians have responded by taking something away. Because recordings provide no visual continuity during extended pauses or tempo changes, musicians may deemphasize temporal discontinuities when performing in the studio. This may be accomplished, as several performers have attested, by "tightening" the spaces between phrases and larger sections. Cellist Janos Starker has explained that "while in a concert hall, the performer is able to create tension with rests . . . he cannot do this with recording." On disc, then, "the presentation of a composition" must "become much tighter."[44] Eugene Drucker of the Emerson String Quartet has offered a specific example of this "tightening" response. Drucker recounted how, in recording the Schubert Quintet, guest cellist Mstislav Rostropovich encouraged the group to shorten pauses that, in concert, they might normally extend for dramatic effect. For example, "after the big chord in the coda of the first movement [m. 428] . . . we took no extra time for rhetorical effect. Rostropovich pointed out that in a recording, one cannot always afford to play quite as broadly as in a performance. The impact of the performer's presence, even visually, can flesh out the musical ideas and add interest to phrases that might sound dull on tape." In concert, the performers would have lifted their bows off the strings after playing the chord, paused for a moment, and slowly returned them for the following phrase. Such a gesture would have heightened the drama of the moment and visually linked the two chords. On a recording, however, an extended silence

like this would simply have been "dead air," something to be avoided. "This streamlining of approach," Drucker explained, "is required by recording."[45]

Why, however, should a second here or there make any difference in the larger scheme? Over the course of the century, there has been a noticeable move in classical performance toward steadier tempos, with fewer and less marked tempo fluctuations.[46] What seems to be a common and almost instinctive "tightening" response has, in part, contributed to this general change in the rhetoric of modern performance.

Recording artists have also reacted to the fact that *they* cannot see their audiences. For many, the task of performing to unseen listeners, with recording equipment as their proxy, can be both daunting and depressing. In her memoirs, French soprano Régine Crespin registered her dismay at the artificiality of performing in the studio:

> Fear of an audience is healthy; it stimulates you. The people are there in front of you. With them there can be mutual lovefests. But how can you fall in love with a microphone? First of all, a microphone is ugly. It's a cold, steel, impersonal thing, suspended above your head or resting on a pole just in front of your nose. And it defies you, like HAL the computer in Stanley Kubrick's film *2001: A Space Odyssey,* although at least he talked. No, the microphone waits, unpitying, insensitive and ultrasensitive at the same time, and when it speaks, it's to repeat everything you've said word for word. The beast.[47]

Not only Western classical performers are affected by the absence of the audience. Before the era of the phonograph, Hindustani classical musicians not only took inspiration from their listeners, but also improvised directly in response to their reactions. The exact sound and shape of the performance, then, was determined in part by the interaction of artist and audience. For those who recorded, one way to compensate was to manufacture an audience, planting enthusiastic listeners in the studio. On an acoustic-era recording of Maujuddin Khan, for example, one can hear a few "plants" shouting "Wah! Wah! Maujuddin Khan! Subhanallah!," praising the divinity of the singing.[48] In a more recent example, I myself was an unwitting plant in a recording session for the rock group Rotoglow. After observing from the control room, I was invited to sit in the studio while the band

was recording. During a break I asked if I had been a distraction (I was occupying the very small space between the lead guitarist and the drummer) and suggested that I should perhaps return to the other side of the glass. To my surprise, the group insisted that I stay. "You're a part of this, man!" one of them declared.[49] I hardly acted like a typical rock concertgoer—I sat still, remained silent, and took notes when not stuffing my ears with wadded toilet paper to protect my hearing. Nevertheless, my presence must have in some way met the band's need or desire for an audience.

For some, however, the absence of an audience may be welcome, providing respite from the stress and distractions of concert performance. In a classical concert, coughing, snoring, talking, program rustling, and candy-wrapper crinkling may fluster or irritate the performer; at a pop concert audiences may in fact be louder than the performers, and can distract the musicians in any number of other ways. Removing the audience may therefore permit a sharper focus on making music to the artist's own satisfaction. Violinist Yehudi Menuhin, for one, valued recording for allowing him a "monastic dedication which is oblivious of audience."[50] As with every aspect of recording, the mutual invisibility of performer and listener offers both drawbacks and benefits, though in all cases it presents challenges to which both parties must respond.

REPEATABILITY

Sing a single note. Now try to recreate that sound *exactly*—not simply its pitch, but its precise volume, length, intensity, timbre, attack, and decay. Now imagine trying to repeat an entire song in this way, down to the smallest detail. It simply cannot be done. The impossibility of such an exercise reveals what is perhaps the most unbridgeable difference between live and recorded music: live performances are unique, while recordings are repeatable.

This statement deserves further explanation. Live music is in fact repeatable, but in the form of works, not performances.[51] That is, any orchestra can play Beethoven's Fifth Symphony many times; each performance, however, will necessarily be different. Second, to say that a recorded performance is repeated without change is not to deny that a listener may experience a recording differently from one hearing to another, whether by adjusting the playback equipment or by focusing on different aspects of the music. I mean only that the actions that created the sound one hears on a recording are fixed, and do not change when the recording is replayed.

This difference between live and recorded music may not seem especially momentous, but in fact it may have the most complex and far-reaching consequences of any of the technology's attributes discussed in this chapter. Given this complexity, it would be helpful to approach the influence of repeatability from three different perspectives: that of listening, that of performing, and that of composing.

For listeners, repetition raises expectations. This is true in live performance; once we've heard Beethoven's Fifth in concert, we assume it will start with the same famous four notes the next time we hear it. But with recordings, we can also come to expect features that are unique to a particular performance—that a certain note will be out of tune, say. With sufficient repetition, listeners may normalize interpretive features of a performance or even mistakes, regarding them as integral not only to the performance but to the music. In other words, listeners may come to think of an interpretation as the work itself. When I was young, for example, I was particularly fond of Pablo de Sarasate's *Zigeunerweisen,* one of the flashier showpieces in the violin repertoire. I came to know the piece through Jascha Heifetz's 1951 recording, which I listened to obsessively until every nuance of the performance was ingrained in my musical memory.[52] One such nuance was actually an error: in m. 9 of the first movement (0:34 in the recording), the violinist accidentally plucks his open E string. Though I knew the plucked E to be a mistake, I came to expect it not only when listening to Heifetz's recording but whenever hearing the work, even in concert. In fact, I would be a bit surprised and even disappointed when I did *not* hear that E. Though I knew better, on a certain level I regarded that wayward note to be part of the piece.

Expectations can also be raised by sounds that originate not from a performance at all, but from defects in playback equipment or individual recordings. Anthropologist Thomas Porcello tells of the intense expectancy he experienced when listening to recordings afflicted with print-through—a defect in the recording process that results in a faint pre-echo:

> When I was a teenager, I owned a couple of albums with extreme print-through at the beginning. . . . I'd put the needle down and faintly, but distinctly, hear a perfect, amplitudinally miniaturized replica of *what I was about to hear.* That tiny audio shadow always seemed to generate a visceral tension. I'd hold my breath, waiting for the release that came with the "real" beginning of the song, like smelling tequila as you bring it to your mouth, before it scalds your throat on the way down to your stomach.[53]

However arbitrary or incidental, such sonic artifacts can and do affect the listening experience, and do so by virtue of their repetition. If these two examples of raised expectations seem somewhat arbitrary, we can be sure that they stand in for countless experiences of listeners who may not even realize the power of repetition.

The repeatability of recorded sound has affected listeners' expectations on a much broader scope as well. When the phonograph was invented, the goal for any recording was to simulate a live performance, to approach reality as closely as possible. Over the decades, expectations have changed. For many—perhaps most—listeners, music is now primarily a technologically mediated experience. Concerts must therefore live up to recordings. Given that live music had for millennia been the only type of music, it is amazing to see how quickly it has been supplanted as model and ideal.

The impact of recording's repeatability on performers is no less significant. In concert the artist is typically concerned with the first—and only—impression, but with recordings, "shelf life" must be considered. Professional musicians have long been aware of these differences, and have often felt the need to minimize errors and even otherwise acceptable mannerisms when recording, for such "deviations" may become distracting with unchanging repetition. David Soyer, cellist for the Guarneri Quartet, has made this point: "Recordings have a tendency to iron out the eccentric, idiosyncratic, personal things that happen in a concert hall."[54] But what happens when listeners are repeatedly exposed to note-perfect recordings? Do they then expect and demand similar performances? And do performers then feel the need to meet such expectations? Undoubtedly, such feedback loops are created, with performers striving to recreate their recordings. Critic and historian Joseph Horowitz observed this in a concert performance of Brahms's Symphony no. 1, which he described as "machine-like"

and "precision-tooled," concluding that the Chicago Symphony had perfectly imitated the sound of an orchestra "fed through giant speakers." In other words, "they sounded like a phonograph record."[55] At least they were actually playing. Many pop stars, and even some classical musicians, have been known to lip-synch to their own recordings. (The Milli Vanilli case was unusual only in that they were pretending to sing to someone *else's* recordings.) But such phonograph effects are certainly not a necessary consequence of recording. Witness what appears to be the increasing popularity of live recordings—the recent releases by classical violinist Anne-Sophie Mutter and rock group Pearl Jam being two very different examples—which preserve spontaneous, idiosyncratic, even messy performances. These offerings, which seem to represent a reaction against overproduced recordings, suggest that the unique qualities of the live performance are still highly valued.

Repeatability has also affected musicians in their capacity as *listeners.* With recordings, performers can study, emulate, or imitate performances in a way never before possible. In the early days of recording, this possibility was trumpeted as a gift to all musicians, who could learn from the world's great masters by studying their discs.[56] For performers of popular music, recordings have been especially valuable learning aids. The available scores do not always represent performances adequately, and they cannot easily indicate the timbres and sonic effects that musicians seek to develop. An aspiring rock guitarist once explained why he studied recordings instead of scores: "I want to hear what the thing *sounds* like, and there ain't no way a sheet of paper sounds like Jimi Hendrix."[57] As I will explain in chapter 3, the study of recordings is also crucial to the development of jazz musicianship, and has been for generations.

On the other hand, some have worried that repeatability may lead performers to mimic great artists without emulating their spirit, or to create bland patchwork interpretations based on their favorite recordings. The violinist Miha Pogacnik told of visiting a colleague who was preparing the Brahms Violin Concerto by listening to twenty different LPs of the work. "This was reflected in his playing," Pogacnik lamented: "two measures of poor Milstein here, four measures of second-rate Oistrakh and Szeryng there."[58]

Performers exploit repeatability by studying not only the recordings of

other musicians, but their own as well. In 1905 soprano Adelina Patti was finally persuaded to commit her famous voice to wax. After singing a short selection, she heard her recorded voice for the first time. "My God!" she reportedly exclaimed, "now I understand why I am Patti! What a voice! What an artist!"[59] While most of those hearing themselves for the first time are probably less enchanted, surprise seems to be the universal reaction. Soprano Joan Morris, for example, "practically had a cow" upon hearing herself for the first time.[60] Once over this initial shock, however, performers often find recording quite useful in allowing them to assess their work at a temporal and spatial distance—an impossibility before the invention of the repeatable recording.[61] In listening to themselves musicians may hear mistakes—unnoticed during a performance—which can then be corrected. Sometimes, however, what performers notice is not errors, but aspects of style or interpretation. What may have felt right in the heat of performance may in retrospect sound overdone and contrived or, at the other extreme, flat and lifeless. Probably all recording artists modify their playing to a certain extent when a desired sound is not heard. Soprano Martina Arroyo has suggested how this process might work. "There are some . . . who say, 'Oh no, I do exactly the same thing in recording as in live performance.' But what happens is that . . . when you hear [yourself] you adjust without even knowing, because you say 'Ah, that's not exactly the way I want to sound.' And you adjust, perhaps without being aware that in a performance you wouldn't have made that adjustment."[62]

Consider also the testimony of French composer and pianist Camille Saint-Saëns, who made his first recording in 1900. "While the phonograph was repeating what I had played," he reported, "I listened with much curiosity and interest. I at once saw, or rather heard, two grave mistakes that I had made. In one part the music was more quick than I had intended, and in another the rhythm was faulty. These mistakes I subsequently corrected."[63] But what was Saint-Saëns really hearing? Perhaps what he described was not so much an error but the type of rhythmic inflection typical of early-twentieth-century performance as documented on countless recordings of the time. Such inflections probably passed unnoticed during the performance, but heard in retrospect may well have seemed objectionable, even wrong. I would speculate that as classical performers became accustomed to making and hearing repeatable performances, they

gradually began to correct certain rhythmic "errors," by minimizing small-scale tempo fluctuations and curbing the once common habit of altering the length and placement of notes. I believe that this response to repeatability, in conjunction with the "tightening" of tempo I mentioned earlier, has led to a striking change in the way modern classical performers approach musical time.[64]

For performers, repeatability is thus a double-edged sword, equally capable of enriching and burdening their work. Its impact may also be more subtle and far-reaching, for if control and precision have become central values in classical performance due in part to this trait of the technology, then recording affects not only technique, but aesthetics.

Like performers, composers have also had an ambivalent relationship with the repeatability of recordings. Some have seen it as an advantage. Expressing an oft-repeated sentiment, George Gershwin wrote in 1933 that "the composer, in my estimation, has been helped a great deal by the mechanical reproduction of music. . . . Music is written to be heard, and any instrument that tends to help it be heard more frequently and by great numbers is advantageous to the person who writes it."[65] Yet repeatability can also have a negative side for composers. Second-rate concert performances fade away, but inferior recordings live on to distort or misrepresent a composer's music every time they are replayed. In a 1937 essay, Béla Bartók described the musical work as a living, evolving entity, suggesting that even composers' own recordings may ill serve their music. Aaron Copland agreed, writing that the "unpredictable element, so essential in keeping music truly alive . . . dies with the second playing of a record."[66]

Phonographic repetition has deeply affected the ways in which composers' works are circulated and received by listeners. Some have speculated that repeatability may have even greater power, influencing the compositional process itself. Jonathan Kramer has suggested that certain early-twentieth-century composers, particularly Arnold Schoenberg, responded to the nature of the medium by minimizing repetition in their works: "It seems as if composers realized subconsciously that their music would be recorded and thus available to listeners for repeated hearings."[67] The connection Kramer proposes is provocative, but unlikely. Schoenberg had only the barest interaction with the medium. None of his composi-

tions appeared on disc until well into his career, and he did not make his first studio recording until he was in his sixties. Moreover, Schoenberg showed little enthusiasm for the phonograph. As he wrote in 1926, he saw "no advantage" in the mechanization of music.[68] Given his sparse recording activity and ambivalence toward the medium, it seems doubtful that he would have altered his compositional technique, even subconsciously, in response to the repeatability of recording.[69]

Nevertheless, I agree with Kramer that repeatability may influence the work of composers. Yet the effect is quite the opposite: recording has begotten whole genres whose identity is fundamentally connected to repetition. It is often forgotten that minimalism—whose most salient trait is the repetition and gradual development of brief musical cells—was indelibly shaped by recording technology. Steve Reich's early minimalist works came out of his experiments in the mid-1960s with tape loops. A tape loop is a length of recorded magnetic tape with its ends connected, so that when played on a reel-to-reel machine (the available technology at the time), the music repeats indefinitely. Purely by accident, Reich discovered that when trying to play two copies of the same loop simultaneously on different machines, the loops very slowly went in and out of synch, creating a type of musical process that he called phase shifting. Reich explored phase shifting in his tape works *It's Gonna Rain* (1965) and *Come Out* (1966), which he described as "realizations of an idea that was indigenous to machines."[70] He later applied the idea to non-tape works such as *Piano Phase* (1967) and *Clapping Music* (1972), demonstrating the deep influence of recording technology on his writing. It is interesting to note that minimalism is often derogated as "broken-record music." Flutist and conductor Ransom Wilson, who later came to perform the minimalist works of Philip Glass, initially had this reaction to Glass's five-hour opera *Einstein on the Beach:* "The music seemed to have no direction, almost giving the impression of a gigantic phonograph with a stuck needle."[71] Despite the dismissive tone of such statements, the link to recording technology is apt. And although it may just be coincidence, it is worth noting that the repeated motives heard in many minimalist works are often about two seconds long, the same time it takes an LP to complete a single rotation.

A decade after Steve Reich was experimenting with tape loops in San Francisco, hip-hop DJs in the Bronx found that a fragment of music could be repeated indefinitely by switching back and forth between two copies of the same LP, each on its own turntable. (See chapter 6 for a fuller account of what came to be known as turntablism.) These repeated musical fragments were also called loops, and became the basic structural unit in the instrumental accompaniment in rap. Even in the digital age, loops persist; listen to any rap song today and you are likely to hear an instrumental foundation of loops, though now the fragments are sampled and are no longer repeated manually. Although hip-hop and minimalism are rarely uttered in the same sentence—they share little by way of sound or audience—we find an unexpected kinship in their mutual reliance on mechanical repetition.

Repeatability is perhaps the most complex of recording's traits. It will arise in nearly every chapter of this book, and figures prominently in the discussion of jazz improvisation, classical violin playing, the computer music of Paul Lansky, and the hip-hop of Public Enemy. If nothing else, the diversity of responses to repeatability should dispel any notion of strict technological determinism, for such wildly disparate phonograph effects demonstrate that there can be no simple cause-effect relationship between recording technology and the activities of its users.

TEMPORALITY

With the advent of sound recording, a new rigidity was introduced into the world of music, one imposed not by performers or audiences, but by a machine. Although over the decades the time limitation has become less severe, for the seventy-one years between the invention of the phonograph and the introduction of the long-playing disc (1877 to 1948) recordings could play no more than about four and one-half minutes of music continuously.[72] Thus, for more than seven decades, listeners, performers, and composers had to live and work with a severe and arbitrary restriction, one that constantly impinged on their activities.

For listeners living in the pre-LP era, the brevity of recordings was, most superficially, a nuisance. Blues singer Son House recalled the trials of the phonograph owner in the 1920s: these included "gettin' up, settin' it back, turnin' it around, crankin' the crank, primin' it up, and lettin' the horn down," all to be repeated every few minutes.[73] Of greater consequence,

however, was the fact that longer pieces had to be broken up over multiple discs. The discontinuity of the experience (caused by the need to change sides and records) could lead some to perceive works in units dictated not by the music itself but by the length of the discs. Composer and professor Andrew Mead has recounted how such listening affected his father's understanding of a Brahms symphony:

> My father has long held that Brahms wrote weak transitions, a position I simply couldn't fathom. One day, we were listening to the finale of the 1st symphony, just at the point of the syncopated climax preceding the continued recap [mm. 289–301] and Dad said, "Here comes one of those bad transitions." After the recap got under way, he allowed as how it was not a weak transition, but that he remembered it as such. I asked him how he had first gotten to know the work, and he said it was through a stack of 78 RPM discs. I asked if the passage in question marked one of the side breaks, and he said, somewhat surprised, that it did.[74]

The elder Mead's experience recalls Theodor Adorno's concept of "atomized listening." Atomized listening, which Adorno linked directly to both recording and radio, privileges the perception of works as collections of seemingly disconnected moments rather than unified compositions.[75] It is impossible to know how common this phonograph effect may have been—information on it can only be collected anecdotally—but given that generations of listeners grew up with cylinders and 78s, the phenomenon must have been pervasive. Moreover, I would speculate that the persistence of the three-minute pop song (more on which later) in an age when song lengths are no longer dictated by the capacity of 78s and 45s may well be a manifestation of atomized listening. The repetition of short pop songs over the decades almost certainly created a feedback loop in which listeners have come to expect works to be of a certain length and in which performers strive (or are pressured) to meet that expectation.

For performers, the impact of the technologically imposed time limitation is clearer. Most obviously, the four-minute limit affected repertoire. In theory, any piece, no matter how long, could have been recorded by breaking it into segments, and even whole operas were released in the era of the 78-rpm disc. Practically speaking, however, the time limitation encouraged performers to record shorter pieces. Any survey of record catalogs from the early part of the century will reveal the dominance of character pieces, arias, marches, and brief popular song and dance numbers, while a similar study of concert programs would show that longer works—sonatas, concertos, symphonies, musicals, and operas—were quite common. It was not long before the time limitation affected not only what musicians recorded but also what they performed in public. We see a striking example of this influence in violinist Maud Powell's Carnegie Hall "Record Recital" of 1917. Part publicity stunt, part serious venture, the concert consisted of seventeen works chosen by the public from her recorded catalog. While typical violin recitals of the time would have offered a combination of shorter and longer works of various genres, Powell's featured mostly character pieces, and all of them—by necessity—were brief.[76] In the 1950s, violin recital programs began to change, comprising fewer but longer works (mostly sonatas); not coincidentally, I believe, the new format arose only after the introduction of the long-playing record, an innovation that made it easier to commit such larger-scale works to disc.

The various characteristics of recording technology affect musicians of all types, and the same is true for the time limitation. Returning to the example of Hindustani music, Suman Ghosh has pointed out that while on disc whole pieces are compressed into just a few minutes, in a live setting "the performance of the *raaga,* the melodic structure of Hindustani music, has rarely taken less than an hour, and it often stretched well beyond two or three hours."[77] In Algerian *raï,* the length of performances is traditionally determined by the amount of money listeners are willing to pay to keep the musicians playing a favorite song, or alternatively, the amount of money competing audience members will pay to hear a different song. "In raï," scholar Marc Schade-Poulesen explains, "a song rarely had a 'full length,' [for] the music was embedded in a social relation which began and ended according to the money involved."[78] In the recording studio, however, the amount of tape available determines when raï begins and ends. And as I will explain further in chapter 3, the same was true with early jazz performers, who often stretched pieces out in concert well beyond three or four minutes, but had to plan their music making quite differently upon entering the studio. These examples should not surprise us, for much of

the world's music exists in the oral tradition, with the length of performances fixed almost solely by the dictates of performers and listeners.

Before leaving the subject of performance length, I want to address a common misconception. It is often said that in the early 1900s Western classical musicians played faster in the studio than they would have in concert in order to stay within the time allotted by the 78-rpm disc. Although it may have happened on occasion, there is little evidence to suggest such a trend. If that had been the case, we would expect, for example, that the LP recordings Jascha Heifetz and Yehudi Menuhin made of the Beethoven Violin Concerto in the 1950s would be slower than their 78-rpm recordings of the work from the 1940s; yet both of their later recordings are *faster,* not slower, than the earlier ones.[79] More conclusively, José Bowen's study of tempo and duration in hundreds of twentieth-century orchestral recordings shows no decisive change in tempo over the course of the century. In fact, some works have gotten faster over the decades.[80]

Rather than rushing through a piece, performers were more inclined to accommodate the time limitation by cutting music. This was very common, as I have found in my own study of early-twentieth-century violin recordings.[81] Many of the concerto and sonata recordings from the 78 era had significant cuts. Even shorter pieces were sometimes truncated. For example, Mischa Elman's 1910 recording of the violin-piano transcription of Chopin's Nocturne in E-flat omits fully one-quarter of the piece.[82] While the nocturne can be played in its entirety on a ten-inch 78, Elman's redaction allowed him to take a quite leisurely pace. In fact, in comparing works recorded over the course of the century, I found the slowest tempos most frequently on the earlier recordings. For Elman, and the countless others who recorded abbreviated works, it would seem that playing at a desired tempo was more important than playing all the notes. Apparently, there are certain changes performers are not willing to make, regardless of the limitations of the technology.

Perhaps surprisingly, however, composers were often willing to cut their own music. Edward Elgar, for example, was merciless in editing his works for the studio. For a 1916 recording of his Violin Concerto he reduced the score so that the performance would take only four record sides. Modern recordings of the work usually fill fifty minutes or more; Elgar's lasts about twenty.[83] Fritz Kreisler's *Caprice viennois* shows another approach. The

sketches for this violin showpiece reveal that the work originally ended with a varied repetition of an earlier section (the presto in 3/8).[84] Kreisler cut that section before recording it in 1910; had it remained, the work would have been too long for even a twelve-inch disc. (His several recordings of the piece average about 3:25.) Kreisler often recorded his works shortly after writing them, so he may have composed with the limitations of the medium in mind. Indeed, fellow violinist Carl Flesch noted that Kreisler's short pieces were "put together with a watch in the hand. They were intended first and foremost for the gramophone."[85]

A number of composers wrote works specifically for the length of the 78. In 1934, Roy Harris composed a four-minute-twenty-second-long work for flute and string quartet that he called, appropriately enough, *Four Minutes-20 Seconds.* The title and its duration are significant to the work's origins, for Harris composed it to accompany the set of discs on which his Symphony no. 1 was recorded.[86] The symphony took up seven record sides, leaving the last side of the fourth disc blank. Harris was asked to provide a piece to fill out the set. Harris was hardly alone in tailoring a work to fit on one side of a 78-rpm record: eminent composers such as Edward Elgar, Gabriel Fauré, Paul Hindemith, Vincent d'Indy, Fritz Kreisler, Ruggero Leoncavallo, Gabriel Pierné, Kurt Weill, and, as we know from the introduction, Igor Stravinsky, did the same, whether to accompany a composition that filled an odd number of sides, or on commission by a phonograph company.[87]

The time limitation affected popular music even more deeply. Martin Williams suggested that some early blues singers crafted the narrative structure of their songs specifically to fit the playing time of the 78, while Gunther Schuller has pointed out that Duke Ellington's mastery of the small form was born out of the same technologically imposed necessity.[88] The three-minute pop song itself may be considered a phonograph effect. In the late 1940s, RCA Victor introduced the 45-rpm record as an alternative to the 33⅓-rpm long-playing format that Columbia had developed. Because of its limited playing time—about the same as a 78—the 45 could not compete with the LP for recording classical music. Instead, it became the standard format for pop, and remained so for decades. Although popular music was sometimes released on LPs beginning in the 1950s, few musicians took advantage of the possibility to record longer works.[89] The rea-

son was strictly commercial. Much of the revenue of pop music came from the sale of "singles" released on 45s, which filled the jukeboxes and received the most radio play. A longer song would have practically no chance to sell well. Billy Joel's 1974 song "The Entertainer" attests to the pressure to keep songs short:

> You've heard my latest record, it's been on the radio
> It took me years to write it, they were the best years of my life
> It was a beautiful song, but it ran too long
> If you're gonna get a hit you gotta make it fit
> So they cut it down to 3:05.[90]

Joel is making a bitter and thinly veiled reference to his 1973 song "Piano Man," which stands at 5:37 on the album but was cut nearly in half for radio play, much to his obvious displeasure.

Perhaps Joel is an exception, but there is reason to think otherwise. Rock musicians often extend their performances considerably in concert, where there is less concern about the salability or "radio friendliness" of the performances. To offer just a few examples, consider Eric Clapton's "Blues Power" and "Cocaine"—the studio recordings are 3:06 and 3:35, while the recorded concert performances are more than twice as long at 7:21 and 7:24.[91] Or compare Jimi Hendrix's live performances of "Killing Floor" and "Hey Joe" in 1967, which come in at 8:05 and 6:44, to the earlier studio versions, much briefer at 2:27 and 3:23.[92] Clearly, not all pop musicians are satisfied with the customary 180 seconds allotted them.

What determines the length of a live performance? Any of a thousand factors, whether the length of a written composition, the inspiration of a performer, the time it takes for a bride to march down the aisle, or the desire of dancers to keep shimmying. Yet of these countless possibilities, few of them fix with any great specificity or regularity the length of performances. Recording, however, parcels performances into fixed segments, regardless of the inclinations of artists or audiences. While this might seem solely a disservice to music, listeners, performers, and composers have, as we've seen, adapted in varied and remarkable ways to this fact of modern musical life.

The room was usually small, windowless, overheated, and empty, save for a large megaphone-shaped horn and a small red light or perhaps a buzzer attached to one wall. No vast stage, no ornate hall, no warm applause greeted the performer's entrance into this, a typical early-twentieth-century recording studio. A session began not with a performance, but with a series of tests. These tests established the type of recording horn and stylus to be used, the optimal distance between performer and horn, and the dynamic range allowed by the equipment. When all the tests were complete, the performance could start, but not at the artist's discretion. The red light would flash, the buzzer would sound, or an engineer would gesture, and the performer would begin. During the performance, musicians had to be careful not to make extraneous, recordable noises, not to gesture unduly (lest they knock the equipment over), and not to sing or play too loudly or too softly. After the performance was finished, total silence was necessary—any exclamation of relief, joy, or disappointment would ruin the recording. Thus ended the first take. (See Figure 1.)

Fast-forward nearly a century. A great deal has changed, and the performer entering a modern studio encounters not an oversized horn, but a multitude of microphones that can pick up any sound in the range of human hearing. Yet despite all the changes in recording technology, one constant remains: no recording equipment, from the simplest acoustic horn to the most sophisticated microphone, is sensitive to sound in the same way as the human ear. The earliest technology was far inferior to its biological model; the latest is in some ways more sensitive. Yet for more than a hundred years recording artists have had to adjust to the special nature of these devices, whether insensitive or hypersensitive.

Before the introduction of microphones in the mid-1920s, all recordings were made using the acoustic, or mechanical, process. Musicians sang or played into a recording horn, which funneled the sound to a narrow opening covered with a flexible membrane (often of mica or glass); the diaphragm, as it was called, transferred the vibrations to a stylus, which in turn engraved a cylinder or disc. No electricity was involved.

The demands this system placed on performers were tremendous. Soft

FIGURE 1 An early recording session using the acoustic process: Rosario Bourdon conducting the Victor Salon Orchestra. George H. Clark Radioana Collection, Archives Center, National Museum of American History, Behring Center, Smithsonian Institution. Used by permission.

and loud notes, for instance, demanded drastically different techniques. A vocalist might literally stick her head inside the horn to ensure that her pianissimo would be heard, but then, with the timing of a lion tamer, quickly withdraw for her fortissimo, so as to avoid "blasting" the engraving needle out of its groove. Alternatively, studio assistants would push the artists toward the horn or pull them away according to the changing dynamics of the music. German soprano Lotte Lehmann once quipped that in her early recording sessions she not only sang but danced as well, her partner being the "pusher," as this studio flunky was typically called.[93] Experienced recording musicians, however, could dispense with their dancing partners. In 1916 Yvonne De Treville, an American soprano, reported one musician's creative solution. At her first orchestral session she could hardly contain her laughter upon seeing the first violinist. He was, as she reported, "seated astride a little, low, rolling box, for all the world like the

push cart of the beggar who has had his legs cut off and propels himself around Fifth Avenue, selling matches and shoelaces."[94]

Many performers learned to internalize the necessary adjustments by controlling their singing or playing to suit the limitations of the technology. In 1913 a British sound engineer stressed the importance of understanding the nature of recording equipment, particularly the diaphragm: "Much depends on the manner in which the musician sings or plays in intelligent rapport with the diaphragm before him, and by a little practice it is comparatively easy . . . to manipulate it for the production of first-class effects."[95] Sometimes adjustments in performance were simply not enough, and certain instruments were replaced or modified for studio use. Brass instruments often took the place of strings, for they could play louder and their sound was more easily directed toward the recording horn. In the case of the Stroh violin, string and brass merged. This contraption consisted of a violin fingerboard, bridge, and chin rest, but substituting for the traditional hollow wooden body was a conical aluminum horn with a flared bell. One Stroh could replace an entire section of fiddlers, and the sound was deemed sufficiently similar to the original.[96] (Notice the man playing the Stroh violin in the right foreground of Figure 1.)

It was not only the classical tradition that was affected in this regard. Consider the case of klezmer music. Before the twentieth century, one of the core instruments of any klezmer ensemble was the *tsimbl,* a gentle-sounding hammered dulcimer. Yet the tsimbl is rarely heard on early-twentieth-century recordings; it did not register strongly on acoustic machines, and its sound would have been lost in recordings of larger ensembles.[97] The tsimbl largely disappeared from the music, particularly in America where most klezmer discs were made. Its unsuitability in the studio was almost certainly a contributing factor. While the tsimbl recorded poorly, the piercing tone of the clarinet transferred well, and its growing prominence might also be linked to the phonograph. Jazz, too, saw similar changes in performance practice (as we will see more thoroughly in chapter 3). In early recordings, the double bass was often replaced by the tuba, and drummers were apt to eschew the skins for the more focused sound of woodblocks and cowbells. Some of the most distinctive aspects of klezmer and jazz sound, therefore, arose not within isolated musical worlds, but from their interaction with a recording technology.

An "intelligent rapport" was required not only with horns and diaphragms. Microphones, used since the mid-1920s, are much more sensitive than their predecessors, but have their own demands. Because the microphone was generally placed only inches from the performer, the dynamic range appropriate in a hall or club was generally too great for the recording studio. Performing for the microphone, therefore, required moderating one's technique in a variety of ways. Martina Arroyo has described the restraint she exercised for the microphone: "There are certain sounds that you do on stage when, for example, in *Ritorna vincitor!* Aida says, 'affranto!' *(Rolls the* r *violently)* like that. You can do that on stage, but it can be picked up by the microphone in a rather ugly fashion. So you try to give the same intensity but with an amount of sound that will allow the machinery to record without distortion."[98] Like Arroyo, John Lennon was keenly aware of the need for special techniques, often singing into the side or back of the microphone to get a desired effect or waving his hand in front of his mouth to soften the sibilants that microphones tend to exaggerate and distort.[99]

Instrumentalists, too, must be aware of the sensitivity of microphones. In concert, the guitarist's left hand sliding up and down the strings or the clicking of the saxophonist's keys are rarely heard. Yet such incidental sounds are picked up in the studio, and although performers may not always want to eliminate the noises, they must be conscious of their presence. In 1932 the Czech pianist Josef Jiránek noted that when recording he was instructed not to use the sustain pedal—a crucial expressive device in much of the repertoire—presumably because the noise of the mechanism itself would be picked up by the microphone.[100]

The sensitivity of the microphone also provided the means for new sounds and performance practices. Consider "crooning," the soft, restrained vocal style popular from the 1920s to the 1950s, heard in the singing of Rudy Vallee, Bing Crosby, Perry Como, and Frank Sinatra. Crooning was only possible with the microphone, for without amplification such singing would be expressively flat and nearly inaudible. Yet the technique achieved a remarkable effect. Crooning is akin to whispering, which under normal circumstances can be heard only when one is physically very close to the speaker; crooning thus provides a sense of intimacy between artist and audience, collapsing the technologically imposed distance that would

seem to preclude such a relationship. No wonder the only moderately prepossessing Vallee was hailed as "God's gift to us girls."[101] As I hope is clear, although all recording machines require an "intelligent rapport," the ways in which the technology is accommodated may both limit and expand the possibilities of musical performance.

MANIPULABILITY

Listen to most early-twentieth-century recordings and you will hear a performance in the traditional sense. That is, you are hearing a single and complete take, in which the beginning, middle, and end of the piece were recorded in that order on the same day, in the same place, and by the same performer or group. This was hardly out of a desire for authenticity; it was a product of necessity. However, since the introduction of magnetic tape (in the late 1940s) and digital recording (in the late 1970s), it has been possible to offer the illusion of a traditional performance as well as to create "performances" that could never have existed. With the ability to manipulate sound through such technology, musicians have been able to transcend time, space, and human limitations, and in the process have created wholly new sounds, works, genres, and performance traditions.

One of the most basic manipulations is splicing, in which passages recorded at different times are joined together. The Beatles' "Strawberry Fields Forever" (1967) provides a famous example. The Beatles did over two dozen takes of the song, none of which completely satisfied John Lennon. But he did like the first half of Take 7 and the second half of Take 26. So he asked George Martin, their producer, to put the two together. Unfortunately, they were in different keys and tempos. The two takes, however, were related in such a way that when one was sped up and the other slowed down so that the tempos matched, the pitches also matched. Thus the two takes could be joined, the splice occurring at about 0:59 on the word *going* in "Let me take you down 'cause I'm going to Strawberry Fields."[102] Although the splice is nearly undetectable, the slightly altered speed of Lennon's voice helps give the song its distinctively dreamlike quality.

Pianist Glenn Gould, a passionate champion of splicing, recounted a similar experience, but with a very different repertoire. In recording the A minor fugue from the first book of Bach's *Well-Tempered Clavier,* he and

his producer decided that the best of several takes were numbers 6 and 8. Neither, however, was acceptable on its own: "It was agreed that neither the Teutonic severity of Take 6 nor the unwarranted jubilation of Take 8 could be permitted to represent our best thoughts on the fugue." So they decided to combine them, opening and closing with Take 6 and splicing the middle of Take 8 in between. The result, Gould felt, was "far superior" to any single, real-time performance, and he declared that the technology had allowed him to "transcend the limitations that performance imposes upon the imagination."[103]

While the Beatles and Glenn Gould created "performances" that were theoretically possible but never actually took place, other performers have taken advantage of the technology to make recordings that could *never* have existed as performances. In 1946 Jascha Heifetz released a disc on which he is heard simultaneously playing both solo parts of Bach's Concerto in D Minor for two violins.[104] In 1991 Natalie Cole recorded the duet "Unforgettable" with her *late* father, Nat King Cole, whose contribution to the song had been made decades earlier and preserved on tape.[105] These documents could only have been created by overdubbing, in which recordings made at different times are combined, not sequentially, as in splicing, but synchronically.

Another crucial type of manipulation comes from the use of the stereo field—the sonic "stage" in which sounds occupy and move through space in a recording. Consider "Strawberry Fields Forever" once again. When listening through headphones, the song begins as if an organ or perhaps flute trio is playing softly into your left ear. (Actually, the sound comes from a Mellotron, an early synthesizer that played prerecorded tape loops.) A chord in the electric bass then sounds in your right ear, followed by John Lennon singing "Let me take you down," seemingly in the middle of your head. Ringo Starr joins the fray, playing the drums as if he were sitting on your left shoulder. A guitar slide, traveling *through* your head from left to right, rounds out the opening fifteen seconds. Clearly, the Beatles (in collaboration with their producer and engineer) created a musical space unique to the work, one with no possible physical counterpart.

Often the stereo field is used simply to enliven a song's texture or to provide added bounce or swing, but the way musical space is deployed can also enhance the meaning of a song. In "Strawberry Fields Forever," it is the fantastic disposition of sound that persuades us that "nothing is real." The guitar and drums moving slowly from left to right in the opening of Jimi Hendrix's "Crosstown Traffic" (1968) musicalize the song's title by imitating the sound of passing cars. Late in Led Zeppelin's "Whole Lotta Love" (1969), Robert Plant's voice travels from right to left to right with ever greater reverberation (c. 4:19–4:27), as if he is plunging into a cavernous space. Perhaps it is meant to illustrate the perceived emptiness of the woman he has just addressed with the single-entendre, "Way down inside, woman, you need it." Radiohead's "Creep" (1993) features the violent tearing sound of a distorted guitar each time Thom Yorke admits, "But I'm a creep" (c. 0:58, 2:01, and 3:28). The first two times it appears, the guitar erupts in the right channel, then moves front and center, filling the stage; the sound seems to depict the anger of the song's persona at the possibility that he is unworthy of the woman with the "face like an angel." The last appearance of the distorted guitar, however, is much different; it is distant and barely audible, having been pushed to the left rear corner of the stage. The sound is dulled and softened, suggesting the bitter resignation of someone who now believes the worst about himself. As careful listening and a good pair of headphones will reveal, the use of the stereo field can add depth to a recording, both physically and expressively.[106]

A more recent development in sound manipulation goes under the general heading of digital signal processing, or DSP. DSP far transcends the limitations and possibilities of magnetic tape. With rhythm quantization, for example, a performance with an unsteady tempo becomes metronomically precise as all notes are forced to fall on the closest beat. Pitch correction follows a similar principle, pushing pitches up or down to the nearest specified level. Moreover, both can be applied in real time. Thus I could go into a studio, belt out "Copacabana" in my wobbly pitch and uncertain rhythm, and have it come back at me through the monitor—*as I am singing*—sounding closer to Barry Manilow than nature or good sense should allow.

Digital processing, though widespread, is a controversial practice. As singer and producer Richard Marx puts it, "You have a guy or girl who literally can't sing one phrase in tune to save their lives, and I can make them sound like they can. It's misleading—but it's not overly uncommon."[107] In an episode from February 2001, the animated television show

The Simpsons skewered the prevalence of pop processing. Bart Simpson and three of his friends are brought together by a successful producer to form the next big "boy band." They have the right looks, the right moves, the right attitudes—everything except for musical ability. At first they can only croak out the lines to their song. The producer shudders, heads over to an oversized console labeled "Studio Magic," and turns the "voice enhancer" dial. The boys sing again, only this time we hear buttery voices, perfect intonation, and exquisite timing coming from the studio monitors.[108] This send-up only slightly exaggerates reality. The website for Auto-Tune pitch correction software and hardware made this triumphant claim: "Auto-Tune corrects 'intonation' problems of vocals and other solo recordings—in real time! In goes out-of-tune screeching, out comes bewdiful *[sic]* singing."[109]

But there is another side to the debate, and many feel that the benefits of processing are far from insidious. Producer Matt Serletic has pointed out that the technology allows performers to minimize the stress and strain of recording sessions. "You no longer have to beat an artist into submission by asking them to pound out a vocal 15 times to get that one magic performance—which can result in a recording that's technically accurate but passionately not convincing. With vocal processing, you can get the passion and then fix something."[110] Moreover, the technology allows singers to produce otherwise impossible sounds. Part of the appeal of Cher's 1999 hit "Believe" was certainly the slightly stuttered, mechanical sound of the title word, an effect created through digital processing.[111] Like splicing and overdubbing, DSP is a tool that can be, and has been, used in a variety of ways, both laudable and censurable.

It is important to realize that sound is manipulated in the studio not (or not typically) by performers, but by a variety of sound engineers and producers, sometimes referred to collectively as recordists. Recordists fall outside (or perhaps in between) the traditional triad of composer, performer, and listener. They might be thought of as sound shapers, artists in their own right who collaborate with performers and composers. Because their work is done mostly behind the scenes, their influence is not as widely or deeply appreciated as it should be, though a growing body of literature is starting to remedy the situation.[112]

Recording technology can be used to manipulate sound not only in the studio. In chapter 6 we will see how, beginning in the 1970s, hip-hop musicians transformed the phonograph into a performing instrument capable of generating complex compositions. Although turntablism, as their art came to be called, was new in its particulars, a long tradition of harnessing the technology for similar ends preceded it. As early as the 1920s, avant-garde classical composers treated the phonograph as a means to develop new sounds, and an influential school of thought developed around the possibility of what was sometimes called *Grammophonmusik* (the subject of chapter 5). Beginning in 1939, American experimental composer John Cage began using the phonograph in his music. The earliest example was *Imaginary Landscape No. 1,* scored for muted piano, cymbal, and two variable-speed turntables. It requires two musicians to "play" the machines by altering the speed of the discs and by rhythmically raising and lowering the styli. Although Cage was attracted to the possibilities of the phonograph, he had little interest in its intended use. "The only lively thing that will happen with a record," he once said, "is if somehow you would use it to make something which it isn't. If you could for instance make another piece of music with a record . . . that I would find interesting."[113]

Forty years after Cage's initial experiments, artist and composer Christian Marclay continued what might be called avant-garde turntablism. On one occasion, he created an art installation consisting of dozens of records arranged on a gallery floor, and instructed visitors to walk across them. Later, Marclay gave a concert in which he took the scuffed and scratched discs and, using several turntables, performed a musical collage of pops, clicks, and some heavily obscured tunes. "Instead of rejecting these residual sounds," Marclay explained in a 1998 interview, "I've tried to use them, bringing them to the foreground to make people aware that they're listening to a recording and not live music. We usually make abstractions of the [recorded] medium. For me it was important . . . to give it a voice."[114]

If recording could foster the work of composer-performers, it could also separate composers from performers. *Musique concrète* was an early manifestation of this radical change. The genre was the inspiration of Pierre Schaeffer, who in 1948 began composing musical works by mixing and arranging nonmusical sounds collected via microphone.[115] In the classical tradition, music is typically first conceived by the composer and then interpreted by performers. But musique concrète dispenses with performers by

starting with sound rather than score; as the name suggests, it begins with the concrete rather than the abstract. Schaeffer's first such "concrete" piece was *Etude aux chemins de fer* (1948), a "railway etude" that, in the long history of train-inspired musical works, was the first to be derived solely from actual train sounds, which Schaeffer collected from a Paris station. In the United States beginning in the 1950s, a similar compositional approach arose known as tape music, which likewise treated recorded sound as raw material. Pioneer tape music composer Vladimir Ussachevsky, for example, kept dozens of individually boxed and labeled loops in his studio as a painter might keep jars of paint, ready for use in any future work.[116] John Cage used a library of six hundred different sounds to assemble (through chance means) thousands of minuscule bits of magnetic tape into *Williams Mix* (1952). Like Schaeffer, both worked directly with sound, leaving performers out of the loop, so to speak. Extending the possibilities of tape music is the more recent practice of digital sampling, a method in which sound is converted into highly manipulable data. The range of material from which composers draw is vast, including speech and environmental sounds, as well as live and recorded music; as we will discover in chapter 7, the practice raises difficult questions about every aspect of composition, from aesthetics to ethics. In fact, the very possibility of manipulating sound after its creation—from splicing to digital pitch correction—forces us to reformulate our ideas about composition, performance, and the relationship between the two.

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Music and musical life have been transformed in the age of recording. However vast and complex, this transformation can be traced to ways in which users of the technology respond to the seven interdependent traits that define recording. Yet recording does more than influence the activities of composers, performers, and listeners. It affects the relationship among these actors and in fact challenges the stability, even the validity, of the triad. It is no longer necessary for listeners and performers, or for performers and composers, to work together in order to create music. Yet at the same time, listeners and composers have discovered a more intimate relationship, one that can bypass the mediation of performers, while performers can work in solitude, without the need to stand before listeners.

Performances and works are no longer clearly distinct, for recordings can take on the function and meaning of both. Just as recordings can be heard as spontaneous interpretive acts, their repetition can transform them into compositions, works that can be analyzed, historicized, canonized, politicized, and problematized. Nor are production and reproduction so easily separated when preexisting sounds can be manipulated in real time. With recording, listeners need not simply receive music, for they have an unprecedented control over the sounds they hear. While there have always been composer-performers—artists who interpret their own works—with recording we can conceive of listener-performers and listener-composers. Recording thus not only affects the practice of music, it shapes the very way in which we *think* about music: what it is, can, and should be.