From sound... 
...to tone... 
...to melody... 
...to harmony... 
...to rhythm... 
...to composition... 
...to performance... 
...to listening...

In the New Guinea rain forest, visitors from afar enter a Kaluli longhouse singing and dancing. Through tumultuous voices and swaying hips they pay homage to their host’s clan, its territory, its ancestors. The audience is greatly moved and Soon tears begin to flow. After a while, it becomes too much. Distressed at having been made to feel such sorrow, some jump up to take their revenge, grabbing torches from the walls and scorching the musician-dancers on their arms and shoulders. But the performers do not flee. In fact, they show no sign of pain, but only greater musical intensity. The singing and dancing and weeping and wounding goes on all night, and by dawn the exhausted performers bear second- and third-degree burns. These they will display as an emblem of musical prowess when they return home, a sort of perpetual applause. But before departing, the performers must first pay compensation to their hosts for having made them cry.

In Frankfurt, an opera by the contemporary American composer John Corigliano is under way. Titled “Eugene,” it tells the story of a young American artist who goes to Europe to study music. He falls in love with a beautiful Czech girl, and they decide to get married. But the girl’s father object to the marriage, and she is forced to return to her home country. The opera ends with the artist returning to America, where he finds success as a composer.

In Zaire, a tribunal opens in a Bambala village. Its purpose is to settle a lawsuit, and the litigants will each present reasoned arguments. But the outcome may depend less upon their skills as lawyers than as musicians. For they are required to sing their cases. The plaintiff intones, “I am like the dog that stays before the door until he gets a bone.” The defendant responds, “Nobody goes both ways at the same time. You have told this and that. One of the two must be wrong. That is why I am attacking you.”

There’s order in this court but very little quiet, for the families of the two litigants join in spontaneously, echoing the high points like a Greek chorus. This harmonious conflict will continue all afternoon, and when the village elders finally pronounce their verdict, the chief will broadcast the decision far and wide—by drums.

In downtown Los Angeles, a car passes through a bustling neighborhood. It would go unnoticed were it not that it has been audible from quite some distance, first as rumbling ear canals, then quivering gooseflesh, then jarred entrails, then rattled bones. Only as the car nears does it become clear that it is a kind of music that it expels, music whose energy is bottled up in bass tones too low to carry melody or harmony. The barrage of sound emerges not from inside the car, where it is relatively quiet, but from the car’s trunk, where giant bass speakers project toward the street. The music is powered by smoldering amplifiers and a phalanx of lead-acid batteries; great expense has gone into this concert for the unwilling. Yet, as much as bystanders

aces, all aspects of the composition have been determined by chance num

...to listening... 237
In the Australian outback, an aborigine returns from a most unusual adventure: a trip to London. He is immediately surrounded by family and friends who clamor for every detail of his journey. And so he produces his diary, a very long song he has composed day after day and committed to memory, its verses and intonations recounting every experience. His audience finds nothing unusual in this. For centuries, aboriginal Australians have devised complex songs that describe the stark terrain they inhabit; songs that anyone can use as a kind of map. The voice rises and falls with arpeggios as it describes a mountain path, only to flatten into a monotone when the landscape bottoms out into a vast basin. Subtlety is required, for the desert landscape may extend for miles without prominent features, and travelers can die if a song misdirects them. So songs mimic minute details of the landscape, even the sounds of footsteps on particular kinds of soil. How much easier it is to describe the infinitely varied landscape of a European city! This traveler’s song concludes with instructions for passing through Heathrow Airport.

These examples from around the world remind us that music is not always, or even usually, something that we listen to for pleasure. Particularly in modern industrial societies, music is everywhere and embedded in everything. We wake to music on our clock radios, then use it to gather energy over breakfast, to pacify ourselves through rush hour, to anesthetize ourselves through work, and to relax at day’s end. And we are bombarded by uninvited music. An hour’s television viewing is accompanied by dozens of tunes designed to draw adrenaline or tears or consumer dollars. Music has been used to make factory workers produce more gadgets and to make chickens lay more eggs. It has been employed for healing and hypnosis and pain reduction and as a memorization aid. We dance to music, shop to music, clean house to music, exercise to music, make love to music. Yet only occasionally do we sit down and intently listen to music.

A visiting Martian might conclude that any species that so surrounds itself with music would be devoted to performing. But this is not the case.

Listening is ill defined. As we shall see in Chapter 10, music began as chant which everyone joined. Just clapping along is a kind of musicianship, hearing sound for all to hear. Dancing, too, can be a sort of music-making, motions of body mimic motions of sound. Musical specialists appeared later as hard-to-play instruments began to accompany the singing voice.

But in industrialized society, specialization has separated the performer and the listener. We experience music through concerts, an institution only a few centuries old and still unknown in some parts of the world. Even in recordings we listen to are a sort of ersatz concert. Concerts take many forms—the jazz club, the big band dance, the rock extravaganza, grand opera—yet have much in common.

In this chapter we’ll consider how a brain poses itself to receive musical sound. There are so many approaches to listening to music, and music has been designed in so many ways to meet these approaches, that some ethnomusicologists have declared that there is no universal phenomenon of “music." We cannot consider every culture’s musical habits here. But as it happens, virtually every approach to music is found in modern industrial society. And so we’ll begin with a quick survey of how music has been heard in the West in recent centuries, and then we’ll turn to the question of how it is that music can be appreciated in so many ways.

Concerts

Today we are so accustomed to hearing music all day long that it is hard to appreciate how rare it once was to hear a skilled performance. To a peasant of the Middle Ages, music rarely amounted to more than work songs of the field and lullabies of the hearth. Music more complex than a bare melody was encountered only at church or at annual fairs where wandering minstrels appeared. Any musical sound, no matter how crudely performed, must have been as delicious as the meats and candies enjoyed only on festive days. But such eager ears were necessarily unsophisticated ears. A brain lacking musical experience is necessarily a brain lacking mu-
Concerts were the perfect excuse for an all-night soirée, and having a fine-rate private orchestra became a top status symbol. But until the seventeenth century, public concerts as we know them today were virtually unknown. In England, the first on record took place in 1672 (thirteen years before the birth of Bach and Handel) through the efforts of an enterprising violinist named John Banister. Until this time, there was simply no way for someone of low birth to hear serious music other than church music.

It was opera that moved performance from the corner of the parlor to the formal stage. Originally the orchestra resided behind curtains at the back. If the orchestra was short of players, a singer might make an elegant exit, grab on to his wig, and rush madly to the rear, where he would pick up an instrument and join in. When the orchestra moved out front—at around the time of Louis XIV—it was still a slapdash affair, with no set floor plan and with parts of the score allotted to whatever instruments were available. Silence reigned in the audience only when royalty was present. On any other occasion, a concert resembled a fairground, with people talking, eating, reading, even playing cards. The performers apparently harbored no resentment, for they also jabbered away, among themselves and even to friends in the stalls.

Until the nineteenth century, concert programming was haphazard. Even a celebrated composer like Handel had to be as much an entrepreneur as a musician to survive. He kept a sort of running inventory of his own writings and those of others, adapting them on the spot to the latest libretto, often without credit to those from whom he had “borrowed.” The public demand for new operas was as insatiable as our demand for movies today, so there was no time to write a fresh score for each new production, which typically lasted only a few weeks. Even when a successful opera was revived, it would be unlike the original. And so today’s “authentic” renditions of Baroque operas are necessarily reconstructions.

The art of conducting was still very much in its infancy at this time. In its earliest manifestations, a choral conductor would wander about the choir whispering instructions to individual performers as they sang. Later, music became more complex, control had to be turned over to an individual whose sole task was to lead. By the early days of grand opera, a conductor might pound a large wooden staff to keep time (a practice that engrossed the French composer Lully that he wounded his foot and died of blood poisoning). Only in the nineteenth century did the conductor set up first a scroll of score paper, and later a baton, to stand directly before the orchestra. Oddly, the first modern conductors faced outward toward the audience, lest they appear rude.

Public concerts begin to achieve a mass following only in the nineteenth century, when the Industrial Revolution produced an affluent merchant class devoted to amusement, self-improvement, and recreational social climbing. Nearly every city boasted an opera house, usually small and unprepossessing by today’s standards, and everybody who was anybody could attend each new production. Small, poorly trained orchestras would have to prepare for one opera after another to keep the house full. Performance standards were commensurately abysmal—not that anyone but the conductor much cared. The audience desired only to hear highly paid star singers, who orbited the European circuit in a whirlwind. Only when these stars appeared on stage, often with each singing in his or her own language, would the crowd quiet down. Rivalries between singers became the choice material for gossip, and no musical event was so celebrated as a midstage fistfight between contending sopranos.

No composer’s music was sacred amidst these follies. Theater posters of the day proudly proclaimed that the latest production of Mozart’s *Don Giovanni* had been “improved,” with parts rewritten or replaced, and all manner of “corrections” made. The worst offenders were the piano soloists, who felt obliged to impose their personal stamp upon older compositions through incessant improvisation and embellishment. But mostly they played their own music, which usually was quite awful. The latter half of the nineteenth century became the age of the virtuoso as composer as hero as sex symbol. Athleticism was so highly prized that audience members would sometimes stand on their seats the better to watch piano passages...
women swooned, but later found the strength to yank out piano strings as souvenirs.

To hear such stories, you might think that today's solemn presentations have entirely forsaken the spirit in which the music was written. But composers appear to have consistently opposed such excesses. Handel threw temper tantrums when people talked during rehearsals. Mozart fulminated against violinists' syrupy vibrato, Beethoven against players' unconcern for accuracy, Rossini against singers' vulgar embellishments. As conductor, Mahler locked out latecomers till intermission, put an end to audience applause between movements, and ignored the clamor to repeat popular arias. Even the ever-extravagant Liszt turned in note-for-note renditions in his old age. Today's performances of old compositions may be unlike their premieres, but they are probably just what the composer wanted.

Today, we're much amused by such tales, smug in our sense of superiority. Yet a circus atmosphere is still very much the norm in concerts for popular music. It is only in the realm of art music that audiences are so restrained that a sneeze draws the opprobrium of the entire hall. Elsewhere, audiences often talk and mill about, eat and dance, and cheer on their favorite musicians. For their part, musicians continue to play mostly their own music, and always bring an individual stamp to the tunes of others. In this respect, it is the rock concert that is truly "classical."

In the second half of the nineteenth century, art music concerts began to resemble those of today. To be sure, many customs of the past remained. A concert might last several hours, with the featured soloist appearing more than once, sometimes just to improvise. The orchestra would lie idle for long periods as smaller ensembles interspersed chamber works among symphonic ones. But as concerts shortened and became increasingly formal, audiences quieted and then were expected to be quiet. The house lights were first turned off under Wagner, leaving nothing for a brain to watch but moving musicians and conductor, nothing for a brain to hear but unblemished sound.

Changing Technology

By the year 1877, a concertgoer would spend an evening at the symphony much as we do today. We would be fortunate to have such a musical year as 1877 in our time. In Moscow, Tchaikovsky's Swan Lake premiered unsuccessfully; in Paris, Saint-Saëns's Samson et Dalila; in Vienna, Brahms's Second Symphony. In London, Gilbert and Sullivan's new song "My Name Is John Wellington Wells" was all the rage. And in New York, Harrigan and Hart introduced the cake walk to minstrel shows with their hit Walking for Dat Cake. But the most significant musical event of that year took place far from any concert hall. It was the invention of a toy—a large empty cone linked to a tiny figure of a man holding a saw. When someone shouted into the cone, sound gathered at a membrane and started the little man sawing. It was an ungainly invention with negligible commercial prospects, and it might well have gathered dust had its creator been a less talented man. But his name was Thomas Edison.

Edison watched the man moving in proportion to the volume of his voice and the proverbial light bulb (which he would invent the following year) lit up. He'd already been at work devising a means of recording telegraph messages on paper discs. Why not record sound? The sound-gathering cone was fitted with a cutting needle that prodded a cylinder covered with tinfoil. As the cylinder was cranked by hand, the needle engraved a thin spiral groove whose width varied with the amplitude of the incoming sound wave. When the process was reversed, with the cylinder pushing against a needle that vibrated a membrane, the sound magically reappeared. Not a man of high artistic sensibility, Edison recited "Mary Had a Little Lamb" as history's first recording.

Three years later, Edison's invention recorded the Paris premiere of Wagner's opera Parsifal. But Edison was not the least bit interested in music. He called his invention a "talking machine" and saw it as a way of immortalizing the voices of great men. This was not to be, for the cylinders wore out quickly. So he patented his device as an office dictating machine, dubbed the "ideal amanuensis." With only about a minute's recording
on Edison's design by coating the cylinders in wax. Patent granted! Never to be outdone, Edison feverishly returned to his invention, improving the stylus. Now cylinders could be played many times. But Edison still saw only an office machine.

It was not until 1897, twenty years after Edison's first inspiration, that the Victor and Columbia companies marketed the first machines specifically designed for music: the gramophone (still named after speech; the phonograph would not appear until later). There was little to listen to, and cylinders were expensive. The problem was that cylinders could not be mass-produced. Musicians would play with all their might into the cones of a dozen recording machines, and then would repeat the performance for the next batch, on and on hundreds of times to meet demand. Because discs could be stamped out, they quickly rose in competition with cylinders, and by 1903 the first complete opera was recorded, Verdi's Ernani, on a mere forty single-sided platters.

Audio technology has come far since: the electric phonograph in 1925, the long-playing record in 1948, stereo in the '60s, the tape cassette during the '70s, the compact disc in the '80s. But these were mere additions of quality and convenience to the real breakthrough: the first mass marketing of gramophone discs. It was that moment that changed music listening forever. Edison had done for music what Gutenberg had done for words, creating mass audiences for musical ideas. His invention would completely alter our relationship with music.

With the recording of sounds, and later the broadcasting of sound through the air and even to astronauts on the moon, music took on all the characteristics of mass affluence. Before, concertgoers were slaves to the conductor's taste, hoping to hear a favorite composition once in twenty years, and never granted the luxury of hearing it enough to understand it deeply. Now anyone could own music and indulge in a cherished piece over and over. Before, music was scarce and terribly expensive. Starved ears sought pleasure in anything that came their way. Now, the listener's favorite music was always in reach, and a flip of a switch could cut short the last note from one's music source where before music could be used as a sort of decoration—something to be noticed but not really observed.

Background music is nothing new. Chronicles tell of it in ancient Rome and before. Actually, the very notion of background music could not exist until the solemn concert sanctified the idea of foreground music. The difference is that today background music is as free as air, where before it was an extravagance of the rich. By having music available everywhere and always, it has shifted from its former primary role as a source of pleasure and become foremost a mood enhancer. None of this is novel, but the degree to which it has become the norm has changed everything. Where music once nourished a healthy appetite, whether in the concert hall or the village square, now a perpetual banquet of song serves only to soothe a blunted palate. We live in an age of widespread musical obesity.

**Hearing and Listening**

When we experience music in the background, we passively hear and do not actively listen. What does this mean? Recall from Chapter 1 that incoming sound is extensively processed in the brain stem. By itself, this primitive neural circuitry allows us to discriminate frequency and loudness and location, and it sharpens the edges of individual sounds. Most cognitive scientists believe that auditory processing is entirely unconscious at this level—not just automatic, but wholly separate from the experience we associate with "me." This notion is buttressed by phenomena like blindsight in which a victim of brain damage has no conscious experience of vision whatsoever, yet can pass certain primitive visual discrimination tests thanks to still-functioning visual centers in the brain stem. We can as blindly experience music in the brainstem. Broadly speaking, at this level of analysis, every part of a sound is given equal weight.

But sounds may be tremendously complex, presenting the brain with a rush of information too great to handle. In our earlier consideration of concert halls, we saw how just a single chord emanating from an orchestra consists of hundreds of frequency components, and that it swims in a sea of background noise. So, what happens?
melody, with a dozen kinds of rhythmic markers at every turn, and constant
variations in tempo for phrasing and expression, the brain has a job to do
that by all rights ought to be impossible. Yet we have very little trouble
making sense of a Brahms symphony, which may not even sound all that
complex.

Clearly, the brain is a master of simplification. But to simplify so much
information flowing so quickly is a tremendous burden. Frequencies com-
combined one way at one moment must be combined another way the next.
And musical phrases can wander in as many directions as pieces in a game
of chess. All this occurs amidst the frightful inaccuracy in tuning and timing
that is the norm in musical performance—and that sounds just fine to our
ears.

We triumph over this chaos not by passively hearing with our brain
stems, but by actively listening with cerebral cortex, which searches for
familiar devices and patterns in music. Listening is led by anticipation. Even
when a piece is entirely new to our ears, we make sense of it by perceiving
constituent parts that we already know well. A musical object is not so
much something that strikes our brains as something that our brains reach
out and grab by anticipating it.

Broadly speaking, we anticipate only what we already know. We rec-
ognize—re-cognize—musical devices. This means that in various ways we
remember these devices from prior experience. Thus memory is essential
to music perception.

Psychologists sometimes draw a distinction between "expectation"
and "anticipation." When we expect something, we await its exact rep-
ication. And so if you know a particular song by heart, you expect its exact
notes. On the other hand, you can anticipate even music you have never
heard before by counting on it to follow rules of musical structure and
style. Expectation is specific; it coincides with the episodic memory we en-
countered in Chapter 6. Anticipation is general and coincides with semantic
memory. The more daring music is, the harder it is to anticipate and the
more you need to hear it several times before you can properly expect its
processing of sound of the kind typified by the brain stem, and the active,
predictive processing of cortex. This is because many operations of auditory
cortex seem to be just as automatic and unconscious as in lower-brain
structures. As we've seen, primary auditory cortex automatically exagger-
ates certain frequencies of incoming sound while suppressing others. It
combines frequencies by "sharpening the edges" of their groupings while
lighting elements between those edges (visual cortex does much the same
for the enormously complex patterns that strike our retinas). Much of this
processing seems to have little to do with prior experience. Rather, it
follows innate grouping mechanisms, joining sounds by whether they start
and stop together, or whether they change properties slowly and smoothly,
as most natural sounds do. Especially important for music, auditory cortex
automatically groups the overtone series that arise naturally from simple
vibrating objects.

This automaticity extends beyond the identification of individual
sounds to form basic groupings of many sounds. In Chapter 3, we saw
such mechanisms at work in the rules of Gestalt psychology. For example,
by the Law of Proximity a brain tends to group nearby objects, such as a
bunch of grapes. When this rule is applied to music, where "proximity"
means nearness in time, adjacent notes tend to be grouped as a melodic
line. But other grouping mechanisms are also at work and one can override
the other. And so the Law of Similarity, which states that similar objects are
grouped even when far apart, may cause nearby notes to group into separate
lines when they're played by two different instruments. Basically, the brain
assumes that the simplest solution is the most likely one.

A simple experiment demonstrates the reality of such mechanisms. In
a dark room, two lights are placed side by side and flashed in alternation.
At slow speeds they look like a single light moving back and forth. But at
higher speeds they appear as two stationary, blinking lights. This phi phe-
omenon apparently occurs because beyond a certain rate of flashing the
brain decides that an object cannot move quickly enough to account for
flashing in both positions. Something very like this happens in music. We
movements to nearby tones. When a leap occurs relatively slowly, we hear it as coming from one voice. When it is quick, we perceive two voices.

Music must be designed in accord with such automatic mechanisms. Otherwise the brain will fail to replicate the composer's intention. In a classic study, different melodies were played in each of a subject's ears using tones of the same quality, loudness, and duration. The patterns of the two melodies are shown in Figure 8.1, part (a). But the listener does not hear the irregular contours of each line. Instead, the brain interchanges notes from the two lines to form the simplest possible contour, that of two scale lines coming together and then parting, as in (b). This scale illusion is remarkable considering that each melody is initially directed predominantly toward its own side of the brain, where it is to some degree processed independently of the other. Yet the brain still recombines the notes. In fact, the pull toward order and regularity is so strong that the illusion occurs even when the two melodies are played on different instruments. Composers have long known of this illusion, sometimes devising an otherwise unplayable passage by distributing its notes among several players.

Phenomena like the scale illusion occur automatically in low-level auditory processing—processing for which our brains have sufficient capacity to work in parallel so that they can accommodate every low-level relationship between all of the frequency components all at once. So our brains more or less take in everything at the lowest levels of perception. The whole visual field finds its way to visual cortex, and our ears' entire sound's frequency components, and quite another to detect the changes among changes among changes that characterize, say, the whinnies of a horse. A brain has a much harder time when it begins seeking higher-level relations among basic sonic entities. Such relations are more complex and no doubt harder to model, and the number of possible linkages grows rapidly. There's not nearly enough cortex available to consider every possibility. This would require the ballooned heads sported by aliens in science fiction movies.

Because life bombards us with far more information than our paltry brainpower can handle, a brain must pick and choose. We automatically hear every note or simple figure, but must listen for larger structures. Just as when it plays chess, a brain can no longer consider every move at deep levels of musical analysis. It must work in serial rather than parallel fashion as it apportions scarce neurological resources first to one aspect of a composition and then to another. In a word, the brain must work strategically. In chess, strategy means anticipating patterns in play whose outcome the player knows through long experience. In music, it means anticipating musical devices in the accustomed style. The brain does this by applying its highest-order circuitry selectively to just a part of incoming information, switching its exposure from moment to moment as circumstances require. This is to say that at higher levels of analysis, the brain starts paying attention.

Attending to Music

The notion of attention, although familiar to us all, has long been a point of contention among cognitive psychologists. Theorists explain attention differently, and attribute it to different sorts of mental activity. One thing that attention should not be confused with is arousal, which refers to a nervous system's general level of activity. Daydreaming at the opera is a problem of attention; sleeping at the opera is a problem of arousal.

Attention refers to a nervous system's exposure to sensation. The notion of attending to something is clear enough in a lizard. When its eyes are fixed on a moth, it's a safe bet that it is attending to its next meal. But
malian mind, and terribly complex in the symbol-clogged minds of human beings. Much of a human brain's experience is of the activities of other parts of the brain. This is particularly true at the highest levels of information processing, levels that we call analytical. These can be turned upon internal imagery so intently that we become momentarily blind to experience right before our eyes, even though low-level processing in visual cortex continues as usual. At the highest level of cognition, we always view the world through a narrow telescope, always labor under a kind of tunnel vision. Even when our eyes are focused wide, we're able to consider only a few aspects of the scene before us at any moment, able to model high-level relations of only one kind though many other sorts of observations lie in wait.

The same is true in listening to music. As complex music passes before our ears, we incessantly shift focus between its many aspects, always on the lookout for the most crucial features, those that form the "edges" of musical objects. And so we attend most intently to melody at the peaks and valleys of its contour, most intently to harmony at crucial shifts of key, most intently to rhythm when metrical patterns are violated or when phrases begin or end. Our brains model relations among these junctures and hold them for some seconds in expectation of finding similar elements with which to fashion still higher relations. The notes between are still heard at low levels in the auditory system, but go unmodeled at higher levels. Accordingly, when the average listener is asked to recall a piece moments after hearing it, he'll be able to recount only the most prominent features, for it is only these that the brain has modeled.

As our attention darts around the musical landscape, we tend to spend disproportionate time among high notes. You might assert that this is perfectly natural, since this is where the melody normally lies. But composers could just as well write melodies at middle or low range (and they sometimes do). Perhaps the most cogent line of explanation for this phenomenon has to do with the nature of language—that the range of frequencies where most melodies lie is also the range in which speech consonants

to augment sounds in this range, and our attention may habitually turn toward them.

Next in importance to our attention is the bass line. Most listeners are unaware of their sensitivity to bass notes, partly because bass lines are seldom written as interesting melodies (and generally can't be, owing to the inherent dissonance of intervals at low frequencies). Nonetheless, our brains latch on to bass tones as a kind of foundation on top of which harmony is built. Bass tones carry much energy, and they project a strong, extensive series of overtones that sets a framework against which higher tones are heard. Composers have long understood that a carefully crafted bass line can propel a composition forward, while a poor one will leave it becalmed. Bass tones are lumbering beasts of burden that pull along the entire harmonic edifice.

Together, the bass and treble lines bound music. As outer edges they form a sort of skin around musical sound. This is probably another reason why our brains pay so much attention to them, since perception is mostly concerned with defining edges and corners. The middle voices play a much less important role in most listening. In harmonically uninspired composition, these voices are simply filler, supporting obvious harmonic transitions made by the bass line. It's only in harmonically complex music that a listener may focus upon inner voices. It's often where the action is in really good music.

For centuries, composers have argued about whether even a well-trained ear can follow more than one voice at once. There's a good deal of recent evidence suggesting that it can't. When subjects hear two unrelated melodies at once, they'll subsequently be able to identify only one. The same is true for simultaneous spoken messages. It appears that the problem lies not in tracking several sensory inputs at once, which the brain can handle quite well. Rather, it is faculties for higher-level processing that are overburdened by multiple messages. It's only when two entirely different kinds of information arrive at once that the brain can handle both by devoting different resources to them. Thus, some musicians
as both tasks are fairly automatic. A difficult spot in either activity will draw the brain's highest-level processors to its aid, and the second activity will falter.

This is a good example of laboratory evidence contradicting subjective experience. Anyone with a good ear has a strong sense of simultaneously following the multiple voices of a fugue as they arise and twist and turn. But the lines are not followed in such a way that they could be individually recollected to a clipboard-carrying researcher. Rather, the listener's attention darts to and fro among only the most important features of each line, observing the openings and closures of phrases, and the peaks and valleys within those phrases. In so doing, the brain builds a map of relations between voices, with parallel flows of anticipations implicitly filling in spots that have not been explicitly attended to.

This is exactly how we view a group of dancers on stage. We don't watch one dancer the whole time, and couldn't (had we the memory) report every step that dancer has taken. Instead we follow the patterns that are formed as dancers interact, focusing upon the relations between them. Since all are dancing in the same style, there's no need to gather information of every change in every pattern of motion. Our brains can make good enough guesses about what is happening in the unobserved. And so we leave a dance concert with abstract memories of the total picture, but relatively poor memory of individual detail. Since the deepest pleasure resides in the deepest relations, we feel fulfilled by the concert although we've had time to closely observe only a small fraction of it.

Perception at this level entails a good deal of guesswork. This may not seem very "scientific" on the part of the brain. But guessing is what cognition is all about: an ongoing series of anticipations of what is happening in the brain's environment. Nothing prevents the brain from drawing erroneous relations between sound components that are in fact unconnected. Sometimes it does. But the information gathered by one moment's anticipations underpins the anticipations of the next. Errors tend to multiply, perception fails, and we try a different strategy.

...to listening... melody begins as pairs of notes (da-Dah! da-Dah!) with pauses between (Fig. 8.2). We hear the first pair and don't know what to expect next. But the second pair is enough to suggest a continuation of these pairings (much as two points define a line) and also a rising melodic contour. Sure enough, the next bar delivers more pairings that rise higher and higher in pitch. And so anticipation is not only satisfied but intensified.

Yet the second bar is not without violation of anticipation. The rate at which the pairings rise abruptly doubles, and this increases tension and fosters the anticipation that the tune might accelerate further. Only five beats into the piece, the composer has enhanced "interestingness" by establishing a trend and then interrupting it. But the deviation is restrained. Simultaneously, other aspects of anticipation are met without surprise as harmony rests in the same key, notes stay paired, and contour keeps rising. By reinforcing some anticipations while violating others, the composer ensures that there will be an adequate flux of anticipations to violate in bars to come.

Violate them he does. In the third bar, Mancini suddenly slams on the brakes and sends melodic contour skidding across a sharply accented, long-held note. At the same juncture, harmony shifts toward pronounced dissonance. And all this happens on the downbeat of the third bar, a point of particularly strong rhythmic focus. The violation is abruptly resolved two beats later, when harmony returns to the underlying key and melodic

Anticipations established........confirmed........violated...

...reestablished................previous violations violated
contour slides back to its starting point. This signals the end of a musical object, of a phrase.

Larger-scale anticipations can bridge elements divided by several bars, or even by whole symphonic movements. When Mancini repeats the first four bars almost note-for-note in the fifth through eighth bars, the listener carries along an “echo” of the first four in short-term memory—an echo not just of the individual notes, but of all the relations observed among them. At every level in the hierarchy of integration, our brains look for difference and similarity. Where we find difference, we unearth relations between what was expected and what has occurred—relations that can in turn be anticipated and violated at higher levels of understanding. When we find similarity, trains of anticipation are reinforced, making their ultimate violation all the more powerful.

Consider the four pairs of notes in the second bar. The first two pairs point the listener’s attention along an ever-rising trajectory. But Mancini inserts a kink into the contour, taking a downturn on the third beat then rising again. The melody would have worked by rising steadily upward, and indeed this is just what happens when it is repeated in the sixth bar. But Mancini is holding back, and thereby building larger musical structure. When you come to the sixth bar, you’ll remember the violation of the second bar and expect it to happen again. Instead the melody shoots straight upward so that experience exceeds expectation, propelling the listener forward and intensifying the surprise when harmony swerves toward dissonance a beat later. In this way, the composer violates anticipations one moment in order to intensify their fulfillment the next.

Not everyone will hear “The Pink Panther” in the way Mancini intended. When a Pink Panther movie makes its way to a remote village in China or India, listeners will hear the same notes, but are apt to anticipate the wrong sorts of relations among them. Similarly, our listening strategies go awry when we encounter music that is entirely alien. We bring to it anticipations tailored to Haydn and Sinatra, and try to assemble nonexistent melodic lines, non-existent meters, non-existent tonal progressions. With a little luck we’ll find a few of the clues that the music

the noise of relationlessness, and declare that the music has little melody or harmony or rhythm—in a word, that it “makes no sense.” It’s as if we bring the rules of chess to a game of backgammon.

We suffer similar difficulties when we encounter unfamiliar styles of music in our own culture. Listening to cool jazz as if it were country and western is a big mistake. But we’re more likely to muddle through than we are with Indian or Chinese music. With repeated exposure we may learn to like a new style of Western music; hardly anyone crosses the abyss to full appreciation of the music of a distant culture.

Much of the problem in cross-cultural appreciation lies in the fact that low-level, automatic perceptual mechanisms are differently trained in the world’s diverse musical traditions. As we saw in earlier chapters, a brain acculturated to Indonesian music does not categorize scales and harmonic intervals the same way we do. Our hard-won categorization abilities are at the lowest level of acquired response to music. These skills are learned, yet become as automatic to perception as shoelace tying becomes to movement. High-level attention cannot penetrate deeply enough to adjust these automatic mechanisms. And so we simply can’t listen to an Indonesian scale without trying to perceive it as an out-of-tune Western scale. Perceptiveness for Indonesian music comes slowly, if at all, as auditory cortex acquires new flexibility through long exposure.

Cognitive Preference

Four friends watch a movie and then talk about it in four quite different ways. The first dwells on costume and decor, the second on twists of plot, the third on character development, the fourth on cinematography. People react to music with similar bias. We each have our own listening style, a tendency to attend to certain features of music while neglecting others. Some people are especially drawn to melody, others to harmony or meter or phrasing and form. Everyone hears each aspect to a degree, of course. There is no rigid typology of listeners. Yet listening styles are often easily observed. Call it “cognitive preference”—a penchant for certain types of music because their structure complements particular listening skills. This
background, a matter we’ll turn to in a moment. Let’s consider each kind of listening bias, starting with melody.

After years of conservatory training, and aeons of practice, a young musician can rightfully bask under Auntie Gertrude’s praise following one of those depressing living room demonstrations of what Junior has been doing instead of going to engineering school. After the usual effusive praise, “I can’t imagine how you move your fingers so fast,” comes the inevitable question: “How many songs do you know?”

Songs? Songs? Fugues, yes. Nocturnes or waltzes or sonatas, yes. But songs? Yet, for Auntie Gertrude, as for most of the world, music is melody, and counting melodies is tantamount to counting compositions. Throughout the world, melodies constitute the basic unit of musical experience, if only because most people cannot remember much more than a melodic contour. Many people become engrossed in music only when they covertly (or not so covertly) sing along.

It is not surprising that the average listener is so attuned to melody. As we saw in Chapter 3, melodic contour is our first musical competence. It has much in common with the prosody of spoken language, in which we are all experts. Melody is the one kind of musical device that nearly anyone can make sense of, and perhaps more important, that nearly anyone can remember and reproduce. This orientation has meant that popular music is a world of three-minute compositions, since simple melody writing generally can’t be stretched out much longer.

Melody listening usually means word listening. Ask someone about her favorite song and she’s as likely to recite its lyrics as to hum the tune. Although melodies can as readily be played on instruments as sung, almost all popular music goes for the words. For most people, “music” is as much about poetry as about tonal sound. In fact, studies show that untrained listeners usually can’t recall melodies without bringing lyrics to mind, yet can readily recognize lyrics apart from their melodies. It’s for this reason that so little music crosses linguistic borders. Americans will listen to English rock, but not French or German or Japanese rock in which the words but so do most other trappings of American youth culture: blue jeans, Coca-Cola, Hollywood movies.)

When music is banal, its only redemption rests in its words. Words also provide a welcome memory aid for the musically undeveloped mind. So popular music sees to it that words are intelligible by emphasizing consonant sounds. In contrast, art music emphasizes vowels, subordinating intelligibility to the overall harmonic good. Audiences for art music don’t expect much from words, and they gladly listen to songs in languages they cannot understand.

Harmony listening is more difficult. Chapter 4 explained how Western harmony originated from counterpoint, the interplay of multiple voices. Although pure counterpoint has been out of vogue for more than two centuries, it still is at the heart of harmonic practice. Elaborate harmony is comprehensible only when successions of chords are heard as multiple voices. Thus harmony requires the sophistication of polyphonic listening. Along with preference for harmony comes a taste for instruments played with “good tone” to produce a lucid, clear chordal overtones. Noise-laden instruments like the electric guitar are anathema to the harmony listener.

As we’ve seen, harmony became the obsession of Western classical music. But harmony tends to be simple in most popular music. Chord changes are predictable and infrequent as inner voices shadow the leading melody rather than strike off on their own. Not surprisingly, studies consistently show that perceptiveness for complex harmony is the rarest of listening skills, with wide disparities between professional musicians and ordinary folk. This should come as no surprise, since fine-grained harmony perception develops later than other skills, arriving only in early adolescence, if ever. Those who fail to grasp harmony can be quite uncomprehending of harmony-oriented music. Like someone color-blind viewing a Monet (“It’s just a haystack. What’s the big deal?”), their musical world is in black-and-white.

Other listeners show a strong bias toward meter, toward music that “has beat.” As we saw in Chapter 5, complex meter is rare in Western
rhythm, and polyrhythm, you must turn to the music of Africa or India. Though drummers sometimes tap out complicated patterns in Western music, the effect usually amounts to nothing more than texture. Nonetheless, many listeners boast that their music “has rhythm,” referring to its emphasis of meter rather than its metrical complexity. For these listeners, music is foremost a device for making their bodies pulse. This pleasure (which we’ll consider in Chapter 10) appears to be gradually gaining priority over the pleasure of melody.

Allegiance to the second kind of rhythm, phrasing, is rarer. Recall that phrasing, like meter, organizes music by marking spans of time. Built up into hierarchies, phrasing merges into large-scale form to create a panorama in sound. This is the ultimate aim of art music and, by its standards, the final measure of greatness. It is a bust of Beethoven—and not of Tchaikovsky or Gershwin or John Lennon—that sits on so many pianos because it was he who devised the deepest phrasing hierarchies ever (“as if phoned in from heaven,” as Leonard Bernstein put it). Devotees of phrasing and form will forgive clumsy orchestration, uninspired melodies, drab beat, even lame harmony, if somehow a composer can find a way to these large structures. For them, to listen to music is to fly over a landscape of infinite variation and surprise. By their lights, most popular music is as tedious as Iowa cornfields.

Music’s many genres are each oriented to a different mix of these four basic kinds of listening (and to many lesser factors as well). When a jazz artist insists that “rhythm is the heart of music,” he merely proclaims his allegiance to meter, and he plays and conducts and writes music to emphasize this focus. Devotees of classical music are just as biased, but toward harmony and form.

Why does one listener zero in on meter while another makes straight for melody or harmony? Exposure is surely one reason. Early training teaches us to observe particular features of music. Thereafter we seek out like-minded music and acquire an ever better ear for its traits. This circularity leaves many listeners almost deaf to whole musical dimensions that biological variability extends to the dimensions of every part of the brain. No brain is proportioned exactly like any other, and broadly speaking, more circuitry makes for greater perceptual skill. Without doubt, some people are better constituted for listening to harmony, or to meter. Considering the multitude of individual modules that make up the auditory cortex, each devoted to a particular kind of sonic relationship, and each varying in capability from person to person, it’s reasonable to believe that an individual could have a biological predilection for particular aspects of music. The composite balance of skills would form a musical personality unique to an individual, although subject to the tyranny of the bell curve, which dictates that most people will be fairly similar, just as they are in general personality. Mozart summed it up quite nicely:

But why my productions take from my hand that particular form and style that makes them Mozartish, and different from the works of other composers, is probably owing to the same cause that renders my nose so large or so aquiline, or, in short, makes it Mozart’s, and different from those of other people.

None of this explains why we prefer particular compositions among the many that complement our individual musical personalities. The blend of individual musical history and individual auditory neurology helps explain enthusiasm for a particular performer or composer. But it doesn’t explain why we like one piece by that person and not another.

Individual compositions succeed or fail by “interestingness,” a concept lacking in scientific rigor but affirmed by every concertgoer’s yawn. Research on melody preference has consistently shown that we like melodies that are slightly challenging to the ear, that go just beyond the expectations we have been taught by prior musical experience. It’s a bit like a tennis player’s always preferring to play with someone slightly better. But when melody (and music in general) is too challenging, our brains rebel. It’s no fun never returning the ball. Music beyond our grasp is not music at all.
Interestingness can be analyzed in terms of information content. In this context, “information” refers to any aspects of a passage that are not strongly implied by the musical conventions of the time the passage was written. Easily anticipated notes contribute little to the total information conveyed by a passage. For instance, each successive note in a scale is readily anticipated and provides no new information, so scales are boring. In contrast, a sudden shift to a remote key is full of surprises and gives the listener something to respond to, increasing the information a composition conveys.

Scholars have attempted to quantify the information content of melodies of different genres of music. This is done partly by counting features like leaps and syncopations, and also by assessing the amount of dissonance in a melody’s underlying harmony. To no one’s surprise, the melodies of much popular music tend to score quite low in information content, which helps explain why so much pop music sounds the same. An extreme case would be the mood-conditioning, utterly featureless music played in supermarkets, music that is written expressly to not draw our attention. Its information content is essentially zero. At the opposite extreme is a good deal of twentieth-century art music that audiences generally detest. In theory, the information content of such music is very high. But whether by inept ears or by inept composition, few people can grasp this music’s deep relations. Studies show that listeners almost always prefer music with too little information over music containing too much. It has also been found that people tend to prefer increasingly complex, information-laden music as they grow older and their listening skills improve. The reverse case, where listeners go from preferring complex to simple music, is virtually unknown.

**Musical Preference**

In recent years, shop owners have found that broadcasting classical music onto the street drives away drug dealers. And Mozart has been played in malls to flush out loitering teenagers. But research shows that it takes...
they maintain the trappings of the young. “Hope I die before I get old,” sing the Who.

Neither portrait is very complimentary, and this only goes to show how extreme music’s social symbolism can be. Happily, individuals can be drawn to music in spite of its outward symbolism.

People also are attracted to genres of music that serve a particular function in their lives. Someone fancies reggae because she likes to dance to it. Someone dotes on opera for the cult of personality. Someone goes to jazz clubs to enjoy the antics of unplanned improvisation. Someone goes to musicals out of a penchant for theater. There are lot of draws.

Yet despite all these factors, research shows that most people largely make their personal musical choices for reasons that are neither “personal” nor “musical.” Rather, they listen to conform, taking on music as an emblem of social solidarity with their peers, each generation adopting its own conspicuously different styles. There are many exceptions of course, but the gross statistics are damning. Most people acquire their musical taste during adolescence among friends of the same age, and they carry early preferences right through to the grave. This powerful force overrides considerations of individual neurology and personality. It is a shocking observation, or at least ought to be, given the complexities of music perception. By all rights, any group of twenty teenagers ought to prefer twenty kinds of music.

Some social psychologists have gone so far as to suggest that we “imprint” to a preferred musical style during early adolescence, much the way young animals imprint upon their mothers, forming an attraction that will never leave them. If this is so, then our brains may literally develop toward a particular musical style during the final years of normal musical development (from about age ten to twelve.) This is not saying much more than that neurons form connections as we learn, and those connections tend to dominate all further perception. Once one way of listening is established, it is applied to all kinds of music, which are accepted or rejected by how well they fit. Neurons are quite capable of branching toward further con-
But why bother? In the modern world, it is as easy to reject an uncom-
prehended genre of music as to turn a radio dial.

It's fair to object that every generation confronts a different world,
and with a different perspective that becomes embodied in new music.
The rustic naïveté of the beer hall polka is long gone, and so is the
optimistic worldview of the Las Vegas crooners. But history does not
stand still; the world goes right on changing through our individual
lives, and we change with it. Forests have fallen to print a vast litera-
ture on the psychology of life stages. Yet as much as we change with
age, our musical taste generally remains stagnant. Most of us stick with
what we know, much as we do with the sorts of food we eat and clothes
we wear. Dumb habit is the main reason, of course. But habit alone does
not entirely explain our listening habits. We are also made narrow by
approaching music too passively. By shunting music to the background,
we do not meet and overcome new perceptual challenges, and so discover
nothing new.

**Expert Listening**

Given the great diversity of approaches to music, it is remarkable that
we so readily assume that others share our own experience. If an audience
leaves a movie with clashing impressions, think how much wider must be
the gulf left by a concert. We share a common apprenticeship in our ex-
erience of the world, but not of music. One person listens exclusively to
pop, another only to the classics. One regards music as decoration, another
consists like a Delphic oracle. One can hardly sing an eight-bar melody,
another can reproduce whole sonatas from memory, whether by keyboard
or in lucid imagery.

Clearly, listening is a skill—a performance skill in which the listener
inwardly reproduces many features of a piece by anticipating them, and
thereby better prepares himself to perceive them. As the myriad tones of
a composition scoot by, an expert listener rounds them up with the pro-
ficiency of a sheepdog attending its flock. The musical mind is constantly
alert—there is no sleep here, no slip into unconsciousness. A momentary
lapse in acknowledgment of the performer's skill might be the ruin of an
entire work. Indeed, the music lover is a slave to the music, and the music
master is also a slave; and they are both perpetually healthy.

Expert listeners perceive large musical objects. Chord progressions,
rhythmic devices, conventions of style—all are so deeply ingrained that
just a hint is needed to start anticipations rolling. These anticipations derive
from prior experience, experience that has molded the mechanisms of at-
tention to embody conventions of harmony and rhythm and style. And so
the expert ear implicitly brings an extensive library of musical ideas to its
listening.

The expert listener's powers of anticipation can be taken one step
further by committing the structure of individual compositions to long-
term memory, cultivating a repertoire of pieces one knows how to follow
well. Such knowledge is normally fragmentary. Rare indeed is the listener
who can play a piece note-for-note in his mind's ear, or plot out its score.
But with repeated exposure a listener acquires a map of a composition's
main events. With hundreds of signposts, the listener can unleash
his anticipations early and accurately, negotiating a composition's twists
and turns with the finesse of a motorist traveling a familiar mountain road.

Anticipation freea a mind from surface detail, allowing it to probe for
dereeper relations. As we saw in Chapter 5, to go beyond surface levels of
hierarchy is to observe musical structures that unfold beyond the span of
the perceptual present. At deep levels of hierarchy, the listener can no
longer count on the "reverberation" of auditory cortex to bring together
musical elements. Thus short-term musical memory becomes important.
The expert listener does not merely perceive notes passing by, but totes
along armfuls of fragments for use moments later.

These memories are largely the responsibility of the frontal lobes,
which act upon auditory cortex to maintain observed relations for many
seconds when they would otherwise fade away. The frontal lobes glow
brightly in brain scans of short-term-memory tasks. As we've seen, atten-
tion is also managed largely by the frontal lobes. In fact, the two phenom-
ena of short-term memory and attention are closely linked, each being
founded upon anticipation.
center for other parts of the brain, a nexus of planning, of effort, of discipline, of will. They are the taskmaster behind mental labor. Thus expert listening is always effortful. Compared to more passive listening, it is the difference between watching a dance from the sidelines and taking part. It may be work, but is a joyous expenditure of energy.

By forcing an impulsive and unruly brain to hold still, the frontal lobes serve the dual role of disciplinarian and teacher. Their repeated exertions gradually renovate the way auditory cortex processes incoming sound, so that what at first is difficult to perceive later becomes automatic. As a mind gradually becomes more musically perceptive, complex patterns begin to make their way as readily as a flighty melody. Attention is no longer called to surface detail, and so is freed for the enchantment of deep relations.

Such sophistication necessarily involves greater left-brain involvement. This is a theme we’ve encountered again and again in past chapters. The right-brain penchant for contour and pattern takes music perception only so far. Complex compositions, with interweaving themes in several voices, requires the sequencing talents of the left brain. By treating music as an assemblage of fragments, the left brain is able to model relations between widely separated moments, and thereby to look deeper into its hierarchy than the present-bound right brain.

Finally, expert listening requires expert music. Considering the vast range of musical experience—in how we perceive music, choose it, use it, count upon it—it is tempting to conclude that any music ought to be as effective in its own way as any other. As Big Bill Broonzy put it, “They’re all folk songs—I ain’t never heard a horse sing.” But they’re most certainly not all folk songs—not a Bach fugue, not big band jazz, not an Indian raga. Music that is painstakingly invented is quite different from popular genres that make no attempt at relational depth and consist mostly of moment-to-moment variations on a simple theme. A brain cannot know the pleasures of deep relations when there are none to be observed.

A New Yorker cartoon spoofs the publishing industry with a fake advertisement for “Ambient Books,” extolled as having “No beginning..."

There’s some yellow ones. Look, more white ones. Could those be rhododendrons? Another best-seller: The Ocean (“Two little waves. A medium-sized wave. Six isy-bisy waves. A large wave. Here comes another medium-sized wave”). We laugh, but much popular music amounts to little more. What is rare is music that tells a story, that brings a multitude of themes and devices into elaborate and unpredictable interplay, like characters in a good novel—in a word, music that is literature and not mere genre writing. Lacking long exposure to such music, many people remain unaware of the limitations of the music they listen to, and haven’t a clue about what music can be. Their unskilled ears make so little sense of complex music that they can only conclude that their own music must be superior.

Happily, any ear can learn to probe deeper if only an effort is made. It’s not always easy. In the name of self-improvement, today’s symphony audiences sometimes sit through premières of contemporary works they can hardly stomach, suffering harmonies that sound consistently dissonant, rhythms without apparent pattern, and a dearth of melody. To this the public responds with remarkable passivity, applauding politely to celebrate the end of their suffering. One is reminded of Suetonius’s description of concerts given by Nero, to which no invitation dared be declined:

No one was allowed to leave the theater during the emperor’s recitals, however pressing the reason, and the gates were kept barred. We read of women in the audience giving birth and of men being so bored from the music and the applause that they shammed dead and were carried away for burial.

Although the modern exercise of subjecting captive audiences to music they do not comprehend may be misconceived, there is something admirable in such blind submission to musical authority. In a world where so many people are oblivious to quality in music, even hostile toward the very idea of quality, it is refreshing to see people recognize that music can mean more than just entertainment...
Following the premiere of his great opera *Don Giovanni*, Mozart heard that the emperor had criticized it thus: "That opera is divine. I should even venture that it is more beautiful than *The Marriage of Figaro*. But such music is not meat for the teeth of my Viennese." The composer quietly replied, "Give them time to chew on it." Alas, taking time is not a virtue of our age. It is so much easier to switch to another channel, to pop in a different CD. But ultimately music cannot become—never has become and never will become—any better than its audiences are able to listen.

From sound...  
...to tone...  
...to melody...  
...to harmony...  
...to rhythm...  
...to composition...  
...to performance...  
...to listening...  
...to understanding...

It is, by Earth time, a.d. 3,721,479, and the citizens of the planet Phyxis are elated: the appearance of a UFO has been confirmed. Reconnaissance craft speed toward a glistening speck in the sky, only to find a gangly spider of metal beams, which they deliver to the planet's leading research institute. There, scientists gather around, fluttering their wings in astonishment. Other alien objects have been encountered during the long history of Phyxis, but nothing so primitive as this. Archaeologists decide that the object must be a spacecraft launched by a civilization only just beginning to reach out from its home planet.

By the fact that this spacecraft has approached at low velocity through a vast expanse of empty space, it is certain to be very, very old. Although its skin has been pockmarked by cosmic dust, somehow the craft has man...