8. My Favorite Things

Why Do We Like the Music We Like?

You wake from a deep sleep and open your eyes. It's dark. The distant regular beating at the periphery of your hearing is still there. You rub your eyes with your hands, but you can't make out any shapes or forms. Time passes, but how long? Half an hour? One hour? Then you hear a different but recognizable sound—an amorphous, moving, wiggly sound with fast beating, a pounding that you can feel in your feet. The sounds start and stop without definition. Gradually building up and dying down, they weave together with no clear beginnings or endings. These familiar sounds are comforting, you've heard them before. As you listen, you have a vague notion of what will come next, and it does, even as the sounds remain remote and muddled, as though you're listening underwater.

Inside the womb, surrounded by amniotic fluid, the fetus hears sounds. It hears the heartbeat of its mother, at times speeding up, at other times slowing down. And the fetus hears music, as was recently discovered by Alexandra Lamont of Keele University in the UK. She found that, a year after they are born, children recognize and prefer music they were exposed to in the womb. The auditory system of the fetus is fully functional about twenty weeks after conception. In Lamont's experiment, mothers played a single piece of music to their babies repeatedly during the final three months of gestation. Of course, the babies were also hearing—through the waterlike filtering of the amniotic fluid in the womb—all of the sounds of their mothers' daily life, including other music, conversations, and environmental noises. But one particular piece was singled out for each baby to hear on a regular basis. The singled-out pieces included classical (Mozart, Vivaldi), Top 40 (Five, Backstreet Boys), reggae (UB40, Ken Boothe) and world beat (Spirits of Nature). After birth, the mothers were not allowed to play the experimental song to their infants. Then, one year later, Lamont played babies the music that they had heard in the womb, along with another piece of music chosen to be matched for style and tempo. For example, a baby who had heard UB40's reggae track "Many Rivers to Cross" heard that piece again, a year later, along with "Stop Loving You" by the reggae artist Freddie McGregor. Lamont then determined which one the babies preferred.

How do you know which of two stimuli a preverbal infant prefers? Most infant researchers use a technique known as the conditioned head-turning procedure, developed by Robert Fantz in the 1960s, and refined by John Columbo, Anne Fernald, the late Peter Jusczyk, and their colleagues. Two loudspeakers are set up in the laboratory and the infant is placed (usually on his mother's lap) between the speakers. When the infant looks at one speaker, it starts to play music or some other sound, and when he looks at the other speaker, it starts to play different music or a different sound. The infant quickly learns that he can control what is playing by where he is looking; he learns, that is, that the conditions of the experiment are under his control. The experimenters make sure that they counterbalance (randomize) the location that the different stimuli come from; that is, half the time the stimulus under study comes from one speaker and half the time it comes from the other. When Lamont did this with the infants in her study, she found that they tended to look longer at the speaker that was playing music they had heard in the womb than at the speaker playing the novel music, confirming that they preferred the music to which they had the prenatal exposure. A control group of one-year-olds who had not heard any of the music before showed no preference, confirming that there was nothing about the music itself that caused these results. Lamont also found that, all things being equal, the young infant prefers fast, upbeat music to slow music.

These findings contradict the long-standing notion of childhood amnesia—that we can't have any veridical memories before around the age of five. Many people claim to have memories from early childhood around age two and three, but it is difficult to know whether these are true memories of the original event, or rather, memory of someone telling us about the event later. The young child's brain is still undeveloped, functional specialization of the brain isn't complete, and neural pathways are still in the process of being made. The child's mind is trying to assimilate as much information as possible in as short a time as possible; there are typically large gaps in the child's understanding, awareness, or memory for events because he hasn't yet learned how to distinguish important events from unimportant ones, or to encode experience systematically. Thus, the young child is a prime candidate for suggestion, and could unwittingly encode, as his own, stories that were told to him about himself. It appears that for music even prenatal experience is encoded in memory, and can be accessed in the absence of language or explicit awareness of the memory.

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A study made the newspapers and morning talk shows several years ago, claiming that listening to Mozart for ten minutes a day made you smarter ("the Mozart Effect"). Specifically, music listening, it was claimed, can improve your performance on spatial-reasoning tasks given immediately after the listening session (which some journalists thought implied mathematical ability as well). U.S. congressmen were passing resolutions, the governor of Georgia appropriated funds to buy a Mozart CD for every newborn baby Georgian. Most scientists found ourselves in an uncomfortable position. Although we do believe intuitively that music can enhance other cognitive skills, and although we would all like to see more governmental funding for school music programs, the actual study that claimed this contained many scientific flaws. The study was claiming some of the right things but for the wrong reasons. Personally, I found all the hubbub a bit offensive because the implication was that music should not be studied in and of itself, or for its own right, but only if it could help people to do better on other, "more important" things. Think how absurd this would sound if we turned it inside out. If I claimed that studying mathematics helped musical ability, would policy makers start pumping money into math for that reason? Music has often been the poor stepchild of public schools, the first program to get cut when there are funding problems, and people frequently try to justify it in terms of its collateral benefits, rather than letting music exist for its own rewards.

The problem with the "music makes you smarter" study turned out to be straightforward: The experimental controls were inadequate, and the tiny difference in spatial ability between the two groups, according to research by Bill Thompson, Glenn Schellenberg, and others, all turned on the choice of a control task. Compared to sitting in a room and doing nothing, music listening looked pretty good. But if subjects in the control task were given the slightest mental stimulation—hearing a book on tape, reading, etc.—there was no advantage for music listening. Another problem with the study was that there was no plausible mechanism proposed by which this might work—how could music listening increase spatial performance?

Glenn Schellenberg has pointed out the importance of distinguishing short-term from long-term effects of music. The Mozart Effect referred to immediate benefits, but other research *has* revealed long-term effects of musical activity. Music listening enhances or changes certain neural circuits, including the density of dendritic connections in the primary auditory cortex. The Harvard neuroscientist Gottfried Schlaug has shown that the front portion of the corpus callosum—the mass of fibers connecting the two cerebral hemispheres—is significantly larger in musicians than nonmusicians, and particularly for musicians who began their training early. This reinforces the notion that musical operations become bilateral with increased training, as musicians coordinate and recruit neural structures in both the left and right hemispheres.

Several studies have found microstructural changes in the cerebellum after the acquisition of motor skills, such as are acquired by musicians, including an increased number and density of synapses. Schlaug found that musicians tended to have larger cerebellums than nonmusicians, and an increased concentration of gray matter; gray matter is that part of the brain that contains the cell bodies, axons, and dendrites, and is understood to be responsible for information processing, as opposed to white matter, which is responsible for information transmission.

Whether these structural changes in the brain translate to enhanced

abilities in nonmusical domains has not been proven, but music listening and music therapy have been shown to help people overcome a broad range of psychological and physical problems. But, to return to a more fruitful line of inquiry regarding musical taste . . . Lamont's results are important because they show that the prenatal and newborn brain are able to store memories and retrieve them over long periods of time. More practically, the results indicate that the environment—even when mediated by amniotic fluid and by the womb—can affect a child's development and preferences. So the seeds of musical preference are sown in the womb, but there must be more to the story than that, or children would simply gravitate toward the music their mothers like, or that plays in Lamaze classes. What we can say is that musical preferences are influenced, but not determined, by what we hear in the womb. There also is an extended period of acculturation, during which the infant takes in the music of the culture she is born into. There were reports a few years ago that prior to becoming used to the music of a foreign (to us) culture, all infants prefer Western music to other musics, regardless of their culture or race. These findings were not corroborated, but rather, it was found that infants do show a preference for consonance over dissonance. Appreciating dissonance comes later in life, and people differ in how much dissonance they can tolerate.

There is probably a neural basis for this. Consonant intervals and dissonant intervals are processed via separate mechanisms in the auditory cortex. Recent results from studying the electrophysiological responses of humans and monkeys to sensory dissonance (that is, chords that sound dissonant by virtue of their frequency ratios, not due to any harmonic or musical context) show that neurons in the primary auditory cortex—the first level of cortical processing for sound—synchronize their firing rates during dissonant chords, but not during consonant chords. Why that would create a preference for consonance is not yet clear.

We do know a bit about the infant's auditory world. Although infant ears are fully functioning four months before birth, the developing brain requires months or years to reach full auditory processing capacity. Infants recognize transpositions of pitch and of time (tempo changes), indicating they are capable of relational processing, something that even the most advanced computers still can't do very well. Jenny Saffran of the University of Wisconsin and Laurel Trainor of McMaster University have gathered evidence that infants can also attend to absolute-pitch cues if the task requires it, suggesting a cognitive flexibility previously unknown: Infants can employ different modes of processing—presumably mediated by different neural circuits—depending on what will best help them to solve the problem at hand.

Trehub, Dowling, and others have shown that contour is the most salient musical feature for infants, who can detect contour similarities and differences even across thirty seconds of retention. Recall that *contour* refers to the pattern of musical pitch in a melody—the sequence of ups and downs that the melody takes—regardless of the size of the interval. Someone attending to contour exclusively would encode only that the melody goes up, for example, but not by how much. Infants' sensitivity to musical contour parallels their sensitivity to linguistic contours—which separate questions from exclamations, for example, and which are part of what linguists call prosody. Fernald and Trehub have documented the ways in which parents speak differently to infants than to older children and adults, and this holds across cultures. The resulting manner of speaking uses a slower tempo, an extended pitch range, and a higher overall pitch level.

Mothers (and to a lesser extent, fathers) do this quite naturally without any explicit instruction to do so, using an exaggerated intonation that the researchers call infant-directed speech or motherese. We believe that motherese helps to call the babies' attention to the mother's voice, and helps to distinguish words within the sentence. Instead of saying, as we would to an adult, "This is a ball," motherese would entail something like, "Seeeeee?" (with the pitch of the eee's going up to the end of the sentence). "See the BAAAAAALLLLLL?" (with the pitch covering an extended range and going up again at the end of the word *ball*). In such utterances, the contour is a signal that the mother is asking a question or making a statement, and by exaggerating the differences between up and down contours, the mother calls attention to them. In effect, the mother is creating a prototype for a question and a prototype for a declaration, and ensuring that the prototypes are easily distinguishable. When a mother gives an exclamatory scold, quite naturally—and again without explicit training—she is likely to create a third type of prototypical utterance, one that is short and clipped, without much pitch variation: "No!" (pause) "No! Bad!" (pause) "I said no!" Babies seem to come hardwired with an ability to detect and track contour, preferentially, over specific pitch intervals.

Trehub also showed that infants are more able to encode consonant intervals such as perfect fourth and perfect fifth than dissonant ones, like the tritone. Trehub found that the unequal steps of our scale make it easier to process intervals even early in infancy. She and her colleagues played nine-month-olds the regular seven-note major scale and two scales she invented. For one of these invented scales, she divided the octave into eleven equal-space steps and then selected seven tones that made one- and two-step patterns, and for the other she divided the octave into seven equal steps. The infants' task was to detect a mistuned tone. Adults performed well with the major scale, but poorly with both of the artificial, never-before-heard scales. In contrast, the infants did equally well on both unequally tuned scales and on the equally tuned ones. From prior work, it is believed that nine-month-olds have not yet incorporated a mental schema for the major scale, so this suggests a general processing advantage for unequal steps, something our major scale has.

In other words, our brains and the musical scales we use seem to have coevolved. It is no accident that we have the funny, asymmetric arrangement of notes in the major scale: It is easier to learn melodies with this arrangement, which is a result of the physics of sound production (via the overtone series we visited earlier); the set of tones we use in our major scale are very close in pitch to the tones that constitute the overtone series. Very early in childhood, most children start to spontaneously vocalize, and these early vocalizations can sound a lot like singing. Babies explore the range of their voices, and begin to explore phonetic production, in response to the sounds they are bringing in from the world around them. The more music they hear, the more likely they are to include pitch and rhythmic variations in their spontaneous vocalizations.

Young children start to show a preference for the music of their culture by age two, around the same time they begin to develop specialized speech processing. At first, children tend to like simple songs, where *simple* means music that has clearly defined themes (as opposed to, say, four-part counterpoint) and chord progressions that resolve in direct and easily predictable ways. As they mature, children start to tire of easily predictable music and search for music that holds more challenge. According to Mike Posner, the frontal lobes and the anterior cingulate—a structure just behind the frontal lobes that directs attention—are not fully formed in children, leading to an inability to pay attention to several things at once; children show difficulty attending to one stimulus when distracters are present. This accounts for why children under the age of eight or so have so much difficulty singing "rounds" like "Row, Row, Row Your Boat." Their attentional system—specifically the network that connects the cingulate gyrus (the larger structure within which the anterior cingulate sits) and the orbitofrontal regions of the brain—cannot adequately filter out unwanted or distracting stimuli. Children who have not yet reached the developmental stage of being able to exclude irrelevant auditory information face a world of great sonic complexity with all sounds coming in as a sensory barrage. They may try to follow the part of the song that their group is supposed to be singing, only to be distracted and tripped up by the competing parts in the round. Posner has shown that certain exercises adapted from attention and concentration games used by NASA can help accelerate the development of the child's attentional ability.

The developmental trajectory, in children, of first preferring simple and then more complex songs is a generalization, of course; not all children like music in the first place, and some children develop a taste for music that is off the beaten path, oftentimes through pure serendipity. I became fascinated with big band and swing music when I was eight, around the time my grandfather gave me his collection of 78 rpm records from the World War II era. I was initially attracted by novelty songs, such as "The Syncopated Clock," "Would You Like to Swing on a Star," "The Teddy Bear's Picnic," and "Bibbidy Bobbidy Boo"—songs that were made

for children. But sufficient exposure to the relatively exotic chord patterns and voicings of Frank de Vol's and Leroy Anderson's orchestras became part of my mental wiring, and I soon found myself listening to all kinds of jazz; the children's jazz opened the neural doors to make jazz in general palatable and understandable.

Researchers point to the teen years as the turning point for musical preferences. It is around the age of ten or eleven that most children take on music as a real interest, even those children who didn't express such an interest in music earlier. As adults, the music we tend to be nostalgic for, the music that feels like it is "our" music, corresponds to the music we heard during these years. One of the first signs of Alzheimer's disease (a disease characterized by changes in nerve cells and neurotransmitter levels, as well as destruction of synapses) in older adults is memory loss. As the disease progresses, memory loss becomes more profound. Yet many of these old-timers can still remember how to sing the songs they heard when they were fourteen. Why fourteen? Part of the reason we remember songs from our teenage years is because those years were times of self-discovery, and as a consequence, they were emotionally charged; in general, we tend to remember things that have an emotional component because our amygdala and neurotransmitters act in concert to "tag" the memories as something important. Part of the reason also has to do with neural maturation and pruning; it is around fourteen that the wiring of our musical brains is approaching adultlike levels of completion.

There doesn't seem to be a cutoff point for acquiring new tastes in music, but most people have formed their tastes by the age of eighteen or twenty. Why this is so is not clear, but several studies have found it to be the case. Part of the reason may be that in general, people tend to become less open to new experiences as they age. During our teenage years, we begin to discover that there exists a world of different ideas, different cultures, different people. We experiment with the idea that we don't have to limit our life's course, our personalities, or our decisions to what we were taught by our parents, or to the way we were brought up. We also seek out different kinds of music. In Western culture in particular, the choice of music has important social consequences. We listen to the music that our friends listen to. Particularly when we are young, and in search of our identity, we form bonds or social groups with people whom we want to be like, or whom we believe we have something in common with. As a way of externalizing the bond, we dress alike, share activities, and listen to the same music. Our group listens to this kind of music, those people listen to that kind of music. This ties into the evolutionary idea of music as a vehicle for social bonding and societal cohesion. Music and musical preferences become a mark of personal and group identity and of distinction.

To some degree, we might say that personality characteristics are associated with, or predictive of, the kind of music that people like. But to a large degree, it is determined by more or less chance factors: where you went to school, who you hung out with, what music they happened to be listening to. When I lived in northern California as a kid, Creedence Clearwater Revival was huge—they were from just down the road. When I moved to southern California, CCR's brand of quasi-cowboy, country-hick music didn't fit in well with the surfer/Hollywood culture that embraced the Beach Boys and more theatrical performance artists like David Bowie.

Also, our brains are developing and forming new connections at an explosive rate throughout adolescence, but this slows down substantially after our teenage years, the formative phase when our neural circuits become structured out of our experiences. This process applies to the music we hear; new music becomes assimilated within the framework of the music we were listening to during this critical period. We know that there are critical periods for acquiring new skills, such as language. If a child doesn't learn language by the age of six or so (whether a first or a second language), the child will never learn to speak with the effortlessness that characterizes most native speakers of a language. Music and mathematics have an extended window, but not an unlimited one: If a student hasn't had music lessons or mathematical training prior to about age twenty, he can still learn these subjects, but only with great difficulty, and it's likely that he will never "speak" math or music like someone who learned them early. This is because of the biological course for synaptic growth. The brain's synapses are programmed to grow for a number of years, making new connections. After that time, there is a shift toward pruning, to get rid of unneeded connections.

Neuroplasticity is the ability of the brain to reorganize itself. Although in the last five years there have been some impressive demonstrations of brain reorganization that used to be thought impossible, the amount of reorganization that can occur in most adults is vastly less than can occur in children and adolescents.

Of course, there are individual differences. Just as some people can heal broken bones or skin cuts faster than others, so, too, can some people forge new connections more easily than others. Generally, between the ages of eight and fourteen, pruning starts to occur in the frontal lobes, the seat of higher thought and reasoning, planning, and impulse control. Myelination starts to ramp up during this time. Myelin is a fatty substance that coats the axons, speeding up synaptic transmission. (This is why as children get older, generally, problem solving becomes more rapid and they are able to solve more complex problems.) Myelination of the whole brain is generally completed by age twenty. Multiple sclerosis is one of several degenerative diseases that can affect the myelin sheath surrounding the neurons.

The balance between simplicity and complexity in music also informs our preferences. Scientific studies of like and dislike across a variety of aesthetic domains—painting, poetry, dance, and music—have shown that an orderly relationship exists between the complexity of an artistic work and how much we like it. Of course, complexity is an entirely subjective concept. In order for the notion to make any sense, we have to allow for the idea that what seems impenetrably complex to Stanley might fall right in the "sweet spot" of preference for Oliver. Similarly, what one person finds insipid and hideously simple, another person might find difficult to understand, based on differences in background, experience, understanding, and cognitive schemas.

In a sense, schemas are everything. They frame our understanding; they're the system into which we place the elements and interpretations of an aesthetic object. Schemas inform our cognitive models and expectations. With one schema, Mahler's Fifth is perfectly interpretable, even upon hearing it for the first time: It is a symphony, it follows symphonic form with four movements; it contains a main theme and subthemes, and repetitions of the theme; the themes are manifested through orchestral instruments, as opposed to African talking drums or fuzz bass. Those familiar with Mahler's Fourth will recognize that the Fifth opens with a variation on that same theme, and even at the same pitch. Those well acquainted with Mahler's work will recognize that the composer includes quotations from three of his own songs. Musically educated listeners will be aware that most symphonies from Haydn to Brahms and Bruckner typically begin and end in the same key. Mahler flouts this convention with his Fifth, moving from C-sharp minor to A minor and finally ending in D major. If you had not learned to hold in your mind a sense of key as the symphony develops, or if you did not have a sense of the normal trajectory of a symphony, this would be meaningless; but for the seasoned listener, this flouting of convention brings a rewarding surprise, a violation of expectations, especially when such key changes are done skillfully so as not to be jarring. Lacking a proper symphonic schema, or if the listener holds another schema, perhaps that of an aficionado of Indian ragas, Mahler's Fifth is nonsensical or perhaps rambling, one musical idea melding amorphously into the next, with no boundaries, no beginnings or endings that appear as part of a coherent whole. The schema frames our perception, our cognitive processing, and ultimately our experience.

When a musical piece is too simple we tend not to like it, finding it trivial. When it is too complex, we tend not to like it, finding it unpredictable—we don't perceive it to be grounded in anything familiar. Music, or any art form for that matter, has to strike the right balance between simplicity and complexity in order for us to like it. Simplicity and complexity relate to familiarity, and *familiarity* is just another word for a schema.

It is important in science, of course, to define our terms. What is "too simple" or "too complex"? An operational definition is that we find a piece too simple when we find it trivially predictable, similar to something we have experienced before, and without the slightest challenge. By analogy, consider the game tic-tac-toe. Young children find it endlessly fascinating, because it has many features that contribute to

interest at their level of cognitive ability: It has clearly defined rules that any child can easily articulate; it has an element of surprise in that the player never knows for sure exactly what her opponent will do next; the game is dynamic, in that one's own next move is influenced by what one's opponent did; when the game will end, who will win, or whether it will be a draw is undetermined, yet there is an outer limit of nine moves. That indeterminacy leads to tension and expectations, and the tension is finally released when the game is over.

As the child develops increasing cognitive sophistication, she eventually learns strategies—the person who moves second cannot win against a competent player; the best the second player can hope for is a draw. When the sequence of moves and the end point of the game become predictable, tic-tac-toe loses its appeal. Of course, adults can still enjoy playing the game with children, but we enjoy seeing the pleasure on the child's face and we enjoy the process—spread out over several years—of the child learning to unlock the mysteries of the game as her brain develops.

To many adults, Raffi and Barney the Dinosaur are the musical equivalents of tic-tac-toe. When music is too predictable, the outcome too certain, and the "move" from one note or chord to the next contains no element of surprise, we find the music unchallenging and simplistic. As the music is playing (particularly if you're engaged with focused attention), your brain is thinking ahead to what the different possibilities for the next note are, where the music is going, its trajectory, its intended direction, and its ultimate end point. The composer has to lull us into a state of trust and security; we have to allow him to take us on a harmonic journey; he has to give us enough little rewards—completions of expectations—that we feel a sense of order and a sense of place.

Say you're hitchhiking from Davis, California, to San Francisco. You want the person who picks you up to take the normal route, Highway 80. You might be willing to tolerate a few shortcuts, especially if the driver is friendly, believable, and is up-front about what he's doing. ("I'm just going to cut over here on Zamora Road to avoid some construction on the freeway.") But if the driver takes you out on back roads with no explanation, and you reach a point where you no longer see any landmarks, your sense of safety is sure to be violated. Of course, different people, with different personality types, react differently to such unanticipated journeys, musical or vehicular. Some react with sheer panic ("That Stravinsky is going to kill me!") and some react with a sense of adventure at the thrill of discovery ("Coltrane is doing something weird here, but what the hell, it won't hurt me to stick around awhile longer, I can take care of my harmonic self and find my way back to musical reality if I have to").

To continue the analogy with games, some games have such a complicated set of rules that the average person doesn't have the patience to learn them. The possibilities for what can happen on any given turn are too numerous or too unpredictable (to the novice) to contemplate. But an inability to predict what will happen next is not always a sign that a game holds eventual interest if only one sticks with it long enough. A game may have a completely unpredictable course no matter how much practice you have with it—many board games simply involve rolling the dice and waiting to see what happens to you. Chutes and Ladders and Candy Land are like this. Children enjoy the sense of surprise, but adults can find the game tedious because, although no one can predict exactly what will happen (the game is a function of the random throw of the dice), the outcome has no structure whatsoever, and moreover, there is no amount of skill on the part of the player that can influence the course of the game.

Music that involves too many chord changes, or unfamiliar structure, can lead many listeners straight to the nearest exit, or to the "skip" button on their music players. Some games, such as Go, Axiom, or Zendo are sufficiently complicated or opaque to the novice that many people give up before getting very far: The structure presents a steep learning curve, and the novice can't be sure that the time invested will be worth it. Many of us have the same experience with unfamiliar music, or unfamiliar musical forms. People may tell you that Schönberg is brilliant, or that Tricky is the next Prince, but if you can't figure out what is going on in the first minute or so of one of their pieces, you may find yourself wondering if the payoff will justify the effort you spend trying to sort it all out. We tell ourselves that if we only listen to it enough times, we may begin to understand it and to like it as much as our friends do. Yet, we recall other times in our lives when we invested hours of prime listening time in an artist and never arrived at the point where we "got it." Trying to appreciate new music can be like contemplating a new friendship in that it takes time, and sometimes there is nothing you can do to speed it up. At a neural level, we need to be able to find a few landmarks in order to invoke a cognitive schema. If we hear a piece of radically new music enough times, some of that piece will eventually become encoded in our brains and we will develop landmarks. If the composer is skillful, those parts of the piece that become our landmarks will be the very ones that the composer intended they should be; his knowledge of composition and human perception and memory will have allowed him to create certain "hooks" in the music that will eventually stand out in our minds.

Structural processing is one source of difficulty in appreciating a new piece of music. Not understanding symphonic form, or the sonata form, or the AABA structure of a jazz standard, is the music-listening equivalent of driving on a highway with no road signs: You never know where you are or when you'll arrive at your destination (or even at an interim spot that is not your destination, but one that provides an orienting landmark). For example, many people just don't "get" jazz; they say that it sounds like an unstructured, crazy, and formless improvisation, a musical competition to squeeze as many notes as possible into as small a space as possible. There are more than a half-dozen subgenres of what people collectively call "jazz": Dixieland, boogie-woogie, big band, swing, bebop, "straight-ahead," acid-jazz, fusion, metaphysical, and so on. "Straight-ahead," or "classic jazz," as it is sometimes called, is more or less the standard form of jazz, analogous to the sonata or the symphony in classical music, or what a typical song by the Beatles or Billy Joel or the Temptations is to rock music.

In classic jazz, the artist begins by playing the main theme of the song; often a well-known one from Broadway, or one that has already been a hit for someone else; such songs are called "standards," and they include "As Time Goes By," "My Funny Valentine," and "All of Me." The artist runs through the complete form of the song once—typically two verses and the chorus (otherwise known as a "refrain"), followed by another verse. The chorus is the part of a song that repeats regularly throughout; the verses are what change. We call this form AABA, where the letter *A* represents the verse and the letter *B* represents the chorus. AABA means we play verse-verse-chorus-verse. Many other variations are possible, of course. Some songs have a C section, called the bridge.

The term *chorus* is used to mean not just the second section of the song, but also one run through the entire form. In other words, running through the AABA portion of a song once is called "playing one chorus." When I play jazz, if someone says, "Play the chorus," or, "Let's go over the chorus" (using the word *the*), we all assume he means a section of the song. If, instead someone says, "Let's run through one chorus," or, "Let's do a couple of choruses," we know he means the entire form.

"Blue Moon" (Frank Sinatra, Billie Holiday) is an example of a song with AABA form. A jazz artist may play around with the rhythm or feel of the song, and may embellish the melody. After playing through the form of the song once, what jazz musicians refer to as "the head," the different members of the ensemble take turns improvising new music over the chord progression and form of the original song. Each musician plays through one or more choruses and then the next musician takes over at the beginning of the head. During the improvisations, some artists stick close to the original melody, some add ever distant and exotic harmonic departures. When everyone has had a chance to improvise, the band returns to the head, playing it more or less straight, and then they're done. The improvisations can go on for many minutes—it is not uncommon for a jazz rendition of a two- or three-minute song to stretch out to ten to fifteen minutes. There is also a typical order to how the musicians take turns: The horns go first, followed by the piano and/or guitar, followed by the bass player. Sometimes the drummer also improvises, and he would typically follow the bass. Sometimes the musicians also share part of a chorus—each musician playing four or eight measures, and then handing off the solo to another musician, a sort of musical relay race.

To the newbie, the whole thing may seem chaotic. Yet, simply knowing that the improvisation takes place over the original chords and form of the song can make a big difference in orienting the neophyte to where in

the song the players are. I often advise new listeners to jazz to simply hum the main tune in their mind once the improvisation begins—this is what the improvisers themselves are often doing—and that enriches the experience considerably.

Each musical genre has its own set of rules and its own form. The more we listen, the more those rules become instantiated in memory. Unfamiliarity with the structure can lead to frustration or a simple lack of appreciation. Knowing a genre or style is to effectively have a category built around it, and to be able to categorize new songs as being either members or nonmembers of that category—or in some cases, as "partial" or "fuzzy" members of the category, members subject to certain exceptions.

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The orderly relationship between complexity and liking is referred to as the inverted-U function because of the way a graph would be drawn that relates these two factors. Imagine a graph in which the x-axis is how complex a piece of music is (to you) and the y-axis is how much you like it. At the bottom left of this graph, close to the origin, there would be a point for music that is very simple and your reaction being that you don't like it. As the music increases in complexity, your liking increases as well. The two variables follow each other for quite a while on the graph—increased complexity yields increased liking, until you cross some personal threshold and go from disliking the piece intensely to actually liking it quite a bit. But at some point as we increase complexity, the music becomes too complex, and your liking for it begins to decrease. Now more complexity in the music leads to less and less liking, until you cross another threshold and you no longer like the music at all. Too complex and you absolutely hate the music. The shape of such a graph would make an inverted U or an inverted V.

The inverted-U hypothesis is not meant to imply that the only reason you might like or dislike a piece of music is because of its simplicity or complexity. Rather, it is intended to account for this variable. The elements of music can themselves form a barrier to appreciation of a new piece of music. Obviously, if music is too loud or too soft, this can be problematic. But even the dynamic range of a piece—the disparity between the loudest and softest parts—can cause some people to reject it. This can be especially true for people who use music to regulate their mood in a specific way. Someone who wants music to calm her down, or someone else who wants music to pep him up for a workout, is probably not going to want to hear a musical piece that runs the loudness gamut all the way from very soft to very loud, or emotionally from sad to exhilarating (as does Mahler's Fifth, for example). The dynamic range as well as the emotional range is simply too wide, and may create a barrier to entry.

Pitch can also play into preference. Some people can't stand the thumping low beats of modern hip-hop, others can't stand what they describe as the high-pitched whininess of violins. Part of this may be a matter of physiology; literally, different ears may transmit different parts of the frequency spectrum, causing some sounds to appear pleasant and others aversive. There may also exist psychological associations, both positive and negative, to various instruments.

Rhythm and rhythmic patterns influence our ability to appreciate a given musical genre or piece. Many musicians are drawn to Latin music because of the complexity of the rhythms. To an outsider, it all just sounds "Latin," but to someone who can make out the nuances of when a certain beat is strong relative to other beats, Latin music is a whole world of interesting complexity: bossa nova, samba, rhumba, beguine, mambo, merengue, tango—each is a completely distinct and identifiable style of music. Some people genuinely enjoy Latin music and Latin rhythms without being able to tell them apart, of course, but others find the rhythms too complicated and unpredictable, and this is a turnoff to them. I've found that if I teach one or two Latin rhythms to listeners, they come to appreciate them; it is all a question of grounding and having a schema. For other listeners, rhythms that are too simple are the deal-breaker for a style of music. The typical complaint of my parents' generation about rock and roll, apart from how loud it seemed to them, was that it all had the same beat.

Timbre is another barrier for many people and its influence is almost certainly increasing, as I argued in Chapter 1. The first time I heard John Lennon or Donald Fagen sing, I thought the voices unimaginably strange. I didn't want to like them. Something kept me going back to listen, though—perhaps it was the strangeness—and they wound up being two of my favorite voices; voices that now have gone beyond familiar and approach what I can only call intimate; I feel as though these voices have become incorporated into who I am. And at a neural level, they have. Having listened to thousands of hours of both these singers, and tens of thousands of playings of their songs, my brain has developed circuitry that can pick out their voices from among thousands of others, even when they sing something I've never heard them sing before. My brain has encoded every vocal nuance and every timbral flourish, so that if I hear an alternate version of one of their songs—as we do on the *John Lennon Collection* of demo versions of his albums—I can immediately recognize the ways in which this performance deviates from the one I have stored in the neural pathways of my long-term memory.

* * *

As with other sorts of preferences, our musical preferences are also influenced by what we've experienced before, and whether the outcome of that experience was positive or negative. If you had a negative experience once with pumpkin—say, for example, it made you sick to your stomach—you are likely to be wary of future excursions into pumpkin gustation. If you've had only a few, but largely positive, encounters with broccoli, you might be willing to try a new broccoli recipe, perhaps broccoli soup, even if you've never had it before. The one positive experience begets others.

The types of sounds, rhythms, and musical textures we find pleasing are generally extensions of previous positive experiences we've had with music in our lives. This is because hearing a song that you like is a lot like having any other pleasant sensory experience—eating chocolate, fresh-picked raspberries, smelling coffee in the morning, seeing a work of art or the peaceful face of someone you love who is sleeping. We take pleasure in the sensory experience, and find comfort in its familiarity and the safety that familiarity brings. I can look at a ripe raspberry, smell it, and anticipate that it will taste good and that the experience will be safe—I won't get sick. If I've never seen a loganberry before, there are enough points in common with the raspberry that I can take the chance in eating it and anticipate that it will be safe.

Safety plays a role for a lot of us in choosing music. To a certain extent, we surrender to music when we listen to it—we allow ourselves to trust the composers and musicians with a part of our hearts and our spirits; we let the music take us somewhere outside of ourselves. Many of us feel that great music connects us to something larger than our own existence, to other people, or to God. Even when music doesn't transport us to an emotional place that is transcendent, music can change our mood. We might be understandably reluctant, then, to let down our guard, to drop our emotional defenses, for just anyone. We will do so if the musicians and composer make us feel safe. We want to know that our vulnerability is not going to be exploited. This is part of the reason why so many people can't listen to Wagner. Due to his pernicious anti-Semitism, the sheer vulgarity of his mind (as Oliver Sacks describes it), and his music's association with the Nazi regime, some people don't feel safe listening to his music. Wagner has always disturbed me profoundly, and not just his music, but also the *idea* of listening to it. I feel reluctant to give into the seduction of music created by so disturbed a mind and so dangerous (or impenetrably hard) a heart as his, for fear that I might develop some of the same ugly thoughts. When I listen to the music of a great composer I feel that I am, in some sense, becoming one with him, or letting a part of him inside me. I also find this disturbing with popular music, because surely some of the purveyors of pop are crude, sexist, racist, or all three.

This sense of vulnerability and surrender is no more prevalent than with rock and popular music in the past forty years. This accounts for the fandom that surrounds popular musicians—the Grateful Dead, the Dave Matthews Band, Phish, Neil Young, Joni Mitchell, the Beatles, R.E.M., Ani DiFranco. We allow them to control our emotions and even our politics—to lift us up, to bring us down, to comfort us, to inspire us. We let them into our living rooms and bedrooms when no one else is around. We let them into our ears, directly, through earbuds and headphones, when we're not communicating with anybody else in the world.

It is unusual to let oneself become so vulnerable with a total stranger. Most of us have some kind of protection that prevents us from blurting out every thought and feeling that comes across our minds. When someone asks us, "How're ya doin'?" we say, "Fine," even if we're depressed about a fight we just had at home, or suffering a minor physical ailment. My grandfather used to say that the definition of a bore is someone who when you ask him "How are you?" actually tells you. Even with close friends, there are some things we simply keep hidden—digestive and bowel-related problems, for example, or feelings of self-doubt. One of the reasons that we're willing to make ourselves vulnerable to our favorite musicians is that they often make themselves vulnerable to us (or they convey vulnerability through their art—the distinction between whether they are actually vulnerable or merely representing it artistically is not important for now).

The power of art is that it can connect us to one another, and to larger truths about what it means to be alive and what it means to be human. When Neil Young sings

> *Old man look at my life, I'm a lot like you were . . . .*
> *Live alone in a paradise that makes me think of two.*

we feel for the man who wrote the song. I may not live in a paradise, but I can empathize with a man who may have some material success but no one to share it with, a man who feels he has "gained the world but lost his soul," as George Harrison once sang, quoting at once the gospel according to Mark and Mahatma Gandhi.

Or when Bruce Springsteen sings "Back in Your Arms" about losing love, we resonate to a similar theme, by a poet with a similar "everyman" persona to Neil Young's. And when we consider how much Springsteen has—the adoration of millions of people worldwide, and millions of dollars—it becomes all the more tragic that he cannot have the one woman he wants.

We hear vulnerability in unlikely places and it brings us closer to the artist. David Byrne (of the Talking Heads) is generally known for his abstract, arty lyrics, with a touch of the cerebral. In his solo performance of "Lilies of the Valley," he sings about being alone and scared. Part of our appreciation for this lyric is enhanced by knowing something about the artist, or at least the artist's persona, as an eccentric intellectual, who rarely revealed something as raw and transparent as being afraid.

Connections to the artist or what the artist stands for can thus be part of our musical preferences. Johnny Cash cultivated an outlaw image, and also showed his compassion for prison inmates by performing many concerts in prisons. Prisoners may like Johnny Cash's music—or grow to like it—because of what the artist stands for, quite apart from any strictly musical considerations. But fans will only go so far to follow their heroes, as Dylan learned at the Newport Folk Festival. Johnny Cash could sing about wanting to leave prison without alienating his audience, but if he had said that he liked visiting prisons because it helped him appreciate his own freedom, he would no doubt have crossed a line from compassion to gloating, and his inmate audience would have understandably turned on him.

Preferences begin with exposure and each of us has our own "adventuresomeness" quotient for how far out of our musical safety zone we are willing to go at any given time. Some of us are more open to experimentation than others in all aspects of our lives, including music; and at various times in our life we may seek or avoid experimentation. Generally, the times when we find ourselves bored are those when we seek new experiences. As Internet radio and personal music players are becoming more popular, I think that we will be seeing personalized music stations in the next few years, in which everyone can have his or her own personal radio station, controlled by computer algorithms that play us a mixture of music we already know and like and a mixture of music we don't know but we are likely to enjoy. I think it will be important that whatever form this technology takes, listeners should have an "adverturesomeness" knob they can turn that will control the mix of old and new, or the mix of how far out the new music is from what they usually listen to. This is something that is highly variable from person to person, and even, within one person, from one time of day to the next.

Our music listening creates schemas for musical genres and forms, even when we are only listening passively, and not attempting to analyze the music. By an early age, we know what the legal moves are in the music of our culture. For many, our future likes and dislikes will be a consequence of the types of cognitive schemas we formed for music through childhood listening. This isn't meant to imply that the music we listen to as children will necessarily determine our musical tastes for the rest of our lives; many people are exposed to or study music of different cultures and styles and become acculturated to them, learning their schemas as well. The point is that our early exposure is often our most profound, and becomes the foundation for further musical understanding.

Musical preferences also have a large social component based on our knowledge of the singer or musician, on our knowledge of what our family and friends like, and knowledge of what the music stands for. Historically, and particularly evolutionarily, music has been involved with social activities. This may explain why the most common form of musical expression, from the Psalms of David to Tin Pan Alley to contemporary music, is the love song, and why for most of us, love songs seem to be among our favorite things.