

WHY DO WE LIKE MUSIC?

People with musical anhedonia, a rare inability to enjoy music, are teaching scientists how the brain processes songs.

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Illustration by Grace J. Kim



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Forty years ago, Bill Weiss, a student at Columbia University, went to see James Galway, a virtuoso Irish flutist, perform at the 92nd Street Y. Weiss had recently earned an A in a required musical-humanities course, and he

thought that at the show he might finally feel moved by great music—an experience that had, until then, evaded him. His seat was in the front row. “I got to see the look of intensity in his eyes,” Weiss told me. “I got to see every bead of sweat that was cascading down his face. I could see that he was completely at one with the music.” He waited to experience some comparable upwelling of emotion, but it never came. Although he could appreciate Galway’s talent and passion, he felt nothing.

People have relished music for so long that we have evidence, from forty thousand years ago, of humans making a flute-like instrument out of a vulture bone. We feel that even wordless music reflects our moods. Music lovers have gone so far as to assign feelings to the keys that songs are played in. Marc-Antoine Charpentier, a seventeenth-century French composer, called F minor “obscure and plaintive,” and Johann Mattheson, an eighteenth-century German composer, said that it “sometimes causes the listener to shudder with horror.” Mattheson believed that music literally mimicked emotions; in his telling, joy was an “expansion of our vital spirits,” and so joyful music had expansive intervals between notes.

None of this made any sense to Weiss. As a child, he took music lessons, but they felt mechanical, like painting by numbers. “I would play the notes, but I wasn’t expressing myself emotionally,” he said. He learned that major chords were considered happy and minor chords were considered sad, and that a screechy violin evokes scariness in movies. But these associations were purely intellectual. He was puzzled by friends who bought band T-shirts and obsessed over concerts. When he watched films—for example, “The Graduate,” released in 1967—the music established a historical context more than an emotional one. “What kind of movie would that be without the Simon & Garfunkel soundtrack?” he said.

Only when Weiss was in his fifties did he start to understand what made him different. In 2014, he heard a radio piece about people who, like him, got no joy from music—a trait called musical anhedonia. A couple of years later, he reached out to Psyche Loui, a cognitive scientist and a musician at Northeastern

University who was researching the brains of people who did and didn't experience chills from music. He offered himself up as a case study. Loui had studied people with varying attitudes toward music, but she'd never met someone with no attitude at all. She tested Weiss for the condition that he'd heard about on the radio. (It is different from anhedonia, a struggle to experience pleasure in general that is associated with various mental-health conditions.)

People with lifelong musical anhedonia, which Weiss turned out to have, easily recognize music. They aren't tone-deaf, and they don't have trouble enjoying other activities. But songs do nothing for them. "If I never heard music again, it wouldn't be a particularly big loss," Weiss told me. Using an MRI scanner, Loui and several colleagues examined Weiss's white matter—nerve fibres that connect different areas of the brain. Weiss had conspicuously little connectivity between circuits in his brain that are involved in auditory processing and in mediating rewards. (In fact, compared to forty-six people in a control group, he had the least white matter between the circuits in question.) In the people who regularly got chills while listening to music, Loui had found the opposite: there were above average nerve connections between these circuits.

When Weiss learned that he had musical anhedonia, he was relieved. The knowledge allowed him to "come out of the closet" about his relationship to music—or the lack thereof. But studies of musical anhedonia also had a broader significance. If scientists could explain why musical anhedonics are unmoved by music, they might be able to explain why music is moving in the first place.

The musicologist Leonard Meyer argued that music gets its power largely from the expectations that it arouses in listeners. In his classic 1956 book "Emotion and Meaning in Music," Meyer writes about a repetitive melodic fragment in the opening of "March to the Gallows," from Berlioz's "Symphonie Fantastique." "We believe that the composer is not so illogical as to repeat the figure indefinitely." The listener feels suspense as she waits expectantly for the music to change. "The greater the buildup of suspense, of tension, the greater the emotional release upon resolution," Meyer wrote.

One of the first researchers to study musical anhedonia, Robert Zatorre, a cognitive neuroscientist at McGill University, knew how powerful that release could be. As a fifteen-year-old rock fan, Zatorre was inspired by the Doors and the Moody Blues to take organ lessons, and his teacher invited him to listen to a Bach performance. “This is magnificent,” Zatorre remembered thinking. “There was an emotional depth. I had chills.” When he became a scientist, he wanted to study the power of music using neuroscience instead of music theory.

In 2011, during a sabbatical in Spain, Zatorre met Josep Marco-Pallares, a neuroscientist at the University of Barcelona who studies how people respond to rewards. They worked with several collaborators to come up with the Barcelona Music Reward Questionnaire, a survey that measures responses to music. (Loui and her colleagues used it in their experiment on Weiss.) After the team gave it to more than a thousand people online, they noticed something strange: two to three per cent of people had extremely low scores. They didn’t seek out music, share it with their friends, or go to concerts, except perhaps to socialize. Zatorre had read that, in rare cases of brain damage, people could lose their enjoyment of music. But these survey respondents were healthy, and, in the lab, they reported normal responses to a variety of activities: food, sex, video games. A reward—in this case, winning cash—increased their heart rates and activated their sweat glands. They had what the researchers called “specific musical anhedonia.” When listening to songs that others found stirring, their physiological metrics were “basically flat,” Marco-Pallares told me.

Back at Zatorre’s lab, in Montreal, his collaborators imaged the brains of music lovers and found that the striatum—part of a network in the brain that releases dopamine during pleasurable activities—was deeply engaged, and seemingly in concert with the brain’s auditory circuits, which help perceive and analyze sounds. That finding helped Zatorre develop a theory. To have an emotional musical experience, he proposed, you must have an interaction between the reward system and the auditory circuits. Brain imaging affirmed this idea: A 2016 fMRI study found that, in musical anhedonics, music produced below-average activation in reward areas, but gambling tasks did not. Musical anhedonics also had fewer connections between the auditory circuits and the

striatum. In contrast, people who showed strong emotional responses to music had more connections.

In 2018, Zatorre showed just how much one's enjoyment of music depends on the reward system. He and a team asked seventeen people to listen to their favorite songs, and to ten other songs that the researchers chose, while his team used noninvasive brain stimulation to increase activity in the striatum.

Remarkably, the stimulation seemed to make songs more impactful and enjoyable. (When participants were given the chance to buy the new music they'd heard, they offered more money for songs that they had heard during the stimulation.) In other experiments, Zatorre found that bolstering dopamine enhanced the enjoyment of music, while blocking dopamine reduced it.

The importance of our reward system in musical enjoyment was something of a surprise, Zatorre told me. Animals are thought to have developed reward systems so that they'd be driven to eat and procreate, and thus to survive. Zatorre's team had demonstrated that music takes advantage of the same circuits that drive those more basic urges.

Studies like Zatorre's have also given neuroscientific credence to Meyer's theory of music and expectation, according to Amy Belfi, a music-cognition researcher at Missouri University of Science and Technology who was not involved in his research. "The idea that music is pleasurable because of its predictive qualities (inducing expectations) is pretty much unequivocally accepted in the field," she told me in an e-mail. Neuroscience was offering a possible explanation for why. Pleasure isn't the only thing that triggers the reward system; the expectation of pleasure triggers it, too. If scientists turn on a light every time they feed laboratory rats, the rats start experiencing dopamine spikes in response to the light alone.

Zatorre now thinks of music as a dance with expectation. I asked him if this might be why, in E.D.M. songs, the buildup before a "beat drop" is so exciting. It's a perfect example of an expectation that's first denied and then satisfied, he told me. "You're in suspense," he said. "You're floating in the air, waiting for this beat to come back. . . . *That's what I was waiting for.*"

A few weeks ago, I had dinner with my friend Timo Andres, a composer and a pianist in New York. At one point, he remarked that many people could learn to enjoy music more if they were taught “how to listen.” After dinner, I texted him to ask what he’d meant, and whether he saw himself as dancing with expectations. “I do agree that much of the pleasure we derive from music comes from our expectations being either fulfilled or confounded,” he wrote back. “This can happen on a macro level (the overall form of a song or symphony) but applies equally on the most micro level; we might find a melody particularly beautiful because of the one note or interval in it that escapes its pattern.”

Training can help a person expect certain patterns, Andres added, which underscores when conventions are being followed or flouted. “The most rewarding music, to me, is that which is quite intentionally complex on some levels and simple on others; that is, it has a foreground and a background,” he said. “Stray too far to either extreme and the music starts to feel a bit two-dimensional.” (His intuitions echoed one of [Zatorre’s experiments](#), which suggested that listeners prefer songs that are neither too predictable nor too unpredictable.)

Over the years, Bill Weiss has continued to try out the occasional concert. Years ago, he went to a performance of Handel’s “Messiah.” It sounded to me like he could recognize the two-dimensionality that Andres had described to me. He just didn’t find it rewarding. “I did it more to check it off my bucket list than to say, ‘I’m going to have this joyous musical response,’ ” he said. He still feels confused when he sees strangers dancing to music—for example, when a cashier dances to the beat of whatever’s playing in a grocery store. “It always takes me aback, and just amazes me, because that thought would never, ever have entered my mind,” he told me. Still, his wife played music at their wedding. (They have a son who also seems indifferent to music.)

But Weiss was quick to mention other things that *do* give him pleasure. “I love walking around cities, admiring architecture,” he said. “I am kind of a foodie.” The chills that some people get from music, he’s felt while reading. He also has an unusually strong connection to visual art. When we spoke, over Zoom, he

showed me an image of one of his favorite paintings: an early-seventeenth-century portrait by Peter Paul Rubens, of the artist's young daughter Clara Serena. Her wispy blond hair filled my screen; her big blue eyes stared out at me.

“Not only has he made her come alive, but somehow, miraculously . . . just with pigment and canvas, he's been able to depict love,” Weiss said. “It is so clear to me that he absolutely adored this child. And, knowing that she died at the age of twelve—around seven years after this was painted—I think Rubens must have been absolutely devastated.” I was moved.

A few days later, I happened to visit an exhibition called “Art of Noise,” at the Cooper Hewitt, Smithsonian Design Museum. On the first floor was a “shrine to music.” Listeners were invited to sit on cloth meditation chairs, facing a custom-built audio system designed by the artist Devon Turnbull.

I sat in the third row and closed my eyes. The introduction of an 1880 composition by Max Bruch, “Scottish Fantasy” in E-flat major, played through the speakers. It started gradually, with recurring slow notes followed by an outpouring of string instruments. For me, these wordless noises were clearly about sadness and longing. Maybe it was the gloomy weather outside, the fact that I was missing someone that day, or the way that the melody played with my expectations, but I was moved again.

Sometimes people tell Weiss that they feel bad for him, and that he is missing out on the rewards that music has to offer. In our conversations, though, he seemed untroubled. Listening to the music, I thought about Rubens's daughter, and about how strongly and sincerely Weiss had responded to her portrait. “I've proved I don't need music to feel alive,” he told me. “I find my rhythm elsewhere.” ♦

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