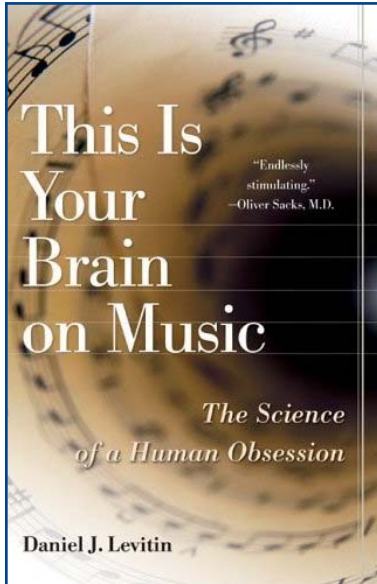

Book Review



Exploring How Music Works Its Wonders

This Is Your Brain on Music: The Science of a Human Obsession

by Daniel J. Levitin

New York: Dutton, 2006

314 pages, \$24.95

Reviewed by David Huron, Ph.D.

Fortune smiles on those sciences lucky enough to have a popular champion, although not all scientists are enthusiastic about the popular face of their discipline. Professional astronomers found plenty to criticize in the popularizing efforts of Carl Sagan. I know paleobiologists who vehemently disagree with various ideas promoted by Stephen Jay Gould. Some linguists bristle at the mention of Steven Pinker, and many oceanographers roll their eyes when they hear the name Jacques Cousteau.

But whatever the shortcomings of these outstanding popularizers, the benefits that they bring to a research discipline are unquestionable. Popular dissemination of the fruits of research inspires smart people to enter a field, and connecting with colleagues on the other sides of disciplinary fences often leads to important interdisciplinary interaction. Every field of research needs a popularizer.

Strangely, for a subject as inherently popular as music, the science of music has so far failed to produce a writer able to capture the public imag-

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ination. For those of us in the discipline, this is a sorry state. When most people hear the phrase “science of music,” they tend to think vaguely of right-brain mysticism, music/math associations, or increase-your-brain-power-through-Mozart. But, in fact, a small professional cohort of experimentally oriented researchers, including cognitive and physiological psychologists, neuroscientists, and systematic musicologists, is studying music and musical behaviors. Their research is widely dispersed in dusty journals, but the aggregate findings are genuinely informative

about how music works its wonders. Although the story remains incomplete, it is a story worth telling and telling well.

FROM ROCK MUSICIAN TO RESEARCHER

Making the fruits of music science accessible is the explicit aim of Daniel Levitin’s book *This Is Your Brain on Music: The Science of a Human Obsession*. The book’s contents unfold against the background of the author’s own fascinating personal story. Levitin grew up in the San Francisco area during the heyday of 1960s popular music. A bedroom romance with the guitar matured into a successful career as a rock musician and record producer in Los Angeles. Working with the likes of Steely Dan, Eric Clapton, Stevie Wonder, and k.d. lang, Levitin earned either gold or platinum records for 11 of his projects. Eventually he switched careers, undertook graduate training in cognitive neuroscience, and became a professor of psychology, neuroscience, and music at McGill University in Montreal, where he runs the Levitin Laboratory for Musical Perception, Cognition, and Expertise.

I especially like Levitin’s story of how he became transfixed by the acoustic details of recorded sound. His father, eager to gain relief from the racket of Levitin’s bedroom stereo, offered to buy his son high-quality headphones if the youngster would turn off the speakers. Levitin took the deal and spent long hours enveloped in the private space of headphone listening—a practice that sensitized him to the arts of stereophonic imaging, sonic balance, and audio quality, all of which would serve him well in the recording industry.

This Is Your Brain on Music has an appealing breezy style. The first two chapters describe how such basic musical sensations as pitch, loudness, timbre, rhythm, and harmony arise. Other chapters cover such topics as emotion, skill acquisition, musical taste, expectation, and categorization. Listening to music is not the passive activity one might suppose; the brain actively anticipates future sounds, even the sounds of unfamiliar music. The brain parses sound patterns into myriad syntactic categories, from scales, chords, and themes to phrases, melodies, and styles.

The book is full of interesting nuggets. We are introduced to compelling infant studies examining the origins of musical preferences, to the structure of jazz improvisations, and to the effects of courtship songs on songbird ovulation. Fun tidbits include a discussion of what happens in the inferior colliculus of a barn owl's brain when the owl hears Strauss's "Blue Danube Waltz," and the fact that much of the fund-

ing for the development of magnetic resonance imaging brain scanners came from the profits made by the Beatles' music.

The book is also populated with lots of people. Levitin is a sociable sort and likes to relay his encounters with the famous and the talented. We are treated to personal anecdotes about conversations with Joni

Mitchell, Stevie Wonder, and Francis Crick. We vicariously experience Levitin's Forrest Gump-like presence as we rub elbows with Doc Watson and James Watson.

Perhaps Levitin's unique contribution to research on music lies in his drawing attention to the importance of the cerebellum in music listening. Conventional wisdom suggests that the principal role of the cerebellum relates to coordinating motor movement. But research by Levitin is consistent with studies by Jeremy D. Schmahmann, M.D., and Janet Sherman of Harvard Medical School that point to a much broader role for the cerebellum, including tracking the beat and distinguishing familiar from unfamiliar music. Perhaps most surprising is that the cerebellum plays a role in musically evoked emotions and in the formation and expression of musical taste. These discoveries are consistent with anatomical studies from the 1970s that found direct neural connections between the cerebellum and the hearing organ within the cochlea, which converts sound vibrations into nerve impulses.

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An ostinato that recurs throughout the book and comes to the fore in the final chapter is the relationship between music and evolutionary psychology. Archeological evidence shows that music is very old—much older than a Johnny-come-lately like agriculture. Musical instruments have even been discovered in Neanderthal burial sites, suggesting that music-

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making may have been characteristic of the entire genus *Homo*. All known cultures (past and present) have engaged in recognizably musical activities, which raises what might be called the \$64,000 question in the science of music: Is music a spandrel—a non-adaptive artifact of brain organization as suggested by Harvard University psychologist Steven Pinker, Ph.D.? Or could music be an evolutionary adaptation in its own right? Levitin, clearly parting company with Pinker, recounts some of the published evidence for music’s evolutionary role.

WANTING MORE

While Levitin informs, and sometimes delights, he also misses some opportunities. *This Is Your Brain on Music* has little to say about the venerable topic of consonance and dissonance, which has been the subject of considerable confusion and misinformation ever since the ancient Greeks speculated about why some sound combinations are more pleasing than others. Yet one of the foremost successes in the science of music has been our understanding of how the physiological properties of the hearing organ influence the perception of dissonance.

Also missing is the pioneering work of psychologist Neil Todd, Ph.D., of Manchester University, on the perception of rhythm and musical “motion.” The cochlea of the inner ear contains not only the hearing organ but also the vestibular system, and Todd’s work relating the sense of rhythm and motion to auditory-induced activation of the vestibular system is as fascinating as it is unorthodox. A neuroanatomist might well expect that the connections between the cochlea and the cerebellum exist to coordinate movement with vestibular sensations. Given Levitin’s interest in the musical role of the cerebellum, a summary of Todd’s work would have made a pertinent (and interesting) addition to the book.

Unfortunately, the book is also marred by many small errors, especially with respect to musical acoustics and music theory. For example, an octave is defined as any frequency that is two, three, four (and so on) times

some initial frequency; the list should read: two, four, eight, sixteen (and so on). Similarly, the tonic pitch of a scale is constantly referred to as the root, but only chords have roots. It is difficult for the knowledgeable musician to read the text without a little eye-rolling. The book seems to have been written in haste, which is a shame, because Levitin has real gifts as an accessible writer.

Like religion and sex, music has a special allure that combines mystery with passion. For those of us engaged in music research, this allure is both good and bad—good because it inspires and motivates, bad because it can lead to sloppy thinking.

A PROMISING POPULARIZER

Like religion and sex, music has a special allure that combines mystery with passion. For those of us engaged in music research, this allure is both good and bad—good because it inspires and motivates, bad because it can lead to sloppy thinking. The study of music has always been dominated by music lovers (with potential axes to grind, and sometimes eccentric agendas).

People outside the discipline are right to be a little skeptical of the motives of the music-lover/researcher.

The serious student of music, like the sexology researcher, is also haunted by the fear that others may regard the work as frivolous, even suspect. Insecurity is an unfortunate occupational hazard of empirical research in music. The predictable response to the fear of not being taken seriously is to carry out highly technical research and to make certain that the language of scholarly communication is professional, abstruse, and consequently impenetrable.

Music cognition research is in its golden age. Tremendous progress has been made in understanding musically evoked emotions, expectation, memory, the acquisition of musical skills, style, sociocultural factors, and other aspects of this great art. But, regrettably, the best research in our discipline has not been communicated beyond a small coterie of professionals. While Daniel Levitin is not our field's Carl Sagan, *This Is Your Brain on Music* represents a promising start. ■

Excerpt

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The emerging picture from such studies is that ten thousand hours of practice is required to achieve the level of mastery associated with being

a world-class expert—in anything. In study after study, of composers, basketball players, fiction writers, ice skaters, concert pianists, chess players, master criminals, and what have you, this number comes up again and again. Ten thousand hours is equivalent to roughly three hours a day, or twenty hours a week, of practice over ten years... No one has yet found a case in which true world-class expertise was accomplished in less time...

The classical rebuttal to the ten-thousand-hours argument goes something like this: “Well, what about Mozart? I hear that he was composing symphonies at the age of four! And even if he was practicing forty hours a week since the day he was born, that doesn't make ten thousand hours.” First, there are factual errors in this account: Mozart didn't begin composing until he was six, and he didn't write his first symphony until he was eight. Still, writing a symphony at age eight is unusual, to say the least. Mozart demonstrated precociousness early in his life. But that is not the same as being an expert. Many children write music, and some even write large-scale works when they're as young as eight. And Mozart had extensive training from his father, who was widely considered to be the greatest living music teacher in all of Europe at the time. We don't know how much Mozart practiced, but if he started at age two and worked thirty-two hours a week at it (quite possible, given his father's reputation as a stern taskmaster) he would have made his ten thousand hours by the age of eight.



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