BOOKS: NEUROSCIENCE

Where Science Meets the Arts

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Beethoven's Anvil
Music in Mind and Culture
by William Benzon
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The classic Buddhist tale about the blindmen and the elephant is a good metaphor for modern science with its specialized niches, where individual scientists perceive and follow only what goes on in their immediate vicinity. How refreshing it is to find a book written by someone who deviates from this picture. William Benzon, a cognitive scientist and an outstanding amateur jazz musician, has accomplished this rare feat in *Beethoven's Anvil* by uniting many aspects of musical science in a truly multidisciplinary manner. The apt subtitle "Music in Mind and Culture" conveys the main thrust of the book. Benzon considers music the archetypal expression of human culture—preceding even language—and tries to understand how this complex phenomenon, which is ubiquitous in the world's societies, is tied to the human mind.

Assuming that "the mind is what the brain does," this strategy should also tell us something about the brain bases of music processing and music making ("musicking," as Benzon calls it). In somewhat outmoded cognitive fashion, however, the author is generally anxious not to wade too deeply into the reductionist world of neuroscience. Rather, he seems most comfortable staying at a theoretical systems level, which describes the actions of our brain in terms of "neurodynamics." Clearly, with this "speculative engineering" approach, Benzon is an avid follower of the pioneering work of Walter Freeman, whose not-always-mainstream ideas have spawned numerous studies on state changes (or "attractors") in the brain. Auditory neurophysiologists trying to analyze the decoding of complex sounds might want to begin by defining music, rather prosaically, as a concatenation of spectro-temporal events. Benzon skips this level altogether because he intends to go far beyond these "early" events. Throughout his book, he seems almost too much in awe of music and appears concerned that he might desecrate it by such reductionism. Besides, other recent books offer excellent summaries of these fundamental processes (*1*), at the psychophysical (*2*) and the neurophysiological level (*3*), although much remains to be done to understand music even from this vantage point.

Benzon is his most neurobiological when he talks about music and emotion. The ecstasy that music can create in people, individuals as well as groups, is indeed perhaps its most fascinating aspect. How is it that certain forms of music can evoke specific emotional reactions almost like fixed action patterns? Benzon is well aware of recent neuroimaging work (*4*) pointing to the "limbic system" as the site for these emotional aspects of music. Work on these phylogenetically older brain structures, popularized originally by Paul MacLean, has recently seen a renaissance through the work of Damasio and LeDoux, who point out that the artificial separation of reason and emotion by Descartes cannot be sustained on the basis of modern neurophysiology. There is no doubt that composers are able to use music cunningly as a vehicle to convey emotions. It is said that Verdi sat with a pounding heart and on occasion wept while composing the music for his operas. More than a century later, some listeners show the identical reactions. Thus, like written text in literature, a musical score is the medium through which creative artists communicate with their audience.

Giuseppe Verdi, a maestro of emotions.

What is true for the passive listener is even more true for the musician who interprets the composer's works. Benzon mentions the conductor Leonard Bernstein's anecdote that while performing with his orchestra he sometimes felt like he was the composer writing the music at that very moment. This "possession" by the mind of another is universal in music; its presence even in the most primitive societies points to music's relation with ancient rituals. Most of these contain dancing as an essential component, which demonstrates the close ties between the music's sensory and motor components. Everyone who feels compelled to move to a Vienna waltz or tap a foot to the music of a marching band can appreciate that.

As a musician, the author is particularly interested in how a group of musicians communicates. According to Benzon, musicking leads to a coupling of brain activity in the group. He claims this "interactional synchrony" between brains is the essence of music and constitutes its greatest evolutionary advantage. Musicking is an accomplishment that requires the whole brain. Recent neuroimaging studies of music perception point to the involvement of prefrontal cortex, with its executive functions, and the cerebellum, formerly considered a purely motor structure. Imaging studies of language processing also demonstrate the coactivation of "sensory" and "motor" centers of the brain. Thus, it seems close coordination of such structures is required to process both language and music. For a good performance, one must be "in flow" or "in the groove." Benzon speculates that music performance engages two simultaneous streams: "the evolving collective brain states involve both the groove and gesture streams," but it is the "function of the groove stream...to create the psychological space in which music happens." He fails to mention that similar relations hold for other complex behaviors, such as learned motor sequences in athletics.

The book also contains much about ethnomusicology. Beyond conveying interesting facts about music from exotic lands, these sections discuss the evolution of musical culture and the fundamental question of universals in music. In the chapter "The Protohuman Rhythm Band," Benzon locates the initial impetus for developing music in the intense pleasure caused by "group-synchronized neurodynamics" during vocal mimicry in early societies. Like universals of language, this complex theme remains elusive, because it is difficult to collect evidence from ancient cultures.

Benzon concludes his book with a fascinating history of jazz. Anyone interested in that topic will enjoy reading *Beethoven's Anvil*, although there are plenty of other reasons to do so. The book may sometimes drive both scientists and artists crazy with its seemingly unfounded speculations, but it is a potentially productive effort to bring the two communities closer together.

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