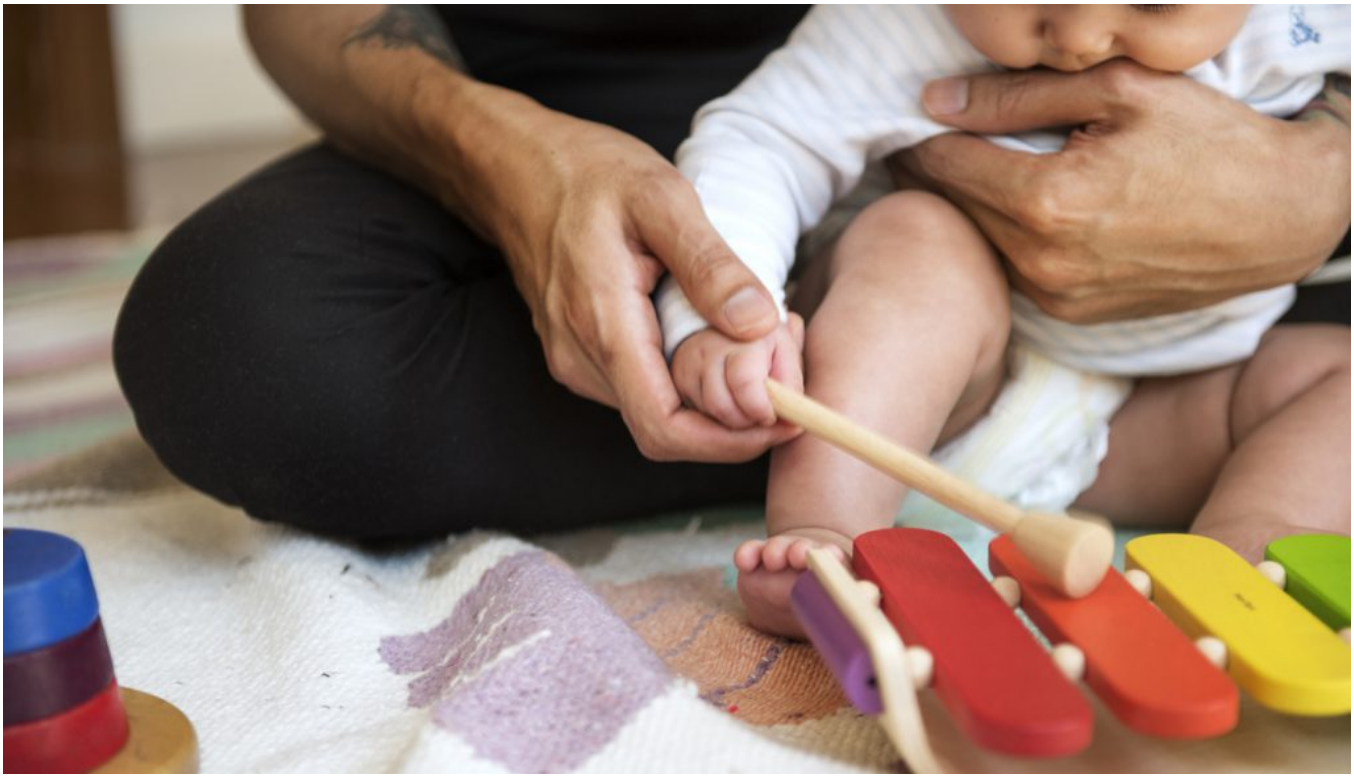
# Music and the Science of Learning

December 27, 2012



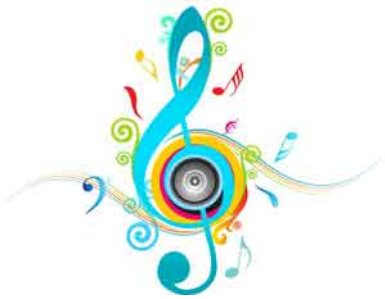
Are musicians born or made? As a cognitive psychologist with a lifelong love of music, but no apparent musical talent whatsoever, I found myself contemplating this very question not long before my 40th birthday.

A first clue might come from evolution. Scientists have pondered for years whether music itself is an adapted part of the human cognitive endowment. Were “musical notes and rhythm … first acquired … for the sake of charming the opposite sex” as Darwin wrote?

Although the jury is still out, the evidence is fairly weak that music, which emerged relatively recently in the history of our species, is a direct product of selection. The notion of a musical advantage initially seems plausible, especially when one considers certain male musicians (e.g., Jimi Hendrix and his many “mates”). But this hypothesis could only be true if there were a consistent reproductive advantage for musicians over nonmusicians, not just at present, but throughout human evolution. Ultimately, there is little evidence to support such an assertion. The genes that contribute to music evolved long before there were radio stations or record deals. And the sexual-selection theory conflates the powerful image of a few exceptionally talented guitarists (such as Hendrix) with the realities of most musicians (only about half of college-degreed musicians, for instance, are even able to make a living in a musical career).

Furthermore, in most aspects of physiology that are shaped by sexual selection, we see a significant

dimorphism between males and females. Peacocks have plumage, their female counterparts don't; male songbirds sing, females generally don't. When it comes to music, however, humans display little obvious dimorphism, either in listening to or in producing music. Meanwhile, theories in which music is seen as a specific target of natural or sexual selection might sometimes seem to imply the existence of a specific music module in the brain that was somehow targeted by evolution, but there is little evidence of a distinct music center in the brain. Instead, music seems to depend on a coalition of neural tissue, none of which appears to be specialized for music, suggesting that music might be better thought of as culturally acquired technology that draws on a diverse basis of (perhaps domain-general) components, rather than a specific target of selection.



Consistent with these ideas, children's initial sensitivity to music is relatively coarse. Even newborns can tell the difference between consonance and dissonance, but it takes years before children can sing in tune or reliably recognize the association between minor chords and sad feelings. Initially, children tend to focus on lyrics to the exclusion of melody, and in infancy, they prefer the human voice to instrumental music.

Yet talent still matters. An idea popular in contemporary culture, based on Anders Ericsson's work, is that anyone can become an expert at anything with 10,000 hours of deliberate practice, but recent studies of chess expertise suggest that there are significant differences between individuals in the speed at which they acquire new skills (Ericsson, Krampe, & Tesch-Römer, 1993). An older study by Edwin Gordon (which is often overlooked, but is the most systematic one conducted to date) showed that almost half the variance in how well schoolchildren played musical instruments could be predicted 3 years in advance based on musical aptitude tests (Gordon, 1967).

How can we put all this together? Musical aptitude seems heritable, yet no gene has been specifically and uniquely tied to music. (There are genes, such as AVPR1A, that seem correlated with musical skill, but they also seem correlated with social behavior more broadly construed.) Music is something we are prepared to learn, but it also involves something that is hard-wired. Like reading, music is best seen as a cultural invention. Musicians may be born with more predisposing talents, but nobody is born musical per se. Even the people with the most helpful predisposing genes still need to learn how to play. (This is true even for singing; young children often don't even recognize that songs contain discrete notes.)

A final question: Is it ever too late to learn? The dominant idea has been that only young children can acquire new skills and that this occurs during a "critical period" in development, but this idea, too, turns out to be far weaker than previously believed. Recent studies have shown that some adults can learn new languages like natives; and animal research suggests that they do better than generally thought if they learn new things incrementally rather than all at once (Birdsong, 2009; Linkenhoker & Knudsen, 2002).

As Aristotle realized, there is a difference between the pleasures of the moment (hedonia) and the satisfaction that comes from constantly developing and living one's life to the fullest (eudaimonia). In recent years, scientists have finally begun to study the latter. The greater sense of purpose and personal growth associated with eudaimonia correlates with lower cortisol levels, better immune function and more efficient sleep.

From the strict "Selfish Gene" perspective — in which all that we do is driven by the self-perpetuating interests of our individual genes — hobbies like playing music rarely make sense, especially for mere amateurs. But the art of reinvention and acquisition of new skills can, at any age, yield a sense of a life well-lived.