

## Are We Wired for Music?

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### **Article:**

In recent years there has been an explosion of research into the phenomenon of music in the brain. This has been paralleled by a much more visible presence in the popular media. Unfortunately, what is reported in scholarly journals is not always what is presented in the press. The purpose of this article is to bridge the gap between the two. Before beginning this discussion, several brief points need to be made. (1) Space does not permit extensive discussion of the ideas presented. Thus, the emphasis is on broad generalities, rather than specific details. Readers wishing more information can consult the reading list provided at the end. (2) Throughout, the terms "myths" and "facts" should be taken quite liberally. That is, some of the statements labeled as myths could be rephrased as legitimate questions or might be positions held by those with differing viewpoints. Likewise, the term "facts" should not be confused with the word "truth." Rather, these statements represent a position taken on the basis of available data. With that in mind, let's proceed.

### **Myth 1. *There is no biological basis for human musicality.***

This may seem like an odd place to begin, but it is an important one. If it can be shown that music has a biological basis, then the role of music in human experience is strengthened. What is the issue? There are a number of statements in the literature to the effect that music has no obvious survival or adaptive value. If true, music is then just a happy afterthought to the more important aspects of living.

Fortunately, however, there is enough evidence to make a strong case for the biological basis of human musicality. The three most important ideas center on mother-infant bonding, social organizations, and music as a unique way of knowing (see Fact 10). Musical capacities in mothers and infants allow them to share and express emotions that are critical for infant survival. Mothers share important information by a host of behaviors that include singing, rocking and patting in a rhythmic fashion, and speaking in a way that emphasizes pitch, timbre, rhythm, and dynamics. Babies, too, soon learn to modulate their voices to convey emotional states.

Humans thrive in group settings and those things which help to meld individuals into a cohesive unit provide an obvious survival value. Singing and dancing are two of the most powerful ways to create social unity, as every tribe or cultural group identifies itself through particular songs and rituals. Though these few sentences barely skim the surface, they provide a glimpse at the evidence that dispels the myth and leads to the following.

**Fact 1: *An evolutionary theory can account for the existence of music and for the fact that music provided a survival benefit for the development of humankind.*** Music is not a happy accident, but rather an adaptive behavior that provided significant survival benefits to us in our emergence as a species. We come equipped with a brain because it is important to us.

### **Myth 2a: *Only humans make music.***

### **2b: *Animals make music, too.***

Related to the previous discussion, is the notion of whether or not, or to what extent, animals make music. On one side of the debate, some say that animal vocalizations and soundmaking have to do with such things as

territoriality, homing, courtship, and signaling. Conversely, others claim that *birdsong* and *whalesong*, are just that—singing—in the sense of making music. Rather than resolving the debate in this brief discussion, perhaps it suffices to recognize that, if not in kind, there is certainly a difference in the degree of musical behavior among humans when compared to other animals. That is, even if one can make the case that some animal vocalizations qualify as music, certainly nothing in the animal kingdom remotely compares to the richness, variety, and sheer amount of music that humans produce. Thus, we can easily say—

**Fact 2: *There is a significant difference between human musicality and animal soundmaking.*** Music is at the very core of what it means to be a human being. To find music is to find human beings and to find human beings is to find music.

**Myth 3: *Music developed later in civilization.***

Somewhere along the way, the notion has arisen that music and the arts occur after the important business of living is taken care of. That is, when there is adequate food, shelter, and so on, people find the leisure to create art. There is no evidence to support such an idea and, in fact, the records indicate quite the opposite.

Ancient cave paintings give evidence of visual art and while we would expect that most musical evidence has disappeared in the mists of time (early instruments primarily being made of biodegradable substances such as reeds, wood, and hides), there are numerous indicators of early music. These include footprints in the floors of caves indicating dance (hence music), wear patterns on bone and rock fragments indicating usage as percussion instruments, and even some early instruments. One bone flute is thought to be around 53,000 years old. There is corollary evidence, too, for example, in the fact that the caves most acoustically suited for singing and chanting are precisely the ones that have the most paintings. Anthropologists also tell us the how is as much a musical instrument as it is a weapon. All of this strongly supports—

**Fact 3: *Music is as old as humankind.*** The fact that 50,000 years ago our ancestors were spending the time, energy, and creative brain power necessary to make and use musical instruments says something quite important about the significance music has for us.

**Myth 4: *Music is a universal language.***

This is one of the more common platitudes espoused in music classrooms. Unfortunately, it is most certainly not true, at least not in the sense that everyone understands all musical languages. Here is where a parallel with language is helpful. It is obvious that there is no universal spoken language. If an English speaker were to hear poetry in Swahili or a story in Mandarin Chinese, there would be no understanding. The same is true of hearing music from different cultures. Any meanings derived are likely to result from Western musical structures superimposed on this unfamiliar music.

Dubos coined the term "invariant" to refer to a human behavior that is universal in the general sense, but whose specifics are culturally determined. Thus, all human beings use language, but the specifics of the language used (grammar, syntax, vocabulary) are modified according to particulars of time and place. Music is an invariant. Lomax studied folksongs from 233 cultures around the world, finding that all of them use music. Moreover, the particular folksinging style is deeply imbedded in lifestyle behaviors (political systems, courtship rituals, religious practices, etc.). This leads to –

**Fact 4: *Musicality is universal, but specific musical expressions are culturally determined.*** Our brains are wired in such a way that we could have learned any musical style, but we learn the musical language of our culture. Some of us are multi-musical, just as some are multilingual.

**Myth 5: *Only a talented few are musical.***

One of the enduring myths of our society is that there are only a handful of talented musicians. This is paralleled by research studies that purport to compare musicians with non-musicians. In fact, there is no such

thing as a nonmusician, because all human beings are musical to some degree. Consider the musical experiences that persons along these three continua can have:

from birth \_\_\_\_\_ death

from one person ----- -to thousands of people at the same time

from the lowest—to the highest level of cognitive functioning

No aspect of the human condition—gender, age, race, socioeconomic status, and so on - can per se prohibit any person from a meaningful experience with music.

Consider, too, exceptional individuals, such as those with Williams Syndrome, who typically have overall IQs of 65-70. They are actually mentally asymmetric., displaying peaks and valleys in various cognitive domains. Frequently, they possess remarkable musical skills, even in the absence of other abilities. All of this leads to—

**Fact 5: *All human beings have the possibility of meaningful musical experiences.*** Although we may vary in our musicality, no one is bereft of musical sensitivity Peretz has coined the term "congenital amusia" to refer to certain individuals who have limitations in their musical skills (e.g., can't match pitch, can't recognize familiar tunes, etc.). But two points are important to remember: (a) these individuals represent a very tiny percentage of the population; they are the exceptions that prove the rule and (b) even these individuals can recognize and enjoy music in spite of their deficits.

**Myth 6a: *Musicality develops later in life.***

**6b: *After a certain point, it is too late to develop musicality.***

As stated in the previous discussion, there is no point along the lifespan that precludes meaningful musical experiences. Considerable research indicates that infants respond to music immediately (and, in fact, in the womb during the last 3 months before birth). At the other end of the life spectrum, some retired nuns have willed their brains to science. They are being studied constantly as they age and as they progress into their 80s and 90s these women are being encouraged to learn new skills. Learning to play a musical instrument, or a different one if they can already play one is one suggestion from the neuroscientists.

Certainly, there are optimum periods for musical learning. One could hardly expect to become a world-class concert pianist beginning in later years. Nevertheless, there is nothing about age that keeps one from participating in and enjoying music. Because —

**Fact 6: *Music is important from cradle to grave.*** Music educators should be aware that lifelong learning in music is supported by neuroscientific research.

**Myth 7: *Musicians are born that way.***

Our society has a tendency to think of talented individuals as ones who are naturally gifted, implying that they were born that way it is likely that every music teacher has had some students who progress very rapidly while others struggle. Nevertheless, there is increasingly clear evidence that early musical experiences change the way the brain is organized.

Studies demonstrate that the primary auditory cortex and other parts of the brain are larger in trained musicians than in the untrained ( Schlaug et al., 1995). Violinists show greater responsiveness in the motor cortex controlling the left hand than do controls (Elbert et al., 1995). In both cases the effects were greater for those who started studying music before the age of seven. The findings in these two studies are corroborated by numerous other studies, which support—

**Fact 7: *Early and ongoing musical experiences change the brain.*** It must be clearly stated that this is true not just for music, but for anything one spends time doing (e.g., learning to play chess, solving math problems, etc.). Nevertheless, this is compelling support for the effects of early childhood musical experiences.

**Myth 8a: *Music is in the right side of the brain.***

**8b. *There is a “music center” in the brain.***

These have been frequent misstatements about music being on the right side of the brain or about the notion of a “music center.” Neither of these is correct and there are many new studies to demonstrate that music is processed on both sides of the brain. Cognitive neuroscientists support the general idea proposed by Gardner in his theory of multiple intelligences. That is, the brain is modularized, in that there are relatively separate musical networks for various cognitive domains (e.g., language, mathematics, music, etc.). Within the neural network for each domain are modal points involved in particular facets of processing. In language, for example, there are locally-specialized domains for speaking, for understanding speech, for reading, and so on. The same is true for music, although neuroscientists are just now beginning to map musical pathways. Differences have been found in the ways that the two hemispheres process music, but there are still many details yet to be filled in. In the meantime, data support –

**Fact 8: *Music activates areas in the front-back, top-bottom, and left-right sides of the brain. More formally, it activates regions of the brain that are widely distributed, but locally specialized.*** These newer findings place music in closer proximity to the understandings we have of other cognitive domains.

**Myth 9a: *Emotional responses to music can't be studied.***

**9b: *Emotional responses to music shouldn't be studied.***

There are those who are afraid that a scientific study of the core experience of music is beyond our capabilities or that by attempting to understand it we will destroy the very thing we are most interested in. Perhaps the best response to this is to share Carl Seashore's response to similar concerns. (Carl Seashore was the first modern music psychologist who conducted numerous musical experiments.) He said that when he was young he was a stargazer, in awe of the beauty of the heavens. Later, he was an astronomer, with a much deeper appreciation for the starry heavens. In like manner, as an old man he still felt the power of music just as he had in his youth, but then he had a much greater understanding of it. Far from diminishing our love of music, scientific learning has the potential to enhance it significantly. Studying emotion is difficult, so progress is likely to be slow. Nevertheless, —

**Fact 9: *Neuroscientists are beginning to identify brain sites involved in affective responses to music.*** Some physicians are already using our responses to music in the practice of music medicine. In time, there will be many other applications and understandings.

**Myth 10a: *Music makes you smarter.***

**10b: *The Mozart Effect.***

These ideas have been given considerable coverage in the popular media, and unfortunately, many parents, administrators, and even some music educators have accepted them at face value. However, there is no scientific evidence to believe that this is the case, at least not in the simplistic sense. Students who participate in band, chorus, or orchestra do typically have higher SAT scores than the average student, but this is more likely due to good time-management skills, parental support, and so on, than because the music has made them smarter.

Besides the fact that these myths are not true, another reason to move our profession away from these ideas is that if they were true, music is then placed in a secondary role. Music study becomes a means of obtaining success in something else; it does not have value in and of itself. As demonstrated throughout the first nine facts, neuroscientific evidence provides clear support for –

**Fact 10: . Music is a unique way of knowing.** Just as language, mathematics, and the other intelligences provide ways of understanding, sharing, and expressing our inner and outer worlds, so does music. Music, as has been demonstrated, is not just an accidental byproduct, providing us with pleasant things to do in our leisure time. Music was critically important to our survival and development as a species and it continues to be at the core of what it means to be human. Our basic, biological equipment includes a musical brain that provides us with rich insights into the human condition and bring us great joy and beauty.

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