



# Music and the Brain ...

©Arlene R. Taylor PhD  
[www.arlenetaylor.org](http://www.arlenetaylor.org)



9/19

**According to some historians, music has been part of every known culture (and creatures)**



**The human voice was likely the first “instrument” – the brain is your most important musical instrument**

**Percussion was likely next – the earliest drum may be one found in Antarctica, made of elephant skin**

**Three flutes found in the Hohle Fels cavern of southwest Germany may be oldest melodic instruments ever found**

**In the 3<sup>rd</sup> century BC, Ktesibios, a Greek engineer from Alexandria reportedly invented the *hydraulis*—the first “keyboard” instrument and forerunner of the organ**

**One of the earliest recorded examples of “music therapy” (circa 1000 BC) related to King Saul. When he fell into a bad mood, David would strum on his lyre of small harp and sing psalms (using vocal and instrumental music) which brought relief to Saul**



**—The Historian Josephus —I Samuel 16**

**For many, a mother's lullaby is among the first of human experiences - fetus is believed able to hear music during gestation as well as the *music of Speech*—researchers theorize that Mozart was born with musical harmony already developed in his brain**



**Music has also become a big part of many churches and liturgies — author E. G. White wrote that music is as much a part of worship as prayer**

**The last memories that humans keep in mind are for music;  
a familiar song may be one of the last of human experiences**  
—Christo Pantev, PhD, Neuroscientist – University of Toronto

**Individuals with Alzheimer’s disease may lose tremendous  
amount of memory abilities and still be able to recognize  
songs, especially ones they learned in younger years;  
these individuals often recognize songs to the end  
of life and may play them or even sing the words**



—Daniel J. Levitin, *This Is Your Brain on Music*

**In Speech, letters are combined to form syllables, that are combined to form words, that are combined to form sentences, that are combined to form paragraphs and larger works**



**In Music, notes are combined to form intervals, that are combined to form melodic phrases, that are combined to form melodies, that are combined to form larger works**



**—Jeff Hawkins, *On Intelligence***

**Eventually, good sight-readers learn how to recognize letters, words, and groups of words (sentences, paragraphs) at the same time for smooth reading of a written passage**



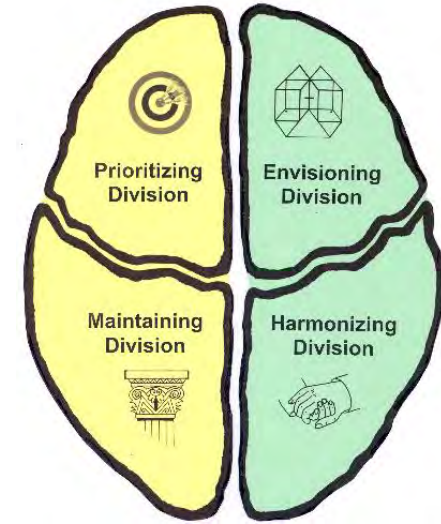
**Eventually, good sight-readers learn how to recognize notes, phrases, and groups of phrases (measures) at the same time for smooth reading of the music**

**—Jeff Hawkins, *On Intelligence***

**Areas of the brain that are primarily concerned with language and with music overlap considerably**

**Your native tongue influences the way in which you perceive music—  
the same succession of notes may sound very different depending on the language you learned growing up**

**—Sir Ken Robinson PhD, *Out of Our Minds***





**Music may occupy more areas of space  
in one's brain than does language**

**Brain plasticity definitely shows up with  
musical activities**

**Brain-imaging studies related to responses to music have  
shown that the active areas are related to a person's  
individual experiences and musical training**

**—Oliver Sacks MD, *Musicophilia***

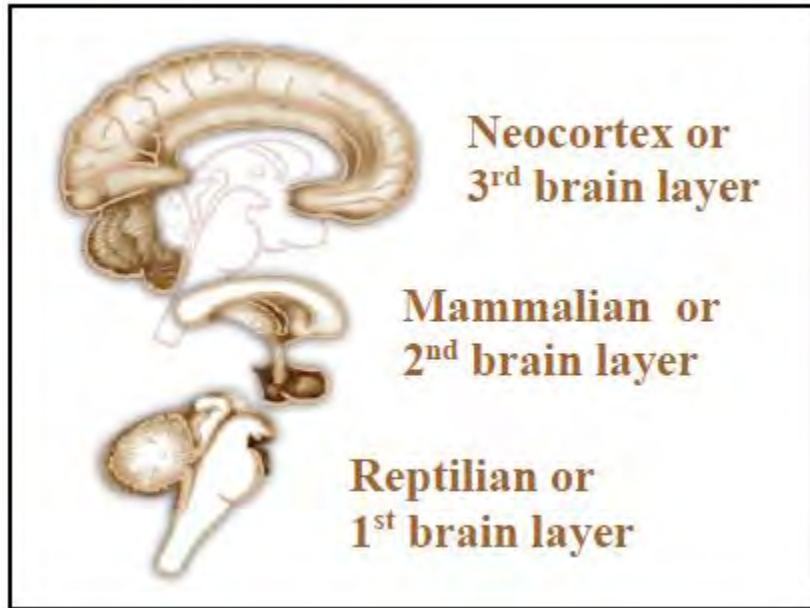


**Music is very subjective and reflects at least the performer's and the listener's own education, cultural background, life experiences, beliefs, thoughts, attitudes, preferences, and wisdom ...**



**Because of this it's definitely different strokes different folks – many do not understand or even like music from a different culture (e.g., Chinese whole-tone scale; African drumming)**

**Music impacts all brain layers—this helps to explain how music is so integral to humans and culture, develops brain functions, and how its skills transfer to other areas of life**



**Conscious appreciation, choice,  
musical decisions**

**Emotional impulses related to  
hearing, singing, or playing music**

**Loaded routines for playing music**



**Left hemisphere is particularly important for fast acoustic processing - It tells a listener whether a note is being bowed on a violin, plucked on a guitar, struck on a keyboard, blown on a woodwind, or beat on a percussive instrument**

**It is more effective in dealing with notational and sign systems, identifying and naming sounds; decodes rhythmic patterns more easily, and is more analytical and sequential**

**—Howard Gardner**

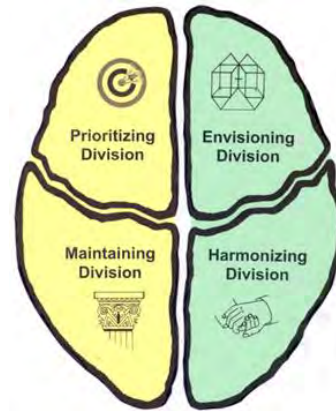
**Right hemisphere is important for slow acoustic processing - It appreciates the notes following the initial attack note and the silence between notes; is involved with the musical quality of sound, such as melody perception; performing primary musical operations involving rhythm, pitch, volume, and timbre**



**Music is primarily appreciated in the right hemisphere—if the left hemisphere is sedated, the person cannot speak but can still sing**

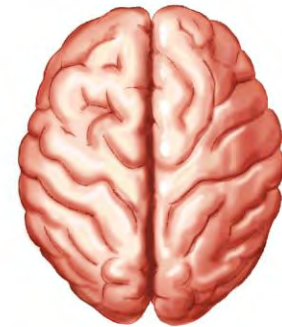
**—Howard Gardner**

**Analyzing form and style**  
**Learning musical “grammar”**  
**Directing**  
**Achieving musical goals**  
**Carving instruments**  
**Counting, learning signs**  
**and their names, writing**  
**music down, sight reading,**  
**prestidigitation**



**Inventing new music forms**  
**or instruments**  
**Composing/arranging**  
**Free harmonizations**  
**Native musical ability**  
**Playing “by ear”**  
**Harmonizing/singing parts**  
**Expressing emotion in music**

**Both hemispheres collaborate in order for a person to get an accurate overall impression of the music, analyze it, make decisions about it, and either dislike or enjoy it**



**The left hemisphere helps with identifying details and sequences, while the right hemisphere is necessary for the overall contour and perception of the music**

**The brain can actually *expand* to store music—it can revise its software wiring to support musical activities, and can devote more area toward motor control of fingers used to play a specific instrument**

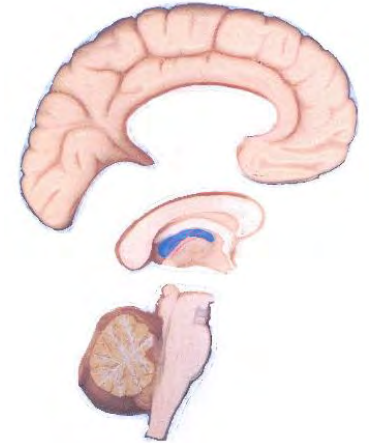
**It is probably practice, training, and experience—rather than genes—that help a person develop a musical ear**



**—Oliver Sacks MD, *Musicophilia***



**Music is irresistible and so powerful that it is impossible to listen to it and consciously override its effects on the brain/nervous system and the nervous system**



**Music can be addictive or trigger addictive-like behaviors; it activates the Brain Reward System just as does food, sex, drugs, alcohol, tobacco, and other addictive substances (your brain likes them all and in the same BRS)**

**Listen to a symphony and catch a glimpse of how your body-mind sounds when it works collectively**



**Metaphorically, compare neurons to symphony players; they do not touch each other yet are attuned to each other, communicate with each other, and work together for the greater good—sometimes everyone plays or just a few, in unison or in smaller groups or parts**

**—Paul Pearsall PhD, *The Heart's Code***

**Brain scans: the corpus callosum (largest neuron highway between the two hemispheres) is 15% larger in adults who started playing the piano before age 8, as compared with those who started later**



**An enriched corpus callosum impacts the transfer of information between the two hemispheres, which in turn can impact a whole host of activities (e.g., mathematics, reading)**

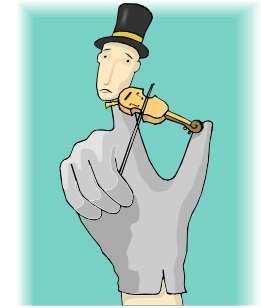
**After eight months of keyboard lessons, preschoolers tested showed a 46% boost in their spatial IQ, crucial for higher brain functions such as complex mathematics**

**Children who received music lessons did better in arithmetic than a control group without music education**

**Listening to music is believed to sharpen spatial skills throughout life**



**Sound waves enter the ear but also strike the skin, stimulating receptor molecules on cell surfaces into a dynamic vibrational state—can help synchronize body rhythms, build cellular memory, and improve physical and mental health**



**Music therapy has been used extensively in the treatment of diseases such as migraine headaches, digestive problems, cancer, respiratory problems, stroke, arthritis, diabetes, depression, and mental illnesses**

**Music influences the release of specific hormones, rate of breathing, blood chemistry, and stomach contractions (e.g., can slow digestion)**

**Increases the production of endorphins, the body's natural morphine, that can help reduce the perception of pain**



**Increases the production of immune globulin “A” that can strengthen immune system function**

**The brain and body have a rhythm—heartbeat, respiration, speech, brain functions**



**The *inner* rhythm can be altered by *outer* rhythm; the body will adjust to an external rhythm, (loud ticking of a clock, beating of a drum in a parade, a metronome), exposure to loud, heavy, repetitive, rhythmic beats (may produce an effect very similar to a hypnotic trance)**

**Body adapts its tempo to the music tempo**  
**Music plays at 80 bpm with accents on 1 and 3**

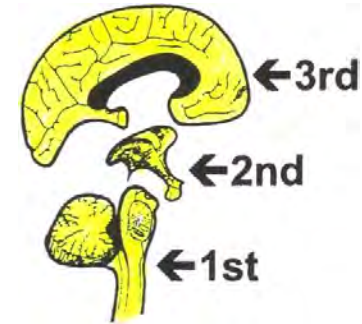


**When music is heavily syncopated (accents on 2 and 4) the body will increase its tempo to 160 bpm (80 bpm plus syncopated tempo of 80 bpm = 160 beats bmp), which can cause exhaustion over time**

**Some have temporarily lost a third of their muscle strength after being exposed to some types of tempo-accent-switching music**



**Loud, upbeat music has a stimulating effect, slow music a calming effect**



**Some types of music appear able to bypass portions of the brain where conscious thought and judgment reside—directly impacting the Autonomic Nervous System that controls heart rate, breathing, and hormones, and the triggering of emotional impulses**

**Make careful choices about the type of music to which you expose your brain and body . . .**