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Music and the Mind

Could the Popular Guitar Hero Videogame Actually have Academic Benefits?

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Music has been a form of human expression and a global fixture for centuries. Due to the pervasiveness of music throughout human history, it seems that the biological origins of music are worthy of study. Recently, the particular connection between music and the mind has become a subject of scholarship, but it is not without its critics. Cognitive scientist Steven Pinker, for instance, has even referred to music as "auditory cheesecake," something nonessential and simply for enjoyment (Scientific American). While some may find studying music to be a trivial method for helping to illuminate how the mind operates, researchers have found that understanding the relationship between the mind and music can allow for parallel developments in comprehending other phenomena, such as language.

Music's Affect on the Brain

The recognition of music's relationship to the brain, especially on an emotional level, dates back to Ancient Greece. Plato postulated that music "gives soul to the universe, wings to the mind, flight to the imagination, a charm to sadness, gaiety and life to everything" (PBS). Due to its emotional effects, music is often utilized for therapeutic purposes. For instance, during W.W.II it was shown that playing music for veterans could affect a person's mood, physical and emotional well-being, movement, fears, and muscle tension (PBS). Accordingly, Michigan State University created the first degree program in music therapy in 1944 (PBS). However, the study of the relationship between the brain and music is often marginalized, as it is often not viewed as an important part of understanding cognition and the brain. This viewpoint changed somewhat when the New York Academy of Sciences organized conference in 2000 on the biology of music, adding intellectual approval to the discipline (Balter 2007). Then, in 2005, researchers added further legitimacy to the subject by showing how music affects how the brain processes speech (PBS).

Also, developing musical skills has been associated with enhanced spatial intelligence. The appreciation of music requires higher brain functions, and learning music can translate into increased skills in math (PBS). In brains of people with musical training, the area that connects planning and foresight, the corpus callosum, is larger. Since enhanced activity in this area of the brain is crucial for quick coordination, it makes sense that the corpus callosum is enlarged for musicians who must perform advanced musical compositions (Newsweek). Interestingly, performing music may not be the only way to reap similar benefits, as mentally rehearsing music has the same effect on the cortical map (Newsweek). Thus, music is not simply an evolutionary dead end without any higher purpose besides entertainment value. Music is part of a larger scheme of brain processes and honing musical skills has not only therapeutic benefits, but academic advantages as well.

The Brain and Music

The relationship between music and the mind is even more complicated, however. While music can have a positive impact on the brain, the brain can subsequently affect interpretation of music as well. Musical hallucinations can result from brain damage; for instance, one individual experienced hearing folk songs as a result of a brain abscess (BBC 2000). When such hallucinations occur, possibly caused by communication difficulties within the brain, the musical illusions are often tunes that are familiar to the person. People with hearing loss have also experienced auditory hallucinations, but these can be attributed to sensory deprivation (BBC 2000).

Music and Culture

Current research both confirms music's pivotal role in human expression and can lead to further illuminations for understanding brain development. Research conducted by Sandra Tehub, a psychologist at the University of Toronto, confirms that babies can detect changes in pitch, tempo, and melody (Newsweek). Furthermore, infants seem to respond well to consonant music but dislike dissonant tunes, which are considered harsh and unpleasant. This research aims to determine whether preference and music interpretation is hardwired in the brain. Certainly, the structure of the brain and how the brain processes music seem to suggest that the brain is "specialized for music." Therefore, by understanding how the brain responds to music, other functions can also be investigated (Newsweek).

Indeed, musicians have more brain cells in certain areas, including ones responsible for following visual and auditory cues. However, researchers are still trying to determine whether or not the enlarged regions first caused these individuals' propensity for music or whether the study of music caused a secondary enhancement of their cognitive abilities (BBC 2001). Deciphering whether the differences in brain composition are the cause or the effect underscores both the current research and the nature of future research. Young children will need to be monitored in long-term studies to ascertain whether or not their brains were different to begin with or if the changes were induced by their study of music. Or, perhaps, another environmental factor may be the cause. One known feature that may help to lead researchers to understand this connection is that the brain does respond to repetitive tasks. In one study it was shown that, due to their navigation skills, the growth of taxi drivers' hippocampi parallels the drivers' increasing experience (BBC). Thus, a similar repetitive task, such as practicing a musical instrument, could have a similar effect

Current Research

In the "Listening to the Mind Listening" experiment, researchers attempted to prove that music affects the brain's electrical activity. They used an electroencephalogram (EEG) to sonificate brainwaves, (i.e. to transform the data into non-speech audio), in order to conduct further analysis. Researchers intended to explore how music produces changes in EEG sonification. Initial data analysis suggests that the sonification was not just random noise, but had a correlation to changes in the music. However, future research should involve more intricate and standardized terminology for classification of the sonified data. This would improve the sonification process, allowing researchers to determine more certainly whether a connection exists between events in the EEG and in the music, and whether or not the reaction is emotional or perceived. Furthermore, researchers are curious as to whether the distinct features of music can be heard in sonification (Stephen Barass et al. 2006).

At the University of Montreal (UM), neuropsychologist Isabelle Peretz is investigating how music is created and how humans react to it. Her studies are conducted at the International Laboratory for Brain, Music, and Sound Research (BRAMS), a collaboration between UM and McGill University. The team intends to use the McGill Music School's concert hall to measure reactions to music with wireless physiological sensors in the seats so that they can record "heart rate, skin electrical responses, and even facial musculature of audience members" (Balter 2007). Other seats will have palm pilots to be used to communicate reactions. However, the accuracy of these responses will be affected by the procedure used to define these responses, and will largely depend on the individual's interpretation.

Furthermore, the team is creating instruments that can be played in MRI machines so that researchers can determine exactly what goes on in the brain while music is being performed. So far, Peretz and her team have discovered that musicians can recall certain pieces with a remarkable ability due to the motor and auditory memory circuits in the brain, the part of the brain which perceives pitch. She has also determined that in people with congenital amusia (tone deafness) less white matter is present in the right, frontal inferior gyrus. But, language is controlled by the left side of the brain, which explains why people with tone deafness have accurate language abilities (Balter 2007). Lastly, the team also hopes to create cochlear implants that allow music to be processed (Balter 2007). These continued advancements in otolaryngology can not only help to elucidate an understanding of the mind, but can also lead to methods to assist the hard of hearing.

Unexpected Results

Still, music's tangible effects can go beyond brain functions and processing to affect the whole body. According to Barry Bitman, a neurologist specializing in alternative medicine, beating a drum for one hour enhances the immune system and alleviates stress (PBS). Furthermore, music can affect heart rate, blood pressure, respiration, perception of pain, physical health, and even self-esteem (PBS). While music has a range of positive effects, it can also unfortunately trigger seizures in certain individuals (BBC 2000).

Conclusion

The study of music's effect on the brain can illuminate other areas of research from whether or not the brain's composition can change in different areas to how the brain processes language. These discoveries could lead to further information concerning the role of music on the brain, and could also confirm the original assumptions that music causes positive emotional effects. The study of music and the mind has progressed from a fringe subject to a legitimate line of inquiry, which is affirmed by its connection to other aspects of brain functions. Although the first major academic conference on the subject was only held in 2000, significant progress has been made, and further possible ways to research the relationship have begun to be explored.

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