Any scholarly investigation of music and the mind must consider the elemental dichotomy of the participants in the musical experience: the producers of music and the consumers.

The producers include such individuals as composers and performers for whom the main product either is creation of a new musical idea by the composer or re-creation of another’s novel idea by the performer—a subclassification that becomes imprecise when the performance of music, itself, has a substantial creative component such as jazz. Furthermore, the expressive urges of composers have led to elaborate attempts to convey musical structure and content beyond the staves of the score as exemplified by the early twentieth century Russian composer and pianist, Alexander Scriabin, who had color-hearing synesthesia. Scriabin composed the symphonic work, Prometheus, the Poeme of Fire, to be accompanied by a light show with projection of the colors that he “saw” in relation to various tones of the orchestral score.

The consumer group of musical participants is a much larger group including, in theory, all of humankind with certain interesting exceptions. Unlike the producer group that is predominantly motivated by the imperative of creativity, the consumer group uses music for diverse purposes.

In the present issue of WORLD NEUROSURGERY, Montinaro eloquently theorizes about two worlds: music-science and music-myth. He elaborates on the mind-brain interface in music by reviewing the physiology and pathology of music perception, music as therapy, and clinical studies reviewing the effects of music on the individual.

Curiosity about music and the brain appears to have developed from a confluence of trends that began several centuries ago: the increasing prominence of secular music; the development of humanism (3,9); and the scientific interest in cerebrocortical localization. With the rise of secular music from an art that previously had been centered on the liturgical service there was a changed perspective about gifted composers and performers fueled by humanism that changed the thinking about the origin of genius and creativity. Rather than being generated by divine inspiration, as was thought previously, genius was deemed to be a natural endowment that set such musicians as Mozart, Beethoven, and Liszt apart from the rest of humanity. Franz Liszt, for example, was idolized like a modern day rock star with fans swooning in the aisles at a Liszt piano concert. This extreme admiration of the musical genius was paralleled in the scientific community by evaluation of human brains through macroscopic examination and weight—an approach that was unsuccessful in identifying an area of the brain that was consistently different in musicians when compared with less musically sophisticated individuals.

More contemporary investigations sought clues about musical function by several techniques including anatomic case studies of patients with deranged musical function and psychologic testing of healthy subjects or those with brain lesions (2). Our knowledge about the anatomy and physiology of music production and perception has had a recent renaissance fueled by the use of new investigatory tools, such as positron emission tomography, functional magnetic resonance imaging, and magnetoencephalography, which help identify either static centers for brain musical function or real-time dynamic interactions of music in various areas of the brain. It is important to note that although pathways of auditory function and the primary auditory cortex are well studied and understood, cortical localization and function for more elaborate musical activities are just beginning to be deciphered (6). We do know that musicians’ brains are different from those of the musically unsophisticated. However, it remains controversial whether the musician is simply born with superior

Key words
- Cortical localization
- Mind-Brain Identity Theory
- Music
- Music therapy

Abbreviations and Acronyms
- fMRI: Functional magnetic resonance imaging
- MEG: Magnetoencephalography
- PET: Positron emission tomography

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circuitry for musical processing or whether musical superiority is the result of plasticity with microstructural change promoted by the hours of study and practice required to become a musician (5, 7, 11).

An additional layer of complexity is added when one attempts to decipher the emotional component of music and the influence of music on healing, neonatal learning, and recovery from illness. Montinaro gives us a telling snapshot of the work in the area of auditory perception of music and music’s purported value in various treatment models. Progress has been made in the nascent field of music and emotion (8), but there remain important questions that must be answered to validate the use of music therapy. Does musical therapy actually work and, if so, how? What are valid experimental approaches to defining the utility of music therapy in various disorders (1, 4)?

Robert Zatorre, an eminent investigator in the field of the musical brain, has asserted that studying music and the brain is “a valuable way to probe a variety of complex cognitive functions and their neural substrate.” However, he also notes the challenges of the field since “music and emotion have not been the subject of much systematic research” (12) and because “emotional responses to music tend to be idiosyncratic and heterogeneous, and depend on a variety of complex and difficult-to-control individual sociocultural, historical, educational, and contextual variables” (12).

How does the topic of music and the brain relate to the philosophical concept of the mind-brain interface? The proponents of the Mind-Brain-Identity Theory assert that all mental events such as pain, consciousness, or the enjoyment of music are caused by the intrinsic physical properties of the brain—the mind is the brain at work and for every mental state there is an identical brain state. Thus, for a pleasurable music listening experience perceived by an individual there is an equivalent firing of a specific cellular network. The main support cited for Mind-Brain Identity Theory is brain localization, as certain mental activities appear to be associated with specific parts of the brain. Numerous studies do show that much of what the brain does can be understood scientifically. Those espousing mind-brain philosophy believe that understanding brain function and aspects of the mind is achievable through collaboration among investigators from diverse fields using technology not yet developed or even conceived. For completeness, it must be acknowledged that other philosophers adopt a non-physicalist position contrary to the concept that the mind is a purely physical construct. Many musicians find it difficult to support the notion that the musical experience is merely the sum of its parts.

There is some irony that the last words on this subject are not those of a neuroscientist but those of the eminent modernist composer Karlheinz Stockhausen.

“Sonic vibrations do not only penetrate ears and skin. They penetrate the entire body, reaching the soul, the psychic center of perception. The esoteric only involves what cannot be described by means of exiting scientific laws and rules. So the next step, time and again, is reinterpretation of the human body as a complicated instrument for perception. That is why every genuine composition makes conscious something of this esoteric realm. This process is endless, and there will be more and more esotericism as knowledge and science become increasingly capable of revealing human beings as perceivers. Neurologists have been seeking for years for the pilot that must obviously exist in the human brain but are unable to find it. They can turn human beings upside down but are unable to discover how the human system is coordinated and centered. That will be discovered step by step, and the profundity of what remains unexplained will also gradually become apparent. I believe the ratio between the amount concealed, the mysterious, and how much is known always remains largely the same. The further your knowledge extends, the more you discover that you cannot explain” (10).

REFERENCES


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