Why brain researchers sing praises of music

By Tom Siegfried
SPECIAL TO THE STAR

Beethoven called music the "one incorporeal entrance into the higher world of knowledge which comprehends mankind but which mankind cannot comprehend."

Jimi Hendrix called it "a safe kind of high."

Neuroscientists call it difficult to explain.

Studying how the brain works is tough enough for simple tasks like seeing, thinking and remembering. Music is much more complicated, both for the musicians and the audience.

"Music is like nothing else the brain is called upon to accomplish," writes Dr. Justine Sergent of the Montreal Neurological Institute. "Listening to music, and producing it . . . are human activities that do not easily lend themselves to scientific experimental inquiry."

But that won't stop scientists from trying. Sure, music is hard to understand, especially the dense metallic variety, which is incomprehensible to the world's best metallurgists or anybody old enough to remember the Beatles. But for all the subjectivity, emotion and personal preferences involved in performing and perceiving music, there are some things about it that science can discover.

In fact, some neuroscientists are singing music's praises because they believe it can reveal a lot about how the brain works. Music involves so many mental skills that understanding it might provide clues to how the brain accomplishes its other tricks.

After all, music involves an intricate interplay of vision (for reading notes), hearing (to detect melody, rhythm and harmony) and muscular control (to operate an instrument). Mixed in with all that are the aesthetic and emotional qualities that musicians bring to their performances.

"A neurocognitive study of musical functions," Sergent writes in the current issue of *Trends in Neurosciences*, "goes beyond understanding music-brain relationships and gives the opportunity to . . . uncover principles by which the brain organizes its resources when it has to co-ordinate a large variety of mental operations."

Sight-reading a musical score and playing it on an instrument, for example, requires precise co-ordination of many brain and muscle operations.

"It is hard to think of any other human activity that calls for the implementation of so many processes for their immediate realization."

Clues to how the brain handles this complex task come from putting brain scanners on the heads of professional pianists and measuring which parts of the brain are most active when sight-reading.

In a study published last year in the journal *Science*, Sergent and colleagues found that music isn't localized in one brain region. Playing a score on the piano requires a network of mental processes spread around the brain's cortex and cerebellum. Different brain regions are involved in representing the sight and sound of the music, in translating the spatial relationship of the written notes into hand movements on the keyboard and in controlling the precise timing and sequence of the finger motions.

The brain areas most active when the pianists were playing a score were not as active when parts of the task were performed separately. Simply reading the score without playing, or playing from memory, did not require the same kinds of complex coordinated brain activity. So music is more than the sum of its parts.

Other insights into how the brain makes beautiful music come from the study of musicians with brain damage. The most famous case is the French composer Maurice Ravel, who died in 1937. He suffered some sort of brain degeneration about four years before his death, destroying his ability to compose. He complained that he could hear a new opera in his mind but couldn't write it down.

Yet he could still listen to and appreciate music, and could even detect the slightest alteration from the original if performers improvised while playing one of his compositions.

"Ravel had become musically illiterate, not because he had lost musical knowledge or technique as such, but because he was no longer able to use this knowledge in an integrated manner in order to translate musical representations from one modality to another," Sergent wrote.

Thus, he could play scales on a piano but could not play while sight-reading a score.

Ravel's affliction and other similar cases offer further evidence of the intricate links among mental processes required to produce music. Yet much about music remains mysterious.

"The study of brain-damaged patients has not resulted in a comprehensive account of the relations between music and the brain," Sergent acknowledges. Further study of music, though, may illuminate the ways the brain mixes and masters the interrelated tasks of seeing, thinking and remembering.

And perhaps such studies will even provide clues about how to get those tunes to stop repeating themselves over and over in your head.

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