Musical Hallucinations: Causes, Conditions and Treatment

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Musical hallucinations (MH) can be described as perceptions of musical sounds in the absence of external auditory stimuli. Although imagined sounds can be non-musical; such as bells, whistles and sirens, case studies indicate that music “[takes] precedence over all other auditory hallucinations” (Sacks, 2006). Furthermore, MH may often take the form of songs from childhood and may be connected with strong childhood emotions. Although the causes of MH are not always known, they affect at least 2% of individuals affected by presbyacousis (Sacks, 2006). In an important literature review, Evers and Ellger (2004) reviewed 132 cases involving MH and found that 61% of the case reports had a history of hearing impairment or deafness. They also found a “female preponderance of 70% and a mean age of 61.5 years.” Although there may be a connection with functional psychopathological conditions such as depression and obsessive compulsive disorder (OCD), it is important to note that MH is not necessarily indicative of psychosis (Mahendran, 2007).

Recently on National Public Radio, reporter Robert Krulwich (2008) interviewed Cheryl C. (not her real name) regarding her experience with MH. Affected by presbyacousis, Cheryl had lost almost all of her hearing. She recollects how one night when she was reading she heard a terrible cacophony of sounds: the tolling of bells, rumbling trolley cars, clanging metal and crashing cymbals to name a few. Yet when she looked out the window to see what was creating the noise she came to the realization these noises were in her head. After approximately twenty minutes, the noise was replaced by music, starting with the song “Michael Row Your Boat Ashore,” then followed by hymns, spirituals, patriotic songs and other familiar songs. Fearful that she might be “going nuts,” Cheryl C. went to visit neurologist Oliver Sacks who, after extensive tests, explained to her “that because her hearing was so compromised…[and] hardly
any sounds were coming into her brain, the cells in her brain dedicated to hearing…were under stimulated…[and] began making stuff up” (Krulwich, 2008).

Positron emission tomography (PET) scans involving six individuals with backgrounds similar to Cheryl C. revealed that a network of regions in the brain became more active as her MH became more intense (Griffiths, 2000). The activation described is typical of the pattern in normal people who are listening to music (Zimmer, 2005). Griffiths (2000) found that the PET scans revealed no difference between normal musical listening and MH with one exception; PET scans of subjects experiencing MH do not indicate activation of the primary auditory cortex. This makes sense because there would be very little, if any input from the peripheral hearing apparatus due to hearing loss. These findings also support the phenomenon of MH in non-hearing impaired individuals who are placed in an environment devoid of auditory stimuli. Although manifestations typically occur in environments devoid of aural stimuli, that is not the only time that MH may occur.

Satoh, Kokubo & Kuzuhara (2007) describe a case study involving a 75-year-old woman who, in July 2002, began hearing “A red sunset,” a Japanese nursery song from a neighboring town office near the hospital her ailing husband was admitted. The MH subsided only when she spoke, sang, or listened to music. To stop the MH she resorted to singing various songs. These songs that she sang, which had no apparent significance to her, became incorporated in her MH. She reported hearing the hallucinated songs with the text and accompaniment by the “ohayashi,” a traditional Japanese vocal accompaniment consisting of short untuned voices. Meanwhile, the timbre of “A red sunset” had changed from a chorus of children to her own voice. In September 2002, the woman was admitted to the hospital for testing. Medical and psychological tests revealed no abnormalities. Her hearing was unimpaired as indicated by pure tone audiometry.
She also received a normal score on the Hamilton Depression Scale as administered by her psychiatrist who subsequently ruled out psychogenic disease. Her prescribed treatment for this condition consisted of carbamazepine, diazepam and antidepressants for 6 months with little improvement. Eventually the MH subsided and by September 2004, she was experiencing MH for approximately half-a-day at a time.

Satoh et al. (2007) surmise that one possible explanation for this case of MH is that accompaniment and timbre may be independent components of musical perception which are stored separately in the brain. When the information is retrieved from memory, the components are combined with the melodic structure of the familiar or frequently sung melody. It is interesting to think of the brain as a musical “mixing board” that can construct and separate different elements of music rather than store the idea of a musical sound as a finished and complete product. This idea does not stray from the description provided by brain scans during musical processing which seem to indicate several areas of brain activation in both normal subjects and those affected by MH (Griffiths, 2000). This idea supports the concept of modularity of musical processing and explains how manifestations of MH can still occur in subjects with brain injury and disease.

In a literature review by Evers and Ellger (2004), manifestations of MH can also be attributed to: a) psychiatric disorder, b) brain lesion, c) epilepsy and d) intoxication. Of great interest to researchers are individuals who experience MH with focal lesions and epileptic brain activity. Until recently, neurologists believed in a hemispheric dominance theory of music. Brain scans of subjects with lesions seem to refute this notion. Evers and Ellger (2004) found no significant difference in the hemisphere associated with the lesion as the major cause of MH.
Furthermore, electroencephalography (EEG) measurements in epileptic subjects neither refute nor support the concept of hemispheric dominance of MH.

When MH occurs in musicians, researchers are highly motivated to study the phenomena. A recent report cites an 83-year-old, female, retired secondary school music teacher who was diagnosed with a probable brainstem stroke and began experiencing MH (Warren & Schott, 2006). Although pure tone audiometry indicated mild presbyacousis, there was no practical deafness or tinnitus reported. Remarkably, none of the tunes associated with this subject’s MH seemed familiar. She continued to derive pleasure from music, and to play the piano. On two occasions, she notated her hallucinations which can be reduced to a series of repeating motifs, three to five notes in length, comprised predominantly of skips of thirds. This report seems to defy the notion that MH is dependent solely upon memory, but may also be based on musical experience and training. It also serves as an example of how the musical brain may be different from individuals without musical training and experience.

For individuals, the conditions associated with MH are perceived as dysfunctional. Therefore, consultation with a neurologist typically results in some kind of treatment. In the case of Cheryl C., she underwent a cochlear implant, hoping that stimulation of the primary auditory cortex would relieve her of MH. In her case the procedure was not successful in that she now experiences a rather hollow sounding impression of sound through her new implant in addition to the high fidelity sounds of her MH (Sacks, 2007). Neurologists in the Netherlands (Gilhaus, Dara Hama-Amin & Renier, 2007) found that treatment of MH may be the result of an ancillary reaction to medication prescribed for epilepsy. In a case involving a healthy 70-year-old woman who suddenly started hearing children’s songs, an MRI revealed leukoaraiosis, a reduction in the density of cerebral white matter. EEG readings indicated spike-wave discharges on the left
temporal side of her brain. She was administered carbamazepine for her seizures which also partially relieved the MH. Another patient, an 85-year-old woman diagnosed with leukoaraiosis also complained of hearing children’s and religious songs from her youth. While hearing songs an EEG revealed epileptic discharges of the right temporal lobe. The drug levetiracetam was administered to counter her seizures which also reduced the amount and intensity of the MH (Gilhaus et al., 2007).

Doctors in Japan (Ukai, Yamamoto, Tanaka, Shinosaki & Takeda, 2007) describe the case of an 82-year-old woman suffering from hearing loss in both ears. She began experiencing MH consisting of voices and old familiar songs accompanied by musical instruments almost all day long. Other than the hearing loss, tests revealed no brain defect. After one week of the administration of carbamazepine, the intensity of the MH subsided, but still persisted. Approximately two years later, the patient consented to a regimen of donezepil, a drug approved only for the treatment of Alzheimer’s disease. After two-weeks of treatment, she reported that her MH subsided and that she only experienced them when focusing her attention in quiet environments. Ukai, et al. (2007) speculate that certain drugs such as donezepil may help support sensory inputs that inhibit the generation of memory traces, in this case songs from childhood, when the threshold of auditory stimuli is diminished.

In most cases, memory plays an important role in creating and recreating musical experience, especially for those who experience MH. Further study of this phenomenon may help explain why individuals experience and describe the same musical stimuli differently. This is of particular importance to music fields that rely on critique such as adjudication, evaluating, musical criticism in the media and education, especially in absence of criteria-specific rating scales. The notion that musical material in MH involve memories of music from childhood not
heard in decades suggests the powerful impact early childhood music education can have on long-term memory storage and retrieval. Whether the impact on memory is music specific or generic is unknown. Nonetheless, the very idea that aural hallucinations tend to be music specific as opposed to random sound is remarkable. It is as if “our auditory systems, our nervous systems, are tuned for music” (Sacks, 2006).
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References


