

Neuron Network Goes Awry, and Brain Becomes an iPod

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Seven years ago Reginald King was lying in a hospital bed recovering from bypass surgery when he first heard the music.

It began with a pop tune, and others followed. Mr. King heard everything from cabaret songs to Christmas carols. "I asked the nurses if they could hear the music, and they said no," said Mr. King, a retired sales manager in Cardiff, Wales.



John Ritter

"I got so frustrated," he said. "They didn't know what I was talking about and said it must be something wrong with my head. And it's been like that ever since."

Each day, the music returns. "They're all songs I've heard during my lifetime," said Mr. King, 83. "One would come on, and then it would run into another one, and that's how it goes on in my head. It's driving me bonkers, to be quite honest."

Last year, Mr. King was referred to Dr. Victor Aziz, a psychiatrist at St. Cadoc's Hospital in Wales. Dr. Aziz explained to him that there was a name for his experience: musical hallucinations.

Dr. Aziz belongs to a small circle of psychiatrists and neurologists who are investigating this condition. They suspect that the hallucinations experienced by Mr. King and others are a result of malfunctioning brain networks that normally allow us to perceive music.

They also suspect that many cases of musical hallucinations go undiagnosed.

"You just need to look for it," Dr. Aziz said. And based on his studies of the

hallucinations, he suspects that in the next few decades, they will be far more common.

Musical hallucinations were invading people's minds long before they were recognized as a medical condition. "Plenty of musical composers have had musical hallucinations," Dr. Aziz said.

Toward the end of his life, for instance, Robert Schumann wrote down the music he hallucinated; legend has it that he said he was taking dictation from Schubert's ghost.

While doctors have known about musical hallucinations for over a century, they have rarely studied it systematically. That has changed in recent years. In the July issue of the journal *Psychopathology*, Dr. Aziz and his colleague Dr. Nick Warner will publish an analysis of 30 cases of musical hallucination they have seen over 15 years in South Wales. It is the largest case-series ever published for musical hallucinations.

"We were trying to collect as much information about their day-to-day lives as we could," Dr. Aziz said. "We were asking a lot of the questions that weren't answered in previous research. What do they hear, for example? Is it nearby or is it at a long distance?"

Dr. Aziz and Dr. Warner found that in two-thirds of the cases, musical hallucinations were the only mental disturbance experienced by the patients. A third were deaf or hard of hearing. Women tended to suffer musical hallucinations more than men, and the average patient was 78 years old.

Mr. King's experience was typical for people experiencing musical hallucinations. Patients reported hearing a wide variety of songs, among them "Don't Cry for Me Argentina" and "Three Blind Mice."

In two-thirds of the cases, the music was religious; six people reporting hearing the hymn "Abide With Me."

Dr. Aziz believes that people tend to hear songs they have heard repeatedly or that are emotionally significant to them. "There is a meaning behind these things," he said.

His study also shows that these hallucinations are different from the auditory hallucinations of people with schizophrenia. Such people often hear inner voices. Patients like Mr. King hear only music.

The results support recent work by neuroscientists indicating that our brains use special networks of neurons to perceive music. When sounds first enter the brain, they activate a region near the ears called the primary auditory cortex that starts processing sounds at their most basic level. The auditory cortex then passes on signals of its own to other regions, which can recognize more complex features of music, like rhythm, key changes and melody.

Neuroscientists have been able to identify some of these regions with brain scans, and to compare the way people respond to musical and nonmusical sounds.

Only a handful of brain scans have been made of people with musical hallucinations. Dr. Tim Griffiths, a neurologist at the University of Newcastle Upon Tyne in England, performed one of these studies on six elderly patients who developed musical hallucinations after becoming partly deaf.

Dr. Griffiths used a scanning technique known as PET, which involves injecting radioactive markers into the bloodstream. Each time he scanned his subjects' brains, he asked them whether they had experienced musical hallucinations. If they had, he asked them to rate the intensity on a scale from one to seven.

Dr. Griffiths discovered a network of regions in the brain that became more active as the hallucinations became more intense. "What strikes me is that you see a very similar pattern in normal people who are listening to music," he said.

The main difference is that musical hallucinations don't activate the primary auditory cortex, the first stop for sound in the brain. When Dr. Griffith's subjects hallucinated, they used only the parts of the brain that are responsible for turning simple sounds into complex music.

These music-processing regions may be continually looking for signals in the brain that they can interpret, Dr. Griffiths suggested. When no sound is coming from the ears, the brain may still generate occasional, random impulses that the music-processing regions interpret as sound. They then try to match these impulses to memories of music, turning a few notes into a familiar melody.

For most people, these spontaneous signals may produce nothing more than a song that is hard to get out of the head. But the constant stream of information coming in from the ears suppresses the false music.

Dr. Griffith proposes that deafness cuts off this information stream. And in a few deaf people the music-seeking circuits go into overdrive. They hear music all the time, and not just the vague murmurs of a stuck tune. It becomes as real as any normal perception.

"What we're seeing is an amplification of a normal mechanism that's in everyone," Dr. Griffiths said.

It is also possible for people who are not deaf to experience musical hallucinations. Epileptic seizures, certain medications and Lyme disease are a few of the factors that may set them off.

Dr. Aziz also noted that two-thirds of his subjects were living alone, and thus were not getting much stimulation. One patient experienced fewer musical hallucinations when Dr. Aziz had her put in a nursing home, he said, "because then she was talking to people, she was active."

There is no standard procedure for treating musical hallucinations. Some doctors try antipsychotic drugs, and some use cognitive behavioral therapy to help patients understand what's going on in their brains. "Sometimes simple things can be the cure," Dr. Aziz said. "Turning on the radio may be more important than giving

medication."

Despite these treatments, many people with musical hallucinations find little relief. "I'm just living with it," Mr. King said. "I wish there was something I could do."

"I do silly things like talking to myself, hoping that when I stop talking, the tune will stop. But it doesn't work that way."

More studies may help researchers find new treatments. Prof. Diana Deutsch, a psychologist at the University of California, San Diego, is planning a new scanning study of musical hallucination on people who are not deaf, using functional M.R.I. Unlike the PET scanning used by Dr. Griffiths, functional M.R.I. is powerful enough to catch second-by-second changes in brain activity.

"It might be awhile before we have results, but it's certainly something I'm very excited about," Dr. Deutsch said. "We'll see where it takes us."

Dr. Aziz also believes that it is necessary to get a better sense of how many people hear musical hallucinations. Like Mr. King, many people have had their experiences dismissed by doctors.

Dr. Aziz said that ever since he began presenting his results at medical conferences last year, a growing number of patients have been referred to him.

"In 15 years I got 30 patients," he said, "and in less than a year I've had 5. It just tells you people are more aware of it."

Dr. Aziz suspects that musical hallucinations will become more common in the future. People today are awash in music from radios, televisions, elevators and supermarkets. It is possible that the pervasiveness of music may lead to more hallucinations. The types of hallucinations may also change as people experience different kinds of songs.

"We have speculated that people will hear more pop and classical music than they do now," said Dr. Aziz. "I hope I live long enough to find out myself in 20 years' time."