Hallucinations of musical notation may occur in a variety of conditions, including Charles Bonnet syndrome, Parkinson’s disease, fever, intoxications, hypnagogic and hypnopompic states. Eight cases are described here, and their possible cerebral mechanisms discussed.

Keywords: hallucinations; Charles Bonnet syndrome; Parkinson’s disease; mental imagery; music

Introduction

Ever since Broca’s demonstration of focal left hemisphere damage in his aphasic patient ‘Tan’, neurologists have sought to correlate neurological deficits of every sort with lesions in particular areas of the brain or their connections, as Déjérine (1892) did in regard to the alexia of his patient ‘Monsieur C’. But Hughlings Jackson stressed the importance of studying positive disorders as well. Whereas localizing function on the basis of lesion studies was indirect and inferential, Jackson felt that the positive phenomena of seizures, migraines, hallucinations, etc., could allow one to directly observe the functions of specific parts of the brain.

It is in this light that Dominic ffytche and his colleagues in London study what they call ‘the positive pathologies of vision’ (chiefly hallucination, but also palinopsia, polypia and other forms of visual perseveration). They have done this particularly in relation to Charles Bonnet syndrome, which may develop in a sizeable percentage of people who lose significant vision.

ffytche and colleagues (Santhouse et al., 2000) have delineated a dozen or more categories of hallucinations: geometric patterns, tesselopsia, dendropsia, landscapes, vehicles, figures with hats, cartoon-like faces, children or small figures, etc. They estimate that more than a quarter of their patients have ‘text hallucinations’, an overall term used for hallucinated letters, lines of print, musical notes, numerals, mathematical symbols or other types of notation.

Hallucinations of musical notation seem to be much rarer than hallucinations of letters or lines of print (D. ffytche, personal communication), although my own experience is the opposite of this, perhaps because I have investigated various musical syndromes, and people often write to me about these. Thus I have seen or corresponded with a dozen or more people whose hallucinations include—and sometimes consist exclusively of—musical notation. The aetiology can be very varied. I have encountered this symptom particularly in patients with Charles Bonnet syndrome, Parkinson’s disease, fever and hypnopompic states as the following cases illustrate; and it is possible that such hallucinations may occur in other conditions that predispose to hallucination, including certain types of migraine and epilepsy, intoxication, etc. However, patients may not volunteer these descriptions unless asked specifically about them.

Case studies

Case 1: Marjorie J

In 1995 Marjorie J. wrote to me about what she called her ‘musical eyes’:

‘I am a 77-year-old woman with glaucoma damage to mostly the lower half of my vision. About two months ago, I started to see music, lines,
They were still faintly: syndrome-type hallucinations, unless she specifically focused on them. But they were still there, faintly:

'A few months later, she reported that the musical hallucinations had begun to fade (as often happens with Charles Bonnet syndrome-type hallucinations), unless she specifically focused on them. But they were still there, faintly:

'I would read a newspaper and the print lines in my lower peripheral vision were music lines. . . . However, if I moved my eyes to look at it, it disappeared, but reappeared as I moved my glance back. Sometimes it looked like the music in hymnals—I used to sing in choirs years ago. But mostly it was and is small single lines and single notes but with the lines and clefs and rests, etc.'

When I re-contacted Mrs. J. 15 years later, her vision had been much improved by further eye surgery—she was able to read real scores again and no longer hallucinated them.

Case 2: Arthur S

Arthur S., a surgeon and amateur pianist, was losing vision from macular degeneration. In 2007, he started ‘seeing’ musical notation for the first time. Its appearance was extremely realistic, the staves and clefs boldly printed on a white background ‘just like a sheet of real music’, and Dr. S. wondered for a moment whether some part of his brain was now generating his own original music. But when he looked more closely, he realized that the score was unreadable and unplayable. It was inordinately complicated, with four or six staves, impossibly complex chords with six or more notes on a single stem, and horizontal rows of multiple flats and sharps. It was, he said, ‘a potpourri of musical notation without any meaning’. He would see a page of this pseudo-music for a few seconds, and then it would suddenly disappear, replaced by another, equally nonsensical page. These hallucinations were sometimes intrusive and might cover a page he was trying to read or a letter he was trying to write.

Though Dr. S. has been unable to read real musical scores for some years, he wonders, as did Mrs. J., whether his lifelong immersion in music and musical scores might have determined the form of his hallucinations.

Case 3: D. W

D.W. is a professional pianist who started playing at the age of four. But when she was 72, she wrote, ‘I lost my eyesight and began to have visions of music in the air, in front of me’.

I asked if she could tell me more. ‘The scores are fleeting’ she said, ‘I see them as notes, but can’t make them out. It doesn’t last long enough for me to recognize’.

Her loss of vision had been a gradual process; she had macular degeneration and cataracts in both eyes. There was a period when she could still play music if the scores were sufficiently enlarged, and it was only after actual sight-reading became impossible that she started to get ‘visions’ of scores—irrespective of whether her eyes were open or shut. Successful cataract surgery restored some vision to her, and this has led to some lessening of musical hallucinations, which are now occasional rather than continual. A substantial number of patients with Parkinson’s disease—perhaps a quarter or more—develop illusions or hallucinations some years after being diagnosed and starting treatment with dopaminergic drugs. The hallucinations may be olfactory or tactile, visual or auditory, but visual hallucinations tend to predominate, and in the following two cases they were exclusively of musical notation.

Case 4: Ted R

Ted R., now 75, developed Parkinson’s disease in his early 60s. He remains very active as a scholar and writer, and he is a gifted pianist. Two years ago, he started to have musical hallucinations—or, as he prefers to call them, ‘illusions’. He was reading a book and turned away for a few seconds; when he returned to the book, he found that the print had been replaced by music. This has occurred many times since, and may also be induced by staring at a page of print. Occasionally the dark border of his bathmat may turn into staves and lines of music. There is always something—letters or lines—that is transformed into music, which may be why he regards these as ‘illusions’, not hallucinations.

Professor R. started to play the piano when he was five and still plays many hours a day. He is curious about his illusions, and he has done his best to transcribe or play the illusory music (his best chance of catching this phantom music, he has found, is to set up a newspaper on the music stand and play it as soon as the newsprint turns into music). But the music is scarcely playable, because it is always very highly ornamented, with innumerable crescendo and decrescendo markings, while the melody line is three or more octaves above middle C, and so may have half a dozen or more ledger lines above the treble staff.

Professor R., who is also a Sanskrit scholar, observed recently that his hallucinations had changed:

‘The music now covers a whole page and sometimes is written very ornately rather than in the crude hand that occurred before, now almost like a hand of the 18th century. I have come closer to copying some of them, but I am still not sure of the accuracy of what I might write since very often the images disappear before I can verify them. Another oddity: the illusions have occurred with the devanagari script, the script used for Sanskrit. Despite the exotic nature of the script the result is still Western music.’

Case 5: Esther B

Esther B., a composer and music teacher, wrote to me that, 12 years after being diagnosed with Parkinson’s disease, she started to have ‘a rather peculiar visual phenomenon’. She described this in detail:

‘When I look at a surface—like a wall, or a floor, or a garment someone is wearing, or a curved surface like a tub or sink, or other surfaces too
numerous to mention—I see a sort of collage of music scores superimposed upon the surface, especially with my peripheral vision. When I try to focus on any one image, it dims out or disappears elusively. These images of music scores come unbidden and are especially vivid after I’ve been working with any written music. The images always appear more or less horizontal, and if I tilt my head one way or the other, the horizontal images will tilt accordingly.’

Case 6: Mary Ann N

Visual and/or auditory hallucinations seem to occur, on the threshold of sleep, at least occasionally, in a majority of people. Hypnagogic hallucinations are usually experienced when one is ready for sleep, lying quietly in bed with closed eyes, and they usually seem (as Nabokov wrote of his own hallucinations) to be ‘projected, as it were, upon the inside of the eyelid’. Hypnopompic hallucinations, by contrast, are commonly seen with eyes open, projected into external space. I have the impression that both hypnopompic and hypnagogic hallucinations are more common in the elderly, and several correspondents have written to me about ‘seeing’ musical notation around them after waking in the morning. Mary Ann N. wrote:

‘Since November 2008, I have had regular views of musical notation on the ceiling above my bed…sometimes reaching from one wall to the other. There are lines and spaces with notes going up and down the staff, but the notes are not distinct enough to formulate a tune…The viewings occur when I wake up in the morning while the room is still dimly lit. When sunlight comes into the room the notation disappears…This morning was different from any of the previous occasions. I awoke very early, looked down to put on bedroom slippers, and there was a string of lines, spaces and notes going across my feet. I looked up at the mirrored doors on the closet in front of me and there was a string of notation (on them) as well.’

Mrs. N. noted, ‘I am in my seventies, and have been playing piano since the age of seven. I have been absorbed with music throughout my life’. Like Esther B., she described the hallucinations as heightened at times of particularly intense musical absorption—rehearsing with opera singers, playing the piano in church, or learning a new piece at home.

Case 7: M. R

M.R. described somewhat similar hypnopompic hallucinations in a letter to me. She too emphasized that such hallucinations are increased during periods of intense musical study leading up to a concert or recital:

‘I am a 73-year-old woman…a music enthusiast since age three when I learned to play the piano. In 1996…I started to take singing lessons, and have been singing with one or another group ever since. The groups I tend to sing with tend to be extremely demanding…A few weeks ago I realized that sometimes when I wake up in the morning and look at the walls or ceiling of my bedroom, there are musical notes dancing around before my eyes. The notes twinkle rather than staying put, and so I’m unable to tell if they represent a composition or even a period of music….After some time I noticed that the notes are not with me all the time but only during the time leading up to a concert.’

Case 8: Christy C

One does not need any ongoing pathology—visual or otherwise—to experience hallucinations. They may occur with drug toxicity or with fever or metabolic disturbance. Christy C. described herself to me as ‘not a musician’, though she had some piano lessons in childhood, and she enjoys listening to contemporary music. She wrote:

‘As a child, I ran high fevers when sick. With each spell, I would hallucinate. This was an optical hallucination involving musical notes and stanzas. I did not hear music. When the fever was high, I would see notes and clef lines, scrambled and out of order. The notes were angry and I felt unease. The lines and notes were out of control and at times in a ball. For hours, I would try to mentally smooth them out and put them in harmony or order. This same hallucination has plagued me as an adult when feverish.’

Complexity of musical notation

It is striking that seven of eight of these cases are gifted musicians—pianists, teachers or composers who have spent a lifetime with musical scores, whether sight-reading, playing or studying them. This is perhaps a coincidence, but it makes one wonder whether there is something about musical scores that is radically different from verbal texts.

Musical scores are generally far more complex, visually, than written text, which (at least in English) relies on 26 letters arranged in different combinations and groupings along a single line. A musical score, by contrast, has not only a variety of notes but a large number of special symbols to indicate how these notes should be organized and played. Each note has its own temporal value, as indicated by its particular symbol (whole note, half note, quarter note, etc.), and its own pitch, as indicated by its position on the staff. The notes may be inflected, sharpened or flattened; there may be sharps or double sharps, flats or double flats to indicate this. There are 16 possible key signatures, as well as many different time signatures and rhythmic groupings—triplets, quadruplets etc. Besides these basic forms of organization, there are all sorts of additional features—acciaccaturas, mordents, turns, trills, signs for intensity or accentuation, for speeding or slowing, for repeats or pauses, ties, slurs, phrasing, etc. Thus music must be read not only vertically, in terms of note pitches and chords, but horizontally, in terms of phrasing and voices.

Sloboda (1981), in an article on ‘The use of space in musical notation,’ writes:

‘Perhaps the most fundamental difference between score and text is that a score must be able to specify different events as occurring simultaneously whereas text portrays a single sequence of events….A second difference concerns use. Score readers are mainly concerned with producing a musical performance. Text readers are more concerned with understanding and remembering what they read. This difference makes issues of layout of foremost importance in a score….A third difference concerns the levels at which spacing and layout become important. Score material presents the reader with diverse spatial information at a microscopic level. Any two-centimetre square of a modern score will contain a rich array of symbols at varying distances and directions from
Hallucinations of musical notation in the non-literate

Performing or studying music requires a great deal of repetition. Thus, one might suspect that musicians studying complex scores and notation may develop neural imprints, so to speak, which—should any tendency to hallucination later develop—are available to be activated.

When I proposed this idea to Dominic ffytche, however, he replied,

‘I recognise the scenario you describe of musicians hallucinating notes but, perhaps more strikingly, have also come across the reverse scenario of patients who are not trained musicians or with a particular interest in music who are puzzled by why they hallucinate musical notation. I would not disagree with what you say...regarding the likelihood that prolonged exposure to music increases the likelihood of “musical eyes” but it is not a pre-requisite’ (personal communication).

Indeed, one does not need to be able to read music to hallucinate it—simply having seen it may be enough, and almost everyone in our culture has seen music. Christy C. is not a musician and cannot read musical scores, although she is familiar with what a score looks like.

One wonders, analogously, whether illiterate people may have text hallucinations from simply having seen print without being able to read it—and if so, whether it has a different neural basis from that of text hallucinations in the literate.

The neural basis of text hallucinations

What is going on in the brain when one hallucinates text or musical notation? Can such hallucinations teach us anything about reading and the brain’s ways of handling such notations?

PET scanning and functional MRI have made it possible to observe areas of heightened activity in normal subjects while they are reading, and these studies have shown that the integrity of a small, specialized area in the left inferotemporal cortex—the visual word form area—is crucial for the act of reading (Petersen et al., 1988). This accords with a century of clinicoanatomical observations connecting acquired alexia with damage in this area.

Clinicoanatomical studies have been less useful with regards to musical alexia, not least because this rarely occurs as an isolated syndrome; it is apt to be part of a more general alexic syndrome, as in the case of Déjérine’s ‘Monsieur C’. But my patient Lilian K., a highly accomplished professional pianist and (in her own words) ‘a fantastic sight-reader’, lost the ability to read music 3 years before she had any difficulties with written language (Sacks, 2010). An isolated musical alexia like this indicates that parts of the brain other than the visual word form area may be involved in reading music—and a clue to which parts was perhaps suggested by PET scan studies that showed hypoperfusion in Mrs. K.’s occipital and parietal lobes.

Musical alexia without print alexia is described by Ian McDonald (2006) in his account of musical and other deficits he experienced in consequence of a stroke. A skilled pianist and sight-reader, he found that ‘written musical notes that convey information about pitch through their placement on the stave meant little, whereas letters designating tones did’. He attributes his difficulties with reading and writing music to a visuospatial deficit caused (like his topagnosia and other visuospatial problems) by involvement of the right angular and supramarginal gyrus.

Certainly if spatial layout is of the essence in music notation, one would suspect the involvement of occipito-parietal and parietal networks—the dorsal visual pathway as well as the ventral one. That the parietal lobes are indeed involved in reading music was shown by Sergent et al. (1992) in a PET scan study of reading musical scores:

‘When the subjects read a musical score (task v) without listening or playing, there was a bilateral activation of the extrastriate visual areas, as expected by requirements of processing visual information. However, the areas in the left lingual and fusiform gyri normally engaged in the visual processing of words were not activated by the musical notations. Instead, the left occipitoparietal junction was recruited, consistent with the participation of the dorsal visual system in spatial processing.’

While ffytche et al. (D. ffytche, personal communication) have shown that text hallucinations are associated with abnormal, spontaneous activity in the visual word form area, there have not, as yet, been any functional MRI studies of score hallucinations. It would be of great interest to obtain these, and to see whether these are accompanied by activation in the dorsal as well as the ventral visual pathway, and whether the patterns of activation differ in ‘musical’ versus ‘non-musical’ subjects.

Meaninglessness of text hallucinations

A striking feature of text and score hallucinations is their unreadability. They may seem plausible at first, as with a patient described by Santhouse et al. (2000) who saw hallucinatory music in blocks of print and said, ‘If I had a piano, I could play it’. But on closer inspection, hallucinated music turns out to be unreadable, pseudomusic or musical nonsense. My correspondent Dorothy S. mentioned this with her text hallucinations:

‘Then there are the words. They are from no known language, some have no vowels, some have too many; “skeeeekkseegsky”. It is hard for me to capture them as they move swiftly from side to side and also advance and retreat. Sometimes I catch a glimpse of part of my name, or a version of it: “Doro” or “Dorthoy”.

Text hallucinations may consist only of proto-letters, as ffytche noted in a letter to me: ‘Sometimes the letters, on closer inspection, turn out to be not letters at all, just lines, dots, dashes and curves that, from afar, bear a passing resemblance to letters’. I have experienced this myself, with no vision in one eye and
reduced vision in the other, I have a mild form of Charles Bonnet syndrome, in which I see a variety of simple visual forms whenever I gaze at a blank surface—walls, ceiling, sky etc. Some of these are geometrical patterns, especially checkerboards; others resemble letters. Sometimes I see a clear ‘N’ or ‘W’ or ‘H’ or ‘T’ (straight edges are more common than curves); other shapes are not recognizable as Roman letters but are letter-like and make me think of runes. These appear and disappear, rapidly, all over the visual field. If, however, I am looking at a ledge, they will organize themselves into a sort of frieze. When I recently returned to playing the piano and to studying scores minutely, I began to ‘see’ showers of flat signs along with the letters and runes on blank surfaces.

Normally the early visual system analyses forms and then sends the information it has extracted to higher areas, where it gains coherence and meaning (there is also a rich reciprocity between top-down and bottom-up processes, so that memory, emotion and expectation influence perception). Damage at different levels can break this flow of information. In this case, a focal stimulation or spontaneous activation of the visual word form area (or analogous areas involved in musical perception), unguided from above by higher-order mechanisms or from below by actual perception, provides only a crude simulacrum of real text or score—pseudo-texts, pseudo-scores, which lack some features of reality while exaggerating others. Arthur S. put this very well when he called his score hallucinations ‘a pot-pourri of musical notation without any meaning’; he contrasted such hallucinated music with his ability to visualize musical scores, to hold in his mind’s eye vivid and accurate images that ‘unrolled’ before him when he ‘played’ a familiar piece in his mind. These memory-images were quite different from his elaborate, unstable, unplayable hallucinations.

We see in hallucinations of musical notation not only notes, staves and clefs, but all the ancillary instructional notations, along with their spatial layout in the case of scores—minus the organizing principles of grammar and meaning.

Normally, in the act of perception or imagination, the entire visual system is engaged, activities at every functional level so seamlessly integrated as to defeat analysis. Paradoxically, one may have to study disorders of the visual system to see how complex perceptual and cognitive processes are analysed and delegated to different levels. Positive disorders of function—‘hyperphysiological’ states, as Hughling Jackson called them—have a unique power to illuminate the processes and levels of construction in the visual system, and hallucinations of musical notation can provide a very rich field of study here.

References


