
'Music is... non-propositional, yet appreciation of music may be more intellectual than emotional'. Whilst many enjoy the experience, the majority of people are not musically literate. Many can recognize a melody but without any appreciation of the elements of music—pitch, timbre, duration, loudness, rhythm and the construction of a chord. Few can fathom musical notation, which includes both verbal and non-verbal elements and indicates both simultaneous and serial events. Music, 'the art or science of arranging sounds in notes and rhythms to give a desired pattern or effect' joins language differently in song, poetry and the prosody of speech; and the appreciation and expression of each may become dissociated. Since some patients speak but are amusic, and others with aphasia retain the ability to sing and appreciate music, how best might amusia be classified and understood in terms of structure and function?

The system proposed by Salomon Henschen is rigidly anatomical. Motor (vocal and instrumental amusia, and musical agraphia) and sensory (music deafness, amnestic amusia and musical alexia) disorders separate depending on selective involvement of the 'singing centre' in the pars triangularis of the third frontal convolution, the receptive centre in the temporal pole, the note-reading centre in the angular gyrus, the instrumental centre at the foot of the second frontal convolution and a special centre for violinists: others distinguish the centres for singing and whistling—all on the left. That said, the 'musical faculty is phylogenetically as well as ontogenetically older than speech, and its representation more uniformly distributed over both hemispheres', such that musical ability in aphasia is due to takeover by the right hemisphere. This is not a view shared by the neuropsychological analyst, Erich Feuchtwanger, who considers that, although phonemic and melodic abilities might be disconnected, symbolic and non-symbolic aspects of speech and music each involve both hemispheres, and (following Hughlings Jackson) it is unjustifiable to draw conclusions regarding normal localization from the site of a lesion associated with a specific functional deficit. Against this background of opinions delivered mainly in the 1920s–1930s, more recent commentators have assigned sound recognition to the right hemisphere and musical understanding to the left, declared that sensory amusia is a dominant hemisphere syndrome and expressive amusia non-dominant, suggested that transference from the right to left hemisphere occurs with musical education and sophistication, or abandoned the doctrines of localization and concluded that anything may occur with lesions of either hemisphere. Clarification seems desirable.

John Brust describes two cases. Both are professional musicians with aphasia and amusia, but each is differently affected. A 22-year-old music student suffered massive left hemisphere swelling during removal of a left sub-temporal meningioma, presenting as focal seizures; cerebral infarction resulted in contralateral hemianopia, hemiplegia and hemisensory loss and global aphasia. After several further surgical procedures and the control of on-going seizures, 18 months later Case 1 had persistent alexia with agraphia, hemianopia and sensory loss. She graduated as Bachelor of Music 2 years after presentation but her musical skills were still impaired. Detailed examination during the period of recovery shows features of transcortical sensory aphasia with relative preservation of repetition, and accurate matching of words that she could not read to pictures. She appreciates musical tone, melody and harmony; identifies instruments heard; recognizes rhythms, intervals, dynamics and articulations; reproduces melodies; and spots deliberate errors. She can produce music by singing or playing the piano and guitar with her left hand (and strumming crudely with the right). But her ability to match activities dependent on hearing music are in marked contrast to her poor success with musical notation, although she 'hears' these errors of transcription and attempts to correct them. Her efforts at reading rhythm are better than pitch, and generally she recognizes whether an interval is upward or downward, but tends to ignore sharps and flats. She can copy a score, slavishly, but not write music spontaneously, especially in the bass clef. Later, and at a time when her speech output had almost returned to normal, she gave a recital singing newly learned works in five languages with no apparent mistakes of words or music. Subsequently, she embarked on a career as a New York night-club singer. Dr Brust found her performances to be faultless.

A 42-year-old hypertensive professional double bass jazz player had a presumed left hemisphere cerebral haemorrhage in association with a middle cerebral artery aneurysm. The offers of further investigation and treatment were declined. His pre-morbid musical skills were eclectic. He could read and write music, and sing; and he knew his way around a keyboard but did not have absolute pitch. Examination shows moderately severe conduction aphasia, with poor repetition, and alexia with agraphia. Music does not sound 'right'. Whilst able to recognize melodies, detect deliberate errors and tell which of two notes is of higher pitch,
he cannot recognize the number of notes or intervals in a chord, or detect metre and rhythm. He is unable to imitate music, however many or diverse the cues. Initially, his performance of written music and ability to write notes or assign these to the correct clef and to produce musical sequences were equally poor. Once speech had improved leaving only residual delays in repetition but good comprehension and output, and with much improvement in spontaneous singing, he still cannot sight-read, imitate rhythm, match written intervals with those heard or write music, even with appropriate cues.

In summary, ‘these two aphasic patients...should discourage one from trying to predict what kind of amusia...might follow a particular brain lesion...Case 1 with transcortical sensory aphasia...had musical alexia and agraphia...greater for pitch than for rhythmic elements...Case 2, with conduction aphasia, had severe expressive amusia, which affected rhythm more than pitch, plus musical alexia and agraphia...Case 1’s musical agraphia was less severe than her language agraphia: in Case 2, the reverse was true’. Warning readers that nothing coherent is likely to emerge from his further review, Dr Brust now embarks on a comprehensive account of the prior literature categorized by syndrome: aphasia with normal musical reading and writing, aphasia without musical alexia and agraphia, and aphasia with amusia but preserved musical reading and writing. Many are accounts of interesting individuals, some well known, facing awkward musical challenges often interpreted and recorded by household neurological names—the intellectual elite of one discipline engaging with that of another.

On aphasia without amusia, Olaf Dalin described, in 1745, a man with right hemiparesis and severe aphasia who, once cued by hearing someone else, could continue with the fluent singing of hymns. Now, John Brust parades a series of case studies highlighting individuals of superior musical ability who suffered brain lesions. Macdonald Critchley reported an aphasic with a parietotemporal glioma who could still conduct his ‘own orchestra’. The Russian composer Vissarion Shebalin wrote music deemed ‘up to standard’ despite having Wernicke’s aphasia and alexia with agraphia. Autopsy showed softening in the left hemisphere and Aleksandr Luria concluded that this provided evidence for different cortical systems and structures ‘subserving phonematic and musical (prosodic) organization of acoustic perception and memory’. A professional pianist with the same combination of aphasic language disorders could read a musical score correctly, write and compose, and perform in public.

The history of aphasia with amusia goes back to the 19th century and includes subtle dissociations, such as the patient who could play heard melodies on the violin but not the piano. A professional singer with absolute pitch suffered slight aphasia, alexia and agraphia but she could only recognize familiar melodies of songs if the lyrics were also available. A patient could not distinguish speech from music but needed only the title of a song to get started in full voice. Another correctly managed to reproduce notes when these were sung by someone else, but could not get them right on the accordion that he habitually played, even though he positioned his fingers on the stops and sensed but was unable to correct his errors. Dr Adrien Proust (père) reported an aphasic patient who could write but not read music, an amateur musician with conduction aphasia and agraphia whose musical disability manifested solely as inability to hum, and a completely aphasic musician who could neither speak nor write in script or hum but read and composed music. Jules Dejerine described a case of alexia...
with inability to read music but normal speech and musical expression. A music teacher described by Achille Souques could play only a single piece from her repertoire by memory, and in thirds not sixths or ninths, but she played a Clementini sonatina well from the score and transcribed music that she heard. Others had described amusia with loss of emotional appreciation of music but retained ability to perform. Maurice Ravel (reported by Théophile Alajouanine) was severely aphasic and agraphic and could not copy or perform, but still enjoyed listening and appreciated the aesthetic qualities of music. Another of Macdonald Critchley’s patients, an orchestral conductor and composer, with amusia and inability to play or write music but with ‘...the music in me’ improved after removal of a left parietal meningioma.

Amusia without aphasia [see page 2527] is less common. Most patients have right hemisphere lesions. Jean-Martin Charcot described a professional trombonist who spoke normally but could neither play nor copy music although he read and appreciated it ‘by singing mentally’. Others report specific impairments of rhythm, inability to understand music sung by male but not female vocalists, loss of high rather than low-pitched chords and misperception of sounds delivered to the left rather than the right ear. Brenda Milner showed the specific effects of right temporal lobectomy on timbre and tonal memory. The ‘Wada test’ has shown that sodium amytal injected into the right carotid artery impairs singing, and pitch more than rhythm, but with retained tonal sense; the ability to correct errors and recognize songs is impaired but without perturbations of the melody of language.

Neither of John Brust’s cases has an exact counterpart in the existing literature categorized as constituting amusia without amusia, amusia without aphasia, aphasia with amusia for reading and expression, and aphasia with amusia for expression but preserved musical reading and writing. Does either illuminate the question of how music is read? As with script, the musically literate assess ‘relations between notes rather than the notes themselves’. Musical annotation involves an heterogeneous group of symbols that includes ‘real words, often abbreviated (allegro, largo, DC, pp, f); notes whose pitch is designated by letters (A, B, C, etc.) but represented spatially, and whose duration is indicated by appearance (minim, crotchet, quaver, etc.); metre expressed as numerical fractions and dependent on the placement of bars; and purely musical symbols for pitch alteration and key signature (sharps, flats, naturals), pauses (rests), tonal prolongations (fermata), pitch calibration (clef), crescendo or decrescendo, staccato, legato and repeat. Both simultaneous and sequential events are indicated’.

But curiously, the components of music that seem closest to language are not the ones most disrupted in either of Dr Brust’s cases showing specific types of aphasia with amusia. And the rates at which Case 1 recovered particular functions do not suggest close linkage between speech- and language-based components of musical competence. The ability of Case 1 to learn and sing new material, and the failure of these skills in Case 2, might be understood in terms of their relative preservation of repetition and the ability of some aphasics to sing, with or without words, realizing the affective component of song just as emotional speech may liberate the otherwise impaired propositional utterances of the person with aphasia. Experimentally, baroque and classical melodies are better recognized by the left ear (and hence the right hemisphere) than the right, as are non-human voice sounds such as laughing, crying and coughing. Others have praised the left ear for its superior appreciation of tone recognition, timbre and chord recognition, whereas the right prefers rhythm and performs better when musical complexity is being handled. Thus, although the evidence for musical sophistication lateralizing to the left hemisphere is consistent with the pattern of disability displayed both by Cases 1 and 2—having more and less musical sophistication, respectively—for many commentators, the concept of lateralization for music is artificial: especially when sophisticated, both hemispheres are involved in the analysis of its symbols. Quoting Chomsky on language, ‘we can only leave open...how these abstract structures and processes are realized or accounted for in some concrete terms...not within the range of physical processes as presently understood—a conclusion that...should surprise no one’; and for John Brust, ‘the same can be said about music...the presence or absence of aphasia or of right or left hemispheric damage fails to predict the presence, type or severity of amusia, including musical alexia and agraphia...the popular notion that receptive amusia follows lesions of the language-dominant temporal lobe, whereas expressive amusia follows non-dominant frontal lobe damage, is an over-simplification, as is the view that increasing musical sophistication causes a shift of musical processing from the right hemisphere to the left—an interpretation that, as the octet of papers published in the present issue of Brain endorses, leaves any composition of how the brain makes and experiences music ‘unfinished’.

Alastair Compston
Cambridge