

Short report

A case of receptive amusia with prominent timbre perception defect

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SUMMARY A patient with a right temporal lesion is described who, in recognising sounds and noises, complained of deficits which seemed to be most evident when sounds and noises could be recognised mainly by timbre whereas no deficit was noticed when pitch and rhythm were the main indicators. In addition, some global distortions in musical appreciation were complained of and described as "resonance" or "loss of aesthetic pleasure".

One of the problems still largely unresolved in the field of the amusias is whether, and to what extent, specific syndromes exist that correspond to selective loss of basic components of musical ability or processing, such as rhythm, pitch, timbre, loudness. This problem is particularly interesting because it is related to a more general problem: whether there is a unitary mechanism of musical cognition, or, rather, a combination of abilities which are independent of each other.^{1,2} Timbre in particular remains largely uninvestigated: clinically and experimentally, only fragmentary findings are reported. Data suggesting a right temporal superiority for timbre perception have been obtained in lobectomised patients³ and in normal subjects by using choice reaction times.⁴ Also poorly understood are some global distortions of musical perception, called "paracousic" by some authors and described by patients as "disturbing resonance", "music out of tune", "music fuzzy and blurred", etc.⁵⁻⁷ A case is here reported which draws attention to these questions.

Case report

BP, 58-year-old male with 8-year school education suffered a transient ischaemic attack with minimal sensory-

motor impairment on the left side. Later he complained of difficulty in identifying sounds and noises and in "grasping music as I used to". Examination revealed no motor or sensory abnormality. CT scan (fig) one month later showed dilatation of the right sylvian fissure, the temporal lobe, being smaller than the left. EEG showed right temporal theta waves. Tonal audiometry revealed slight bilateral high frequency hearing loss with normal recruitment. The patient was treated with 900 mg aspirin daily.

Neuropsychological examination was carried out at 40

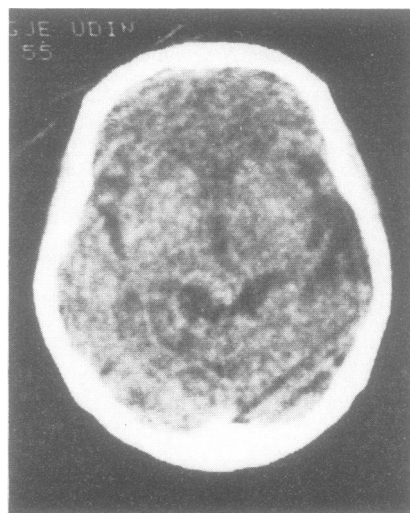


Fig CT scan: shows dilatation of the right sylvian fissure; the temporal lobe is smaller than the left post-ischaemic due to necrosis of the right temporal cortical region.

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days from the onset. The patient was right handed, right footed and right eyed; full scale IQ (WBIS) was 123 (Verbal IQ = 114; Performance IQ = 127); there was no evidence of mental deterioration or of memory impairment in both verbal and non-verbal tests. In the verbal dichotic listening test (digit 3 + 3; words 2 + 2 up to a total of 64 + 64 stimuli) the score was "59" for the right ear and "36" for the left ear; in the tonal dichotic listening test (24 + 24 sequences of 5 semitones) the score was "21" for the right ear and "3" for the left ear.

Recognition of non-musical sounds BP was unable to distinguish between noises of the engines of various vehicles, such as motor-cycles, cars and lorries, or to distinguish between the voices of his relatives and those of famous people he knew well. His own voice did not sound familiar to him; when recorded among other voices, he could not recognise it. He was unable to ignore surrounding noises, which greatly disturbed him.

Recognition of (a) *ambient noises*: water running from a tap, train, type-writer, doorbell, wind, gunshot, rolling tins, bell, car start, ambulance siren. Of these BP recognised seven out of 10, but he said he could only do so from their rhythm (train, type-writer, etc.) or from their pitch (siren); (b) *animal sounds*: cock, dog, cow, horse, hens, cat, birds. BP recognised five out of seven, but only after hearing them at least twice; (c) *human noises*: coughing, laughing, yawning, baby's crying, sneezing, snoring. BP recognised six out of six, and could also tell if it was a woman or a man; (d) *human voices*: again BP could tell whether it was a man, a woman or a child, but was unable to distinguish between his relatives' voices or those of famous actors and well-known politicians which he could have easily recognised previously. He could not distinguish between the various intonations in which the same phrase was uttered by the examiner.*

Recognition of musical sounds BP previously was between the 4th and the 5th group according to Grison⁸ and between the 1st and 2nd group according to Botez and Wertheim.⁹ He had been quite fond of music and could play the guitar; his ability to read music was poor as were his notions of musical theory; he had sung for many years in a folk choir.

Symptoms complained of were (a) "distortions" that made the melodies sound "low and dull", although he was able to recognise them; (b) "resonance" or a sort of echo with overlapping of sounds; (c) "loss of pleasure" or "loss of aesthetic appreciation" in listening to music: the patient claimed it was difficult for him to express verbally this loss of "aesthetic pleasure", but, in any case, this feeling was distinct from acoustic distortions and just perceived as "aesthetic".

Recognition of (a) *musical instruments*: BP recognised the guitar, the trumpet and the drum (the last named "by

its rolling"). He had trouble in identifying the violin (after listening to it twice, he said "that's violin, I guess; I can tell though only from the bow screeching on the strings and by way of exclusion; first I thought it was a flute or a clarinet"), the piano (he recognised it after listening to it twice), the piano playing low on the keyboard ("it sounds like a thunderstorm"), the organ ("it's a combination of sounds . . . an orchestra . . . is it perhaps an organ?"), the flute (after having listened to it three times ". . . could be a flute, given its velvety whistle"), the bass ("it is a cello"); (b) *Pitch*: BP had preserved his ability to recognise the relative pitch of notes; the similarity or the difference between two notes, the major, the minor and its inversion; whether a scale was "ascending" or "descending"; the melodic intervals of one tone and half a tone; (c) *Tunes*: playing on the piano five well-known tunes in a simple way made it possible for the patient to recognise them; the addition of the major third irritated him, but he could still recognise them; he could identify intentional errors; (d) *rhythm*: BP easily recognised the "presto", the "adagio" and the variations in tempo of the same tune, the various rhythms in symphony, jazz, march, and hymn; the "maestoso", the "allegro" and so forth. He recognised complex melodies heard on a record-player, but he said that "they sound better if subdued" and if the instruments that were playing simultaneously were few, otherwise he experienced "confusion, discomfort".

Singing test BP could sing five well-known songs mentioned by the examiner, even though he said that his voice sounded to him "dull, not rich enough"; he reproduced five songs hummed by the examiner; he could sing along with the examiner the same tune, even in the major third.

Musical performance BP found it difficult to tune the guitar, which was more easily done by having the strings vibrate very little. He could play the guitar as before and any note or chord he had been asked to; he could learn new songs. **Score reading** BP's ability to read the relatively plain scores he knew was unchanged.

Differences in perception between the right and the left ear A melody was presented monaurally to the right and the left ear: BP reported that it sounded to him "not normal" and that the sound was coming out as if it were "coupled with a sort of echo, kind of a resonance, as if the previous sound and that which followed overlapped"; this phenomenon was more marked at the left ear.

Tonal pairs perception test This was intended to determine whether any continuous tonal perception impairment was present over a part or the whole of the frequency band (65 to 4186 Hz) commonly used on a piano keyboard. BP's ability to appreciate the differences between two successive pure tones was assessed and compared with that of a group of nine normal subjects, whose average age and cultural level matched the patient's. Both the nine controls and the patient had to report on whether the second tone was lower than, equal to, or higher than the first. The percentage of errors did not differ on the whole band of the frequencies presented (Kolmogorov-Smirnov test: $D = 0.32$; $p = ns$).

*All the stimuli had been recorded for use as ambient noises during radio broadcasts.

Discussion

It is not easy to set the deficits in recognising sounds and noises in a coherent context, but a unitary interpretation can be attempted if a selective deficit of timbre perception is assumed. The patient showed difficulty in distinguishing musical instruments which can be most easily identified by timbre (flute, bass, violin) or noises belonging to the same "timbre category" (vehicles), especially when they are characterised by very high pitch (cat, bird, violin, flute) or low pitch (piano playing low, gunshots). This agrees with the fact that in these conditions there is greater difficulty in perceiving timbre. The same difficulties were experienced in recognising familiar voices and intonations. On the other hand, the patient recognised tunes (including test of frequencies), pitch, and loudness. He had already noticed himself the need to focus his attention, in a conscious effort, on rhythm or loudness, in order to recognise noises or sounds, and conversely he had noticed difficulties in recognising noises that are not easily distinguishable by rhythm (running water, rolling pins), or musical instruments of different timbre. In short, he seemed to show a better discriminative ability when indicators other than timbre predominated, and less ability when timbre was the main indicator. Not all details fit perfectly in this framework and we do not imply that timbre processing exists as a distinct function, which can be lost separately, but we simply call attention to timbre perception as a semeiological aspect which should be investigated in any amusic syndrome and could typify some of them. In addition, the patient complained of some distortions of musical perception, or "paracusias", that he perceived as "resonance", "interfering surrounding noises", "loss of aesthetic pleasure". The potential interest of these symptoms for understanding musical perceptual mechanisms is obvious, but an objective study would be arduous and only a few hypotheses may be advanced so far. "Resonance" could be in some way correlated to timbre loss (in acoustics, resonance is regarded as a typical cause of timbre distortion). Hood¹⁰ reports a similar distortion in cases of deafness due to Ménière's disease; however, since our patient showed no audiometric deficits, no comparison can be made. The difficulty in ignoring surrounding noises could be interpreted in terms of an "efferent control theory" in which auditory activity is gated at some peripheral level so that non significant inputs are prevented from entering the afferent pathways.¹¹ The "loss of aesthetic pleasure" is certainly the most intriguing of these disturbances, even if it could hardly be called "paracusic" in this respect. It was described by the patient as a true

"aesthetic" loss and not as a simple result of elementary distortions of sounds. This disturbance could be regarded as one which expresses the very essence of amusia *sensu strictiori*, or rather, as one that suggests a two-level view of amusia, the first level involving aesthetic appreciation, and the second the identification of melodies, musical passages and basic musical components. Any hypothesis, however, is greatly limited in its validity by the highly subjective nature of the symptoms concerned. As to clinical pathological correlations, the lesion in this case was in the right hemisphere, suggesting that the right hemisphere prevails in selective appreciation of timbre. This hypothesis is in agreement with Milner,³ who found a significant increase in error scores for timbre only after right temporal lobectomy, and of Kallman and Corballis,⁴ who found a left ear superiority in timbre perception using a reaction time test.

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