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Quick guide

Congenital Amusia

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What is it?

Congenital amusia, also called developmental amusia or dysmusia, is a lifelong disorder characterized by a difficulty in perceiving, or making sense of, music. People with amusia fail to recognize familiar tunes, cannot tell one tune from another (unless the tunes have lyrics) and often complain that music sounds like noise.

Is it the same as tone- deafness?

People typically use the term 'tone- deafness' as a label for people who cannot sing in tune, but while many people claim to be tone- deaf in this sense (15% of the population), only about 4% of the population are estimated to have perceptual difficulties with musical listening (Kalmus and Fry, 1980).

Do I have it?

To find out, take an online musical listening test at www.delosis.com/listening/ home.html. As a guide, a score below 22 would be in the amusic range, though the cut-off varies with age (see http://www.brams. umontreal.ca/peretz/).

Why haven't I heard of it before?

The first report of amusia was published more than a century ago (Grant-Allen, 1878) but it is only within the last five years that case studies have been anything other than anecdotal. It is now possible to systematically assess different aspects of people's musical listening ability. The Montreal Battery for the Evaluation of Amusia (MBEA; Peretz, 2003) consists of seven subtests, each comprising a pair of musical phrases which are either exactly the same or slightly different. The nature of the deviation is systematically different in each subtest: scale, contour, interval or rhythm.

Is it a pitch problem?

While most normal listeners can judge the direction of a pitch change with intervals smaller than a semitone, people with amusia often require the change to be much greater, for example, close to the distance between the first two notes of Somewhere over the Rainbow (Peretz et al., 2002; Foxton et al., 2004). Given that most pieces of Western music move in steps of a semitone, it is not surprising that, for amusics, all the songs tend to sound the same. However, Foxton et al. (2004) found that increasing a pitch change so that it exceeds an amusic's pitch threshold does not overcome the problem when the task is to spot the difference between two musical phrases, showing that there is no simple relationship between the ability to hear a pitch change between two notes and the ability to hear a change in the context of a whole phrase.

It seems likely that the ability to integrate a sequence of pitch changes into a coherent whole and form a representation of it in short-term memory requires an intact ability to perceive differences between individual notes.

Is the problem specific to music?

So far, the evidence would suggest so. People with amusia have normal intellectual functioning — Milton Friedman and Che Guevara are both thought to have been afflicted — and do not appear to have had any difficulty in understanding speech, including the melody of speech. However, some researchers feel that the preserved ability to perceive intonation in language is more apparent than real.

In languages such as English, pitch changes are often several semitones, commonly co-occur with changes in stress and timing, and are used to convey emphasis, emotion or a questioning style, rather than semantic meaning. For all these reasons, subtle problems in hearing pitch differences are unlikely to be a limiting factor for comprehension. It will be important to investigate whether amusics who speak a tonal language are sensitive to pitch change in a linguistic context, as changes in a language such as Mandarin are subtle and can profoundly alter semantic meaning.

Can people with amusia hear rhythm?

The MBEA includes a test of rhythmic perception and those with amusia often score in the normal range, although this aspect of the disorder seems variable (Che Guevara was notoriously useless on the dance floor, as depicted in the film The Motorcycle Diaries). Auditory psychophysics shows that, even though a group of people with amusia failed to spot subtle deviations in pitch from a monotone standard, they were able to spot deviations in time (Hyde and Peretz, 2003). However, the story is not so simple: another group of amusics performed poorly when deviations from isochrony were presented in the context of a changing pitch (Foxton et al., 2006), suggesting that pitch processing problems can limit the development of rhythmic and timing abilities.

Do people with amusia enjoy listening to music?

Some people with amusia describe music as sounding like a noise or like banging, and go to great lengths to avoid being in situations where music will be played, while others, who are just as perceptually impaired, derive considerable pleasure from listening to music.

Music contains a myriad of sound elements and those who appreciate music may be getting pleasure from the tone colours used and/or the combination of instruments and rhythms that they hear. The reasons for such individual differences in musical appreciation are far from clear but such dissociations between perception and emotional appreciation are also seen in neuropsychological patients.

Does the condition run in families?

A study by Denis Drayna (2001) using the ‘distorted tunes test’ (similar to the scale subtest of the Montreal Battery for the Evaluation of Amusia) with a group of identical and non- identical twin pairs, found that musical listening ability is about 80% heritable. Whether or not this level of heritability extends to amusia depends on whether amusia is found to occupy the tail end of the musical listening ability spectrum or to be a categorically distinct phenomenon. However, familial cases of amusia are common and pedigree analyses have suggested a pattern of autosomal dominant inheritance with imperfect penetrance (Kalmus and Fry, 1980). Genetic linkage studies of amusia are currently in progress.

Do these people have normal brains?

People with amusia do not have a history of neurological damage and structural brain imaging using magnetic resonance imaging (MRI) does not reveal any gross anatomical differences. However, the technique of voxel-based morphometry allows structural MRI data from two groups, for example amusics versus non- amusics, to be interrogated with respect to potential regional differences in grey and white matter volume.

A recent study (Hyde et al., 2006) using this approach revealed differences in white matter between amusics and control participants in the right frontal cortex, suggesting that abnormalities occur in areas outside of the auditory cortices. The involvement of right frontal cortex in musical perception is not unprecedented: an fMRI study revealed a similar area to be involved in the musical listening behaviour of non-amusic individuals when musical pitch has to be retained in memory (Zatorre et al., 1994).

What can amusia contribute to our understanding of the brain?

An understanding of amusia has implications that extend well beyond our conception of normal and disordered musical processing. It provides a model that can be used to ask how potential changes at the genetic level impact upon brain structure function and, ultimately, behaviour. If amusia can be thought of as a disorder of connectivity, one might hypothesize that those genes which encode fibre tracking proteins will be found to be atypical. Though speculative at present, any such finding could shed light on a number of other developmental disorders. Though different development disorders are very different at the behavioural level, it remains possible that they are underpinned by a similar genetic mechanism operating at a different locus and/or at a different points during the developmental trajectory.

Where can I find out more?

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