

Thanks to new research, we are much closer to understanding why some people suffer from tone-deafness, or amusia. **Lauren Stewart** reports

PitchFever

Up to 14 per cent of us claim to suffer from the musical affliction that is tone-deafness. But it's not that we can't hear or appreciate music; the current iPod generation is addicted to it. All we usually mean is that we're shy about stepping up to the karaoke microphone. Despite popular misconceptions, tone-deafness has nothing to do with singing. It refers to people who can't perceive music – a condition that is known as 'amusia' in scientific circles. Although amusic individuals

unwittingly danced a slow, passionate tango while everyone else jiggled to a lively Brazilian dance. Although the anecdote evokes a comical image, the issue can be a serious one. While most people listen to music as a source of pleasure and frequently choose to share the experience with friends, amusic individuals often hear it as noise. Rachmaninov's second piano concerto, voted Britain's favourite piece of classical music for the last five years, can send shivers down the spine of some listeners. But one amusic described it as 'banging' that would be best avoided. Unfortunately, this

come forward to participate in psychological research. By studying what these individuals can and cannot perceive, researchers are starting to understand the nature of the condition. Isabelle Peretz at the University of Montreal has pioneered investigations into amusia. Through newspaper advertisements she has appealed for people who report difficulty in recognizing well-known tunes and who have been told by friends or family that they sing out of tune. After checking that hearing problems cannot account for their difficulties, she measures their musical perception with tests that probe their understanding of melody and rhythm.

Unlike the many individuals who claim to be tone-deaf but really aren't, she has found that many self-reporting amusics are profoundly impaired in their ability to make sense of music. In a typical test, two short melodies are played. They may be the same or they may differ at a single point. If the difference is a change in pitch, amusics are unlikely to spot it, even when it is glaringly obvious, causing the tune to go out of key. Comics like Les Dawson may have built a comedy career out of such musical blunders, but amusics just don't get the joke.

PITCHING HITCHES

If you can't hear pitch changes in music, you'll certainly be deprived of the tonal nuances that the composers intended you to hear. But pitch changes are also crucial for ▶

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sing out of tune, the reason for this is because they cannot hear themselves accurately so can't take steps to fix the situation. They don't recognise tunes that would be very familiar to the rest of us, and can only tell two songs apart by listening to the words. American president Ulysses S Grant once commented: 'I know only two tunes: one of them is *Yankee Doodle Dandy*, and the other isn't.'

Although the disorder is no barrier to political or academic success, there are social consequences of being unable to appreciate or participate in music. Amusic revolutionary Che Guevara was unable to distinguish between musical styles. At a party, he once

is rarely an option. Unless amusic people are willing to exclude themselves from the many social situations in which music plays a central role, they must endure whatever life's jukebox throws at them. One amusic recalls: '[It was] a nightmare to be asked to go to a friend's house to listen to music. Parties, dinner dances, work dos, I really, really dreaded the occasion.' Another amusic even admitted that she plays CDs when her friends come round for dinner, not because she enjoys listening to the music, but because she fears it is a social taboo to entertain without it.

The disorder has now become a topic of scientific interest, and many amusics have

A D A F D A E G

frequency

(IN THE KEY OF F.)

Voice.

f

PHRASING

dim.

pitch

Melodies

Piano.

2

ANALYSES

range

the dominant, and subdominant keys.

Minuet in E.

Ear Exercises

Air Variations.....

notes

keys.

Melodies

notes

D^b E^b F OR G.

compositions



conveying emphasis and meaning in speech. For instance, in both the English and French languages, a sentence may be interpreted as a statement or a question, depending on whether the last syllable goes up ('He speaks French?') or down ('He speaks French.'). Isabelle Peretz investigated whether the amusics were able to hear this difference by playing them pairs of sentences that were either identical or differed in the inflection of the final syllable. The amusics were able to indicate when pairs of sentences were different and could tell a question from a statement.

The finding that pitch changes are noticeable in speech but not in music might seem puzzling, but research carried out by Jessica Foxton at the University of Newcastle suggests why this might be so. She set out

perception required to decipher meaning in tonal languages is very demanding. In the same way that dyslexia is more evident in England than in Italy, owing to the non-transparent writing system, the effects of amusia on speech perception may be more evident in China than in England, owing to the different conventions of spoken language.

Even if amusia does manifest differently across different cultures, the common underlying deficit is likely to be genetic in origin. Amusics report that close family members share their musical difficulties and a study by Denis Drayna at the National Institute of Health in America shows that pitch perception in the general population has a strong hereditary component. He measured the performance of identical and

characterizing the deficits and residual capacities of amusics, to exploring their brain function and investigating how differences could be explained by genetic makeup.

Amusic individuals are contributing to our understanding of how the brain perceives, appreciates and performs music. While a musical awakening for them is not on the immediate horizon, learning more about what they can and can't perceive may help them to gain access to a musical world. In the same way that deaf people learn to enjoy music via its vibrations, amusic people may be able to choose their listening material according to their residual listening capacities. Many amusics can perceive rhythm and most can dance. While the 'banging' of Rachmaninov's piano concerto might not make it onto their iPods, perhaps the rhythms of *Carmina Burana* could set their feet tapping. ■

Research into amusia continues. If you fulfil the following criteria and would like to help, please email: icn-amusia@ucl.ac.uk.

■ *You know someone who cannot recognise familiar tunes*

■ *You sing out of tune, but don't think you do*

■ *You have no neurological condition or hearing impairment.*

The effects of amusia on speech perception may be more evident in China, owing to different language conventions

to find the limits of pitch perception in a group of self-reporting amusics, asking them to distinguish between pairs of tones that differed in pitch. She made the task gradually harder by reducing the interval between the tones until a difference could no longer be heard. The interval at which people started to fail was much larger for amusics than for non-amusics of a similar age and musical background. The amusics needed the tones to be at least one semitone apart before they could hear a difference. Some could only tell two tones apart when the difference was as large as ten semitones. The non-amusics performed well when the pitch difference was smaller than a semitone, and in some cases, around a tenth of a semitone.

TONAL HONING

Clearly, successful perception of pitch doesn't depend upon the nature of the material but rather the size of the pitch change. The inflection at the end of a question can be as large as 12 semitones while melodies from western cultures typically move in steps of one or two. While the melody of language is clearly within their range, the melody of music is lost on them. One interesting avenue for future research will be to investigate whether amusic individuals from tonal language cultures have difficulty in deciphering spoken language. In Mandarin, for example, word meaning is radically altered by the pattern of changes in pitch. The word 'ma' can mean 'mother', 'scold', 'horse' or 'hemp', depending on intonation. The pitch

non-identical twins on a test that required them to spot an out-of-key note within a tune. By comparing the similarity in scores between identical twin pairs, who share all their genetic material and non-identical twin pairs, who share only half, he calculated that 70 to 80 per cent of the variance was genetically determined. Drayna's demonstration that there is a range of pitch perception ability in the normal population suggests the possibility that, with pitch perception, amusics may have been dealt a poor genetic hand.

Currently, we do not precisely know how pitch perception ability is coded in the genes, or in what way the genetic instructions carried by amusics and non-amusics might differ. But genes carry the instructions for the development of the brain, making it an obvious place to look for evidence of a biological marker of amusia. Using brain scanning methods such as magnetic resonance imaging, we can ask whether the brains of amusic people are different to those of non-amusics. There are several ways in which their brains could differ. The neurons in those areas of the brain that make sense of sound may be less numerous, or they may show different patterns of connections with other areas of the brain. Alternatively, the neurons in these regions may be similar in number and in their pattern of connections, but they may respond to incoming sound in an atypical way. Current efforts to distinguish between these possibilities are being made through the concerted effort of researchers working at all levels of the disorder: from

AMUSIA – THE FACTS

Why music is nothing more than Greek to some people

SOME PEOPLE CAN'T make sense of music, despite normal hearing they have trouble noting changes in pitch. They can hear intonation patterns in speech and tell the difference between a



statement and a question, but only because the pitch changes are large. They rarely listen to music, finding it annoying, and although they can't sing, they don't realize this unless they are told. Amusia is no barrier to intellectual development: Che Guevara (above) was afflicted, as was American president Theodore Roosevelt. Amusia should not be confused with what most people refer to as 'tone deafness' – a perceived lack of singing ability without associated problems in hearing or appreciating music. While tone deafness often stems from a negative experience with music making, the perceptual disorder of amusia may have a genetic origin, resulting in subtle differences in brain development and difficulties in perceiving the changes in pitch required to make sense of music.