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General

Through to the next round

Someone whistles in the distance, and without having to think about it, you know the tone you just heard is F sharp. It is as obvious to you as the fact that the surface of your desk is white.

Less than one in 10 000 people have the ability to recognise a tone without reference to other tones. But what exactly is perfect pitch (also called absolute pitch)?

Not relative pitch

Perfect pitch should be distinguished from relative pitch. Most people with some musical training have relative pitch ability – that is, that when given a point of reference, say a middle C, they use that point of reference to recognise other notes.

This is done by means of intervals, or in common language, using their 'do re me' – if you know that 'do' is C, 'me' will be E, and so on.

Without a reference tone though, people with only relative pitch ability will have no way to recognise a specific tone.

Can you learn perfect pitch?

Professor Diana Deutsch, of the University of California, San Diego, is sceptical of the notion that perfect pitch can be learnt after a certain critical period in early childhood.

Many courses and programmes that claim to help you develop perfect pitch are in fact based on the relative pitch ability. In these cases, a single tone is memorised, and other tones are deduced from that reference tone using intervals.

"Musicians do sometimes acquire absolute pitch for a single note - such as concert A on the violin, and can then use relative pitch to determine the names of other notes. But this takes time, and tends not to work well," Deutsch says.

The key thing is that real perfect pitch involves instantaneous recognition, and does not require any point of reference nor does real perfect pitch require any calculating of intervals.

Thus, the 'perfect pitch' that you will learn on various courses and programmes advertised on the internet is not likely to be anything like real perfect pitch.

Why only some people have it

How some people come to have perfect pitch is unclear. Yet, there are strong suggestions that the first few years of life play a critical role

"It looks as though, for children to acquire absolute pitch, they should have begun musical training - or have had informal exposure to musical notes and their names, say in a family environment - by age seven, and the earlier the better," Deutsch said.

"This relates to the literature on critical periods for language acquisition, which indicates that children who, for some very unusual reason, didn't have the opportunity to acquire language at a very early age, don't later on acquire it properly - the window of opportunity closes pretty tightly. I believe that the same thing happens with absolute pitch," she said.

Depends on language?

In a study published in the US journal *Acoustics Today*, Deutsch found that Chinese music students were significantly more likely to have perfect pitch than American music students. The key is thought

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to be that the Chinese students grow up speaking a tonal language (Mandarin). In tonal languages, the same sound spoken at different tones has different meanings.

Thus, it is thought that the fact that young Chinese children have to distinguish tones as a part of their language learning may help them develop the neurological tools they will later need for perfect pitch.

As Deutsch puts it, the findings support the conjecture that, 'if given the opportunity, infants can acquire absolute pitch as a feature of speech, which can then carry over to music'.

She also points out that "it may alternatively be hypothesised that the differences between the two groups found here are due to dissimilarities in brain structure, which might be genetically determined. Indeed, both critical period and genetic factors might be involved."

Is it in the genes?

In a study published in the US journal *Proceedings of the National Academy of Sciences*, researchers hypothesise that a single gene may hold the key to developing perfect pitch.

They base this notion on the fact that perfect pitch seems to be an all-or-nothing affair – something that they take to mean that the gene is either present or not.

No specific gene has, however, been identified, and it is hoped that gene mapping studies may in future yield more clarity.

Nature vs nurture

'Our hope is that once we have a gene or genes in hand, we will be able to more carefully dissect the nature vs nurture question,' says Jane Gitschier, professor of medicine and paediatrics at the University of California, San Francisco, who led the study.

Gitschier went on to say that 'it appears, from the work of Jenny Saffron at the University of Wisconsin, that all babies may be born with absolute pitch (AP) but then rapidly replace it with relative pitch recognition. It could be that in people with AP, that window of using AP could be extended, for a genetic reason, such that when the children have music training the AP is able to "stick".'

On the nature vs nurture question, Deutsch says she will not be surprised if a genetic link eventually shows up, but she points out that 'at present the evidence simply isn't there'.

'What has been shown is that absolute pitch runs in families - but that's also consistent with a critical period explanation - infants born into musical families in which pitches are frequently associated with their names would have the opportunity to acquire absolute pitch early in life,' she says.

The actual difference

Another interesting part of the puzzle, and probably the closest thing to evidence of a genetic link, involves the finding that people with perfect pitch tend to exhibit an unusual brain asymmetry.

'Anatomically it has been reported that there are differences in the degree of asymmetry between the left and right hemispheres in regions that deal with sound processing and analysis. The asymmetry seems to be more exaggerated in those with AP than in the average population,' says Dr Robert Zatorre, of the department of neuropsychology at McGill University in Montreal.

'Problem is, nobody really understands yet what exactly this means. But it is a "marker", indicating that there is some differential brain organisation there,' he said.

Apart from anatomical differences, researchers have also identified differences in brain function.

'When you measure a certain electrical brain wave, usually elicited by sounds, it is absent in people with AP. This suggests that people with AP don't index sounds in the same way as everyone else, presumably because they don't need to "update" what they're hearing every time a new sound arrives. They already know what each pitch is, so no need to update. At least, that's the theory,' says Zatorre.

'Also, we know that a certain part of the frontal cortex is active in AP people when they hear tones. This area of frontal cortex is thought to subserve associations in memory. So it makes sense that AP people would show this, since every time they hear a tone it evokes an association ("that's an F#").'

More prevalent in blind people?

One study has suggested that the incidence of perfect pitch is higher among blind people. Though the findings need to be duplicated, Zatorre feels that the association is probably real.

'It means that under some circumstances, even people who have no genetic predisposition to developing AP can learn it, assuming they are exposed to music early,' he said. But blindness is an extreme situation. Most people who are trained musically do not develop AP, no matter how intensive the training. So there may well be a genetic aspect, especially given that there is a very high rate of familial association (higher even than schizophrenia).

'But nobody has proven this yet. In any case, it's absolutely clear that nobody develops AP-genetics or not-without early exposure to music,' he concluded.

Mystery still unsolved

On the whole, it seems that perfect pitch is still rather poorly understood. There is strong evidence of a critical period during childhood development, the importance of musical training, and some suggestions of a genetic link, but many uncertainties remain.

Tonal language speakers and people who grow up in musical families certainly do seem to have a better chance of having this strange gift. Beyond that though, who will have it, and who not, is anybody's guess.

'The thing that I think is so fascinating about AP,' says Gitschier, 'is how uncanny it seems to us who don't have it. Yet, it really is like identifying colours, something we all take for granted. A bigger question could be why most of us don't have it.' – (Marcus Low, Health24, October 2007)

The fascinating Acoustics Today article is available [here](#).

Sources:

Deutsch, D. The enigma of absolute pitch. *Acoustics Today*, 2006, 2, 11-19.
Reuters article on the genetics study published in the *Proceedings of the National Academy of Sciences*. ([Read it here](#).)

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