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Why Henry Higgins could tell his barrow girl from his fair lady

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When Professor Henry Higgins instructed Eliza Doolittle that it was "Ay not I, O not Ow, Don't say 'Rine,' say 'Rain'", he was drawing on years of experience as a professor of phonetics. But research funded by the Wellcome Trust and the European Commission suggests that Higgins's ability to differentiate expertly between similar sounds may have stemmed from birth.

Neuroscientists at UCL (University College London) have shown that the brain structure of expert phoneticians differ from those of the general public. However, whilst some of these changes can be explained by the brain's 'plasticity' – the ability of experience and training to change the brain's shape – the researchers believe that some of the differences are likely to have been present since birth.

"We know that experts, for example professional golfers or London taxi drivers, have different brain structures or patterns of brain activity from ordinary members of the public," says Professor Narly Golestani, now based at the University of Geneva, Switzerland. "It's often hard to tell whether these differences have been shaped entirely by experience or whether a person's brain structure may influence the profession that they enter."

Professor Golestani and colleagues, whose work includes understanding how the brain recognises and processes sound, investigated brain structure in expert phoneticians – individuals who are specialised in the study of phonetics and need to able to distinguish accurately between

very similar speech sounds and subtle regional accents. Unlike other expertise, such as musical ability, phoneticians gain their experience and training in adulthood, allowing the researchers to test the effects on brain structure of extensive and naturalistic training in adults.

Using magnetic resonance imaging (MRI), the researchers compared the brain structures of seventeen phoneticians against sixteen healthy control volunteers and showed clear differences in the structure of key areas of the brain. Their results are published in the Journal of Neuroscience.

Professor Sophie Scott, a Wellcome Trust Senior Research Fellow explains: "We found a brain area which correlates in size with numbers of years of analysing the sounds of speech. Interestingly, we also find that the shape of the left auditory cortex – something which is established in the womb – also differs between expert phoneticians and lay controls, but doesn't correlate with years of practice.

"This finding may suggests a predisposition in some people to be interested in sound, and may help them decide to choose this kind of career. Perhaps this is why Henry Higgins became a professor of phonetics rather than, say, a professor of physics."

The researchers found that an area of the brain known as the left pars opercularis – part of the Broca's area, a region of the brain involved in speech production but also in analysing and separating speech sounds – correlated with the amount of training in transcription that a phonetician had undergone. Phonetic transcription involves accurately identifying phonetic sounds and associating them to phonetic symbols.

They also found that the shape of an area known as the left transverse gyrus, which includes the left primary auditory cortex, differed in phoneticians compared to the lay public, but that its shape and size did not correlate with the amount of training a phonetician had undergone.

The left transverse gyrus in phoneticians tended to include a greater number of folds – and hence surface area – which in turn allows for a greater capacity for establishing new and more complex patterns of brain connectivity. The folding of this brain region is thought to be established before birth, starting during the thirty-first week of gestation; there is no evidence that it can develop further folds during adulthood.

Dr John Williams, Head of Neuroscience & Mental Health at the Wellcome Trust, says: "This intriguing study provides an insight into how language is processed in the brain and why some people may have more of a penchant towards languages. It goes beyond being a merely curious finding to one which may in time help us understand also why some people have phonological difficulties, such as people with developmental dyslexia."

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