# How musical training affects speech processing

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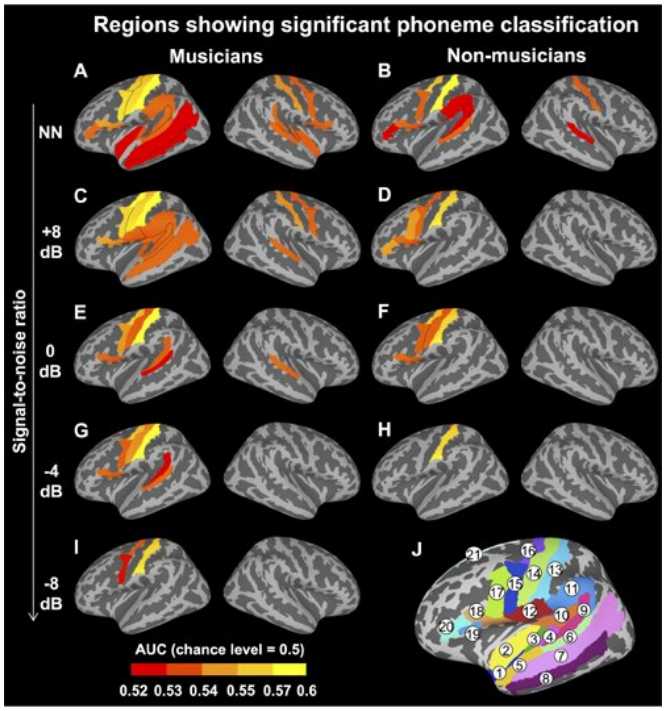



(A-I) Brain regions showing significant classification of phoneme-elicited neural responses at each SNR in musicians (left panels) and non-musicians (right panels). (J) Speech-relevant anatomical regions used in multivoxel pattern analysis. Credit: DU Yi

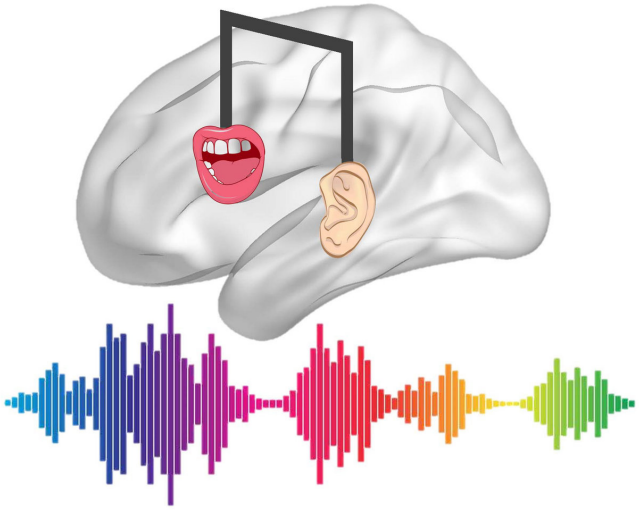
Musical training is associated with various cognitive improvements and pervasive plasticity in human brains. Among its merits, musical training is thought to enhance the cognitive and neurobiological foundation of speech processing, particularly in challenging listening environments such as noisy restaurants. However, the brain mechanisms supporting any such potential advantages related to speech perception are not well specified.

A brain imaging study by Dr. DU Yi from the Institute of Psychology of the Chinese Academy of Sciences and her collaborator Dr. Zatorre Robert from the Montréal Neurological Institute and McGill University has revealed that musical training might improve speech perception in noisy environments via enhanced neural foundation in bottom-up auditory encoding, top-down speech motor prediction, and cross-modal auditory-motor integration.

This study, titled "Musical training sharpens and bonds ears and tongue to hear speech better," has just been published online in *PNAS*.

The study analyzed brain activity measured by functional magnetic resonance imaging (fMRI) of 15 musicians and 15 non-musicians, all on average 21 to 22 years of age, as they identified speech syllables against changing levels of background noise.

The musicians had started their musical education before age seven and accumulated at least 10 years of musical training. They had practiced consistently (?3 times per week) over the past three years. The two groups showed no difference in their hearing level, education, auditory working memory or non-verbal IQ.



Musical training strengthens cross-modal auditory-motor integration during speech in noise perception. Credit: *PNAS*

While the two groups performed equally under a no-noise condition, the musicians outperformed non-musicians at all other signal-to-noise ratios (SNRs). This ability was associated with enhanced activation of the left inferior frontal and right auditory regions in the musicians' brains.

Additional analysis revealed that neural patterns related to phonemes, which compose syllables, were more distinct in the bilateral auditory regions and speech production-related frontal motor regions of the musicians' brains, as compared with non-musicians.

Moreover, musical training strengthened the functional connectivity of the auditory-motor network, which scaled with better behavioral performance.

The finding that musical training sharpens and bonds ears (the auditory system) and lips/tongue (the speech motor system) so that individuals can hear speech better is important.

It not only deepens our understandings of the neural mechanisms underlying musical training-related plasticity in processing speech, but also suggests great potential for musical training programs in alleviating speech perception difficulties commonly observed in aging populations and related to hearing disorders.

**More information:** Yi Du et al, Musical training sharpens and bonds ears and tongue to hear speech better, *Proceedings of the National Academy of Sciences* (2017). DOI: 10.1073/pnas.1712223114

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