Musical training, speech processing, and neural plasticity: what are the principles?

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There are growing indications that musical training (e.g., learning to play a musical instrument) enhances the auditory processing of speech. While these findings have potentially important implications, there is a need for experimental (vs. correlational) studies, and for specific hypotheses about how and why such effects would occur. In this lecture I present the “OPERA” hypothesis, which proposes that such effects occur when five essential conditions are met. These are: (1) Overlap: there is anatomical overlap in the brain networks that process an acoustic feature used in both music and speech (e.g., waveform periodicity, amplitude envelope), (2) Precision: music places higher demands on these shared networks than does speech, in terms of the precision of processing, (3) Emotion: the musical activities that engage this network elicit strong positive emotion, (4) Repetition: the musical activities that engage this network are frequently repeated, and (5) Attention: the musical activities that engage this network are associated with focused attention. According to the OPERA hypothesis, when these conditions are met neural plasticity drives the networks in question to function with higher precision than needed for ordinary speech communication. Yet since speech shares these networks with music, speech processing benefits.