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Distinct mechanisms of perceptual reactivation: An fMRI study using mental imagery of speech

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Sensory cortices can be activated without any external stimuli. Yet, it is still unclear how this perceptual reactivation occurs, and which neural structures mediate this reconstruction process. In this study, we employed fMRI with mental imagery paradigms to investigate the neural networks involved in perceptual reactivation. Participants performed two speech imagery tasks: Articulation Imagery (AI) and Hearing Imagery (HI). We found that AI induced greater activity in frontal-parietal sensorimotor systems, including sensorimotor cortex, subcentral (BA 43), middle frontal cortex (BA 46) and Parietal Operculum (PO), whereas HI showed stronger activation in regions that have been implicated in memory retrieval: Middle frontal (BA 8), inferior parietal cortex and intraparietal sulcus. Moreover, posterior Superior Temporal Sulcus (pSTS) and anterior Superior Temporal Gyrus (aSTG) was activated more in AI compared with HI, suggesting that covert motor processes induced stronger perceptual reactivation in the auditory cortices. These results suggest that motor-to-perceptual transformation and memory retrieval act as two complementary mechanisms to internally reconstruct corresponding perceptual outcomes. These two mechanisms can serve as a neurocomputational foundation for predicting perceptual changes, either via a previously learned relationship between actions and their perceptual consequences or via stored perceptual experiences of stimulus and episodic or contextual regularity.

Biography

Xing Tian is an Assistant Professor of Neural and Cognitive Sciences at NYU Shanghai. Using electrophysiological (MEG/EEG), neuroimaging (fMRI) techniques and behavioral, computational approaches, he investigates sensorimotor integration and transformation, speech and language, memory, mental imagery and other human higher-level cognitive functions. He has published 22 peer-reviewed journal papers, such as in *Nature Human Behavior, Nature Neuroscience, Psychological Science, PLOS Biology, Current Biology, Journal of Cognitive Neuroscience, Cortex, Cognitive Psychology and Brain Topography.*

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