Behavioral and Neural Correlates of Auditory Distance Perception

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The mechanisms and cortical structures underlying human auditory spatial processing are not well understood. For the horizontal localization, the basic perceptual cues have been identified, while functional Magnetic Resonance Imaging (fMRI) studies suggest that posterior aspects of non-primary auditory cortex (AC) areas are the main processing structures. However, very little is known about the mechanisms and structures responsible for sound source distance processing. Here, we present a framework that combines behavioral experiments with fMRI to directly examine both the mechanisms and structures of auditory distance processing. We illustrate the approach on the results of an experiment that studied auditory distance perception for nearby sources in virtual auditory environment. The combined approach allowed us to identify the processing regions and to separate the contribution of individual distance cues to the processing. Regions of most significant activation were found in non-primary AC areas posterior to the AC when contrasting stimuli that varied in distance to stimuli varying in intensity, suggesting that level-independent cortical distance processing occurs in the regions close to the horizontal spatial maps. This result illustrates the potential of our framework for future examination of the three-dimensional representation of auditory space in the human brain.

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