Spatial Localization of Auditory Stimuli in Human Auditory Cortex is Based on Both Head-Independent and Head-Centered Coordinate Systems

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Abstract:

In humans, whose ears are fixed on the head, auditory stimuli are initially registered in space relative to the head. Eventually, locations of sound sources need to be encoded also relative to the body, or in absolute allocentric space, to allow orientation toward the sounds sources and consequent action. We can therefore distinguish between two spatial representation systems: a basic head-centered coordinate system and a more complex head-independent system. In an ERP experiment, we attempted to reveal which of these two coordinate systems is represented in the human auditory cortex. We dissociated the two systems using the mismatch negativity (MMN), a well studied EEG effect evoked by acoustic deviations. Contrary to previous findings suggesting that only primary head-related information is present at this early stage of processing, we observed significant MMN effects for both head-independent and head-centered deviant stimuli. Our findings thus reveal that both primary head-related and secondary body- or world-related reference frames are represented at this stage of auditory processing.

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