IMAGINED EGOCENTRIC ROTATIONS: AN FMRI STUDY

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Spatial transformations are a necessary part of interacting with the world on a daily basis. For example, humans must be able to recognize an object at a new orientation or keep track of the location of an object even when it is no longer in view. We used functional magnetic resonance imaging (fMRI) to explore one type of spatial transformation, imagined egocentric rotations. Subjects were presented with an image of a rotated hand while in the scanner. They performed two tasks, both of which required a right versus left decision. In the first task subjects imagined rotating their hand to decide if the hand was a left or right hand and in the second task subjects imagined rotating their perspective around the hand, making a decision about whether a part of the hand was on their left or right. Behavioral data in the form of response time and accuracy were recorded in order to verify task execution. Two types of fMRI paradigms were employed; a block paradigm and an event-related paradigm. The results showed that imagined egocentric hand and perspective rotations share many regions common to imagined rotation tasks in general. This network consisted of frontal, parietal, and occipital activation in the cortex, along with significant activity in the cerebellum, caudate, and hippocampus. However, there were differences in activation between the two tasks. The hand task elicited more activation in “motor” processing regions including the left inferior and superior frontal gyri, supplementary motor area, and regions of the temporal lobe and cerebellum. The perspective task elicited more activation in the middle occipital gyrus and the medial frontal gyrus. These findings suggest that although some shared mechanisms across different types of egocentric spatial transformations exist, there are notable differences as well. Namely, imagined hand rotations recruit regions of the motor system involved in real movements to a greater extent than imagined perspective rotations.