

A Meta-analysis of Neuroimaging Studies of Mental Rotation

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Abstract Details

Mental rotation is a mental process of rotating an object around some axis in three-dimensional space (Zacks, 2008). While behavioral studies have been fairly consistent in their results associated with sex differences, age of the participant, angle of rotation and object complexity, neuroimaging results have not consistently replicated the regions of the brain implicated in mental rotation. In the present project, we conducted an activation likelihood estimation (ALE) meta-analysis to investigate the regions of activation during mental rotation, irrespective of task complexity and experimental paradigm. Studies investigating the neural correlates of a mental rotation paradigm were isolated by a Medline search. The search results were filtered to exclude studies that did not report results on normal subjects in stereotactic space (x,y,z coordinates). Deactivations were also excluded. Only coordinates derived from contrasting a mental rotation task to a control condition were included. Based on these criteria, we identified 55 papers with XYZ contrasts that were published between January 1996 and September 2013. Consistent with earlier findings, the largest cluster of activation was found in the parietal regions, specifically the precuneus region. Mental rotation is also associated with activity in the medial superior precentral gyrus supporting the argument that mental rotation depends on motor simulation. These findings help us further understand the mechanism of mental rotation and the brain regions involved.

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