Parietal mapping of visuomotor transformations during human tool grasping

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Abstract:

During daily life, we reach and grasp objects located in a variety of positions in our visual-field. Where is the information regarding the visual (position) and motor (acting-hand) aspects integrated in the brain? To address this question, a functional magnetic resonance imaging experiment was conducted, in which 10 right-handed subjects used their right or left hand to grasp 3-dimensional tools, located to the right or left of a central fixation point. The posterior part of the intraparietal sulcus (IPS), the putative human homolog of caudal-IPS, was found to be primarily involved in representing the visual location of the tools, whereas more anterior regions, the human homologs of medial intraparietal area and anterior intraparietal, primarily encoded the identity of the contralateral acting-hand. Quantitative analysis revealed 2 opposite visual and motor gradients along the posterior-anterior axis within the IPS: although the importance of the visual-field gradually diminished, the weight of the acting-hand became increasingly greater. Moreover, direct evidence for visuomotor interaction was found in all 3 IPS subregions, but not in occipital or frontal regions. These findings support the hypothesis that the human IPS is comprised of subregions that have different properties, and that it is engaged in visuomotor transformations necessary for visually guided prehension.

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