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Track
Action perception

Title
Action categories in the human premotor cortex

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Abstract
Traditionally, the ability to perform complex actions has been thought to rely on assembling sequences of simpler motor plans, a process supported by computational resources in premotor areas. According to this view, those complex motor plans are capable of combining the movements evoked by individual muscle groups across noncontiguous joints. This combinatorial ability would rely on accessing control neurons distributed over the primary motor cortex, and spatially distributed according to the topographic arrangement and degree of innervation of the controlled muscles (somatotopy principle). Recent studies on the monkey motor cortex suggest an alternative organizational principle. Complex actions are topographically represented on their own, clustered into ethologically relevant action categories, with a correspondingly spatial organization over the cortical motor system. Preliminary electrophysiological evidence for this hypothesis has been gathered in the cortex of the macaque, along the post-arcuate cortex. This study aimed to test this novel hypothesis in the human motor system. Using high-resolution functional Magnetic Resonance Imaging (fMRI) and a motor imagery task our aim was to identify cortical representations of two complex actions: (1) reaching out to grasp an object (RG) and (2) bringing the hand holding an object to the mouth (HM). In multiple blocks subjects were presented pictures of objects and asked to imagine
RG and HM actions. Engagement in imagery was controlled through a manipulation of task di_culty, a_ecting imagery durations. In accordance with the hypothesis described above, we expected to see a dorso-ventral shift of activity along the rostral premotor cortex when subjects imagine an RG or an HM action, respectively. No such shift became evident. Moreover, we could not _nd any consistent topographical mapping of the complex actions we investigated. While this study cannot exclude the existence of action categories in the human motor system, it introduces a feasible new methodology for future experiments.