

Charting the Human Posterior Parietal Cortex

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Much is known about the structural and functional organization of the posterior parietal cortex (PPC) in non-human primates. The systematic testing of neurons in the intraparietal sulcus (IPS) for the preferred type of stimulus in association with behavior has led to the definition of a multitude of subregions mainly associated with the sensory control of actions [1]. In contrast, less is known about the structural and functional organization of human PPC, because it has proven difficult to define distinct regions in the human IPS. Using a memory-guided saccade paradigm, we identified six topographically organized areas in human PPC, which are each characterized by a representation of the contralateral hemifield. IPS1 and IPS2 are located in the posterior segment of the IPS, while IPS3 and IPS4 are located in its anterior/lateral segment. We identified a fifth area anterior to IPS4, which extends into the intersection between the IPS and the postcentral sulcus and is termed IPS5. A sixth area, SPL1, was found to branch off the IPS and extends into the superior parietal lobule. The identification of a multitude of different areas in human PPC in individual subjects is an exciting development, since it permits a region-of-interest approach in studying their response properties.

In several series of studies, we investigated the role of topographically defined human PPC areas in spatial attention, the encoding of fast and slow eye movements and, by using adaptation paradigms, their object- and motion-selectivity. Our results revealed functional differences among these PPC areas. The posterior IPS (IPS1-IPS2) exhibited object-selective responses induced by multiple types of object stimuli independent of the size and viewpoint of these objects, whereas the other areas along the IPS did not respond object-selective [2]. Strikingly, these object responses were indistinguishable from those typically found in ventral stream areas and suggest a second, parallel object pathway in the human. All topographically organized areas in PPC responded motion-selective with IPS1-IPS3 showing preference for radial as compared to planar and circular optic flow stimuli. Spatially specific attention signals, however, were similarly represented in all topographically organized areas. Finally, a gradient representation of eye movements was found with decreasing responses for saccadic eye movements and increasing responses for smooth pursuit eye movements from posterior/medial to anterior/lateral regions. Together, our findings reveal striking similarities in the organization of human and monkey PPC, but indicate also some important differences.

Acknowledgments

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References

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