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  Stimulation of human intraparietal cortex disrupts spatial updating of visual locations across saccades

  Mechanisms of spatial updating maintain accurate representations of visual space across eye movements. In monkeys, salient locations are retained across saccades by transferring activity among spatially-tuned neurons within the intraparietal sulcus (IPS). Little is known, however, about similar mechanisms in the human brain. We examined the role of two subregions of the IPS in spatial updating in human observers using transcranial magnetic stimulation (TMS) to transiently disrupt cortical activity while participants performed double-step saccades. Participants made successive saccades to targets such that the retinal location of the second target had to be updated using information about the first saccade. We stimulated three right hemisphere sites: anterior and posterior IPS (IPSa and IPSp), and primary somatosensory cortex. TMS was delivered at the onset or offset of the first saccade. Performance of the second saccade, which is an index of spatial updating, was affected only for TMS over IPSp, and only for trials in which the first saccade was directed to the left. Specifically, second-saccades showed a directional bias toward the mid-sagittal axis and an increase in amplitude regardless of the timing of TMS. Both of these effects are consistent with an over-estimation of eye displacement caused by the first saccade. In addition, TMS applied at the offset of the first saccade increased variable error of the second saccade. Our findings suggest that IPSp is part of a network that integrates visual and saccade-related information to calculate metrics for spatial updating, and implements the coordinate transformation at the completion of the saccade.

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