Neural networks underlying endogenous and exogenous visual-spatial orienting.

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Abstract

The orienting of visual-spatial attention is fundamental to most organisms and is controlled through external (exogenous) or internal (endogenous) processes. Exogenous orienting is considered to be reflexive and automatic, whereas endogenous orienting refers to the purposeful allocation of attentional resources to a predetermined location in space. Although behavioral, electrophysiological and lesion research in both primates and humans suggests that separate neural systems control these different modes of orienting, previous human neuroimaging studies have largely reported common neuronal substrates. Therefore, event-related FMRI (ER-FMRI) was used to independently examine different components of the orienting response including endogenous facilitation, exogenous facilitation and inhibition of return (IOR). In contrast to previous studies, endogenous versus exogenous facilitation resulted in widespread cortical activation including bilateral temporoparietal junction, bilateral superior temporal gyrus, right middle temporal gyrus, right frontal eye field and left intraparietal sulcus. Conversely, IOR compared to endogenous facilitation resulted in only a single focus of activation in the left superior temporal gyrus. These findings suggest that endogenous orienting activates a large cortical network to achieve internally generated shifts of attentional resources versus the automatic orienting that occurs with exogenous cues. However, similar networks may mediate endogenous orienting and IOR. The activation of the temporoparietal junction suggests that it is involved in more effortful processes, such as endogenous orienting, as well as in attentional reorienting and locating targets. Current results are discussed in terms of the functional development of the visual-spatial attentional system.