

Gender differences in the topological map within the parietal lobes

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Introduction:

Controversy exists as to the location within the brain of the spatial topological map used for navigation. The discovery of “place cells” within the hippocampus of rats has convinced many that the hippocampus is the site of the spatial topological map. However, clinical observation is inconsistent with this view, indicating that the parietal lobes are a more likely site. Conventional functional MRI studies of navigation have been unhelpful in determining the site of the topological map because the complexity of the tasks causes a large number of brain regions to become activated, making it difficult to determine the contribution each active brain region is making to the performance of the task. We have constructed a markedly simplified spatial navigation task designed to solely activate the spatial topological map used for navigation.

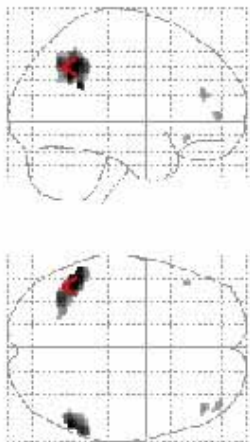
Methods:

18 subjects, 9 males and 9 females, were trained to navigate to a single known target destination within a virtual 3D environment containing a single visual landmark. During data acquisition, the subjects' location within the environment was unexpectedly perturbed. The perturbation of the subject's expected location within the environment requires an update of the cognitive spatial map in order to complete the task.

Results:

BOLD signal changes related to the perturbation of the subject's location in the environment were detected within the parietal cortex bilaterally, deep within the intraparietal sulcus, inferior to both the parietal eye fields and the parietal reach region. The activity was stronger on the left for males and stronger on the right for females. By controlling for all other aspects of the task, we believe we have demonstrated that this functional activity is related to the maintenance of a spatial topological map of the environment.

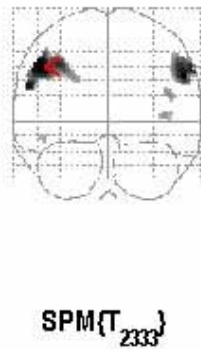
A



Group analysis of female subjects ($p < .05$ corrected)

Group

B



Group analysis of male subjects ($p < .05$ corrected)