POSTER

Neural bases of route-survey processing in topographical memory

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Background

In the experimental psychology literature (Thorndyke & Hayes-Roth, 1982; Ruddle et al., 1997) it is well admitted that recalling the direction to take along a familiar route or pointing to non-visible targets in large-scale environments are based on two different types of mental representations (route versus survey), which are sustained by partially distinct neural networks. However, the neural bases of the route-survey distinction are poorly explored. Until now, the studies have been conducted in distinct environments (one for each type of representation), or in the same environment learned from different perspectives (from above or by navigation, see for instance Shelton & Gabrieli, 2002). In the present study, participants elaborated both route and survey knowledge of the same environment only from ground-level navigation, which is closer to natural situations.

Method

During a pre-scanning learning phase the participants were repeatedly shown a movie of a trip along a fixed route in a virtual environment, until they were able to reproduce the trip two times without errors (route knowledge). Then they were requested to learn the relative position of some salient landmarks encountered along the route (survey knowledge) until their average pointing error was less than 20 degrees. During the scanning phase the participants were presented with snapshots of the environment and had to estimate either the direction to take to follow the previously learned route (Route direction condition) or the position of distant target landmarks (Survey direction condition). In a Control condition they had to indicate the position on the screen of a non-target building located in an empty environment.

Results

Brain functional data (random effect analyses, corrected threshold $p<0.05$) revealed some areas of activation shared by the two experimental conditions when compared with the Control condition (right Hippocampus, bilateral Parahippocampal Gyrus, Lyngual Gyrus, Posterior Cingulate Cortex and Parietal Lobe) and some areas specifically activated when the Route direction Condition was compared to the Survey direction Condition (left Parahippocampal Gyrus, right Lingual Gyrus and Parietal Lobe, and bilateral Cuneus).

Conclusions

These data revealed that route and survey processing acquired from ground-level navigation involved in common a large network of areas, including the right Hippocampus, while survey memory recruited a subset of areas recruited by route memory. These data are partially consistent with those gathered in studies that have been concerned with the neural bases of route versus survey knowledge either acquired from different perspectives (Mellet et al., 2000; Shelton & Gabrieli, 2002) or in different environments (Hartley et al., 2003).

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