The relation between spatial and autobiographical memory in people with medial or posterior temporal lobe damage

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Introduction

• Current theories of hippocampal function propose a role for the hippocampus in highly-detailed spatial and autobiographical memory representations (Winocur & Moscovitch, 2010).
• Schematic representations such as semantic memory and map-like spatial knowledge are not thought to rely on the hippocampus (Rosenbaum et al., 2000; Tang & Squire, 1989).
• In healthy young and older adults, more familiar spatial cues result in more detailed memory for both scenes and autobiographical episodes (Rabin & Moscovitch, 2014).

Objectives:

• In the present study, we sought to determine how memory for remote scenes and episodes was affected following damage to the medial or posterior temporal lobe.
• We compared performance on this test with that on a schematic spatial memory test, assessing knowledge of relationships between landmarks, but not details.
• We also tested whether more familiar cues improved performance, as has been shown in healthy controls.
• MTL amnesic patients were compared with a case of topographical disorientation, who has selective spatial memory impairments but no HPC damage.

Methods and Results

Scene Memory

• Presented with names of high and low familiarity landmarks and asked to describe the scene around that location.
• Scene descriptions lacking in detail in MTL and TD patients compared to controls, with one exception.
• No consistent cue familiarity effects in patients.

Landmark Recognition

• Presented with pictures from Google Street-View of high and low familiarity landmarks and had to identify if familiar and name them.
• Landmark recognition and naming accuracy lower in MTL and TD patients than controls.
• Higher performance for more familiar cues in all cases.

Conclusions

• MTL and TD patients were impaired at recalling detailed representations of scenes compared to controls.
• MTL patients were very impaired at recalling autobiographical episodes, whereas TD patient could recall episodes but they were low in detail compared to controls.
• MTL and TD patients performed worse than controls on a test of landmark recognition, especially for less familiar landmarks.
• In contrast, MTL and TD patients performed as well as controls on a test of spatial memory requiring the retrieval of coarser spatial relational information.
• Cue familiarity did not have a consistent effect on performance for patients, except in the recognition task, unlike in controls.
• These results support the Transformation Hypothesis which states that the hippocampus is needed to encode and retrieve highly detailed spatial and autobiographical representations, but more gist-like versions of memory can survive hippocampal damage (Winocur & Moscovitch, 2011).
• Damage to posterior ventral temporal regions also led to impaired detailed spatial representations, which may have led to reductions in detail of autobiographical memories, but again spared schematic spatial memory.

Participants

3 cases of amnesia due to HPC/MTL damage:

MTL1: Male, age 58, 12 YOE, 58 years in Toronto.
MTLT: Male, age 62, 18 YOE, 62 years in Toronto.
MTLT: Male, age 61, 17 YOE, 17 years in Toronto.

3,4 3 cases of amnesia due to HPC/MTL damage:

MTL1: Male, age 58, 12 YOE, 58 years in Toronto.
MTLT: Male, age 62, 18 YOE, 14 years in Toronto.
MTLT: Male, age 61, 17 YOE, 17 years in Toronto.

MTL amnesic patients were compared with a case of topographical disorientation, who has selective spatial memory impairments but no HPC damage.

Spatial Navigation

• Presented with high and low familiarity pairs of landmarks and had to decide which was farther in one of the four cardinal directions.
• High accuracy on navigation decisions in MTL and TD patients.
• Cue familiarity effects inconsistent in patients.

References


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