Modeling prefrontal and medial temporal contributions to episodic memory.

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Overview

A conventional view is that the hippocampus and prefrontal cortex form a modular system for declarative memory. However, recent work has suggested that these two regions are more tightly integrated than previously thought. In this paper, we present a computational model of episodic memory that incorporates the hippocampus and prefrontal cortex in a novel way. The model is based on the idea that the hippocampus is responsible for generating a context vector that is used to encode and retrieve information. The prefrontal cortex is responsible for maintaining this context vector over time, allowing for long-term memory consolidation.

The hippocampal model

- Creates context vectors using a representation of recent activity.
- Stabilizes memory by updating context vectors over time.
- Supports spatial and non-spatial information through the use of reference frames.

The context vector

- The context vector is a representation of recent activity that is used to encode and retrieve information.
- It is updated over time to support long-term memory consolidation.

The interaction

- The hippocampal model is used to encode and retrieve information.
- The prefrontal cortex is used to maintain the context vector over time.

Applying the model to free recall

- The model can be used to simulate the operations conducted by participants in a free recall task.
- The model predicts that the hippocampus is responsible for encoding information, while the prefrontal cortex is responsible for maintaining the context vector.

Lesioning the model

- Lesioning the hippocampus results in impaired encoding and retrieval of information.
- Lesioning the prefrontal cortex results in impaired maintenance of the context vector.

The paradigm

- We opt for the free-recall condition.

Hippocampus at encoding

- The hippocampus encodes information using a context vector.
- The context vector is used to stabilize memory over time.

Retrieval mode

- At retrieval, the model is used to retrieve information from memory.
- The context vector is used to stabilize memory once again.

Conclusions & future directions

- We extend our model to include the role of prefrontal cortex in episodic memory, using a computational approach. The model is able to simulate the effects of hippocampal and prefrontal lesions on memory performance.

- The model is successful in replicating a number of aspects of recall performance, including the effects of lesioning the hippocampus and prefrontal cortex.

References

[Provide a list of references here]

Figures

- Figure 1: Schematic of the model.
- Figure 2: Encoding and retrieval processes.
- Figure 3: Lesioning the hippocampus and prefrontal cortex.

Appendix A

[Include any additional information or calculations here]