

Memory-Based Attentional States are Established by the Hippocampus and Medial Prefrontal Cortex

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Introduction

Explicitly Instructed



"Look for a person."

Memory-guided



"Uhm... Just don't die!"

Hippocampal (HPC) activity levels are higher *prior* to attentional guidance for memory-guided vs. explicitly instructed attention (Stokes et al., 2012; Summerfield et al., 2008).

HPC activity patterns represent *current* attentional states (Aly & Turk-Browne, 2016a,b).

HPC and medial prefrontal cortex (mPFC) interact for memory-guided behaviors, such as memory-guided decisions (e.g., Shapiro et al., 2014).

Hypothesis: HPC and mPFC represent *upcoming* memory-based attentional states.

Procedure

Phase 1: Learn stay/switch cues



Phase 2: Attention task

Explicitly Instructed Attention

Attentional state is randomly assigned on each trial



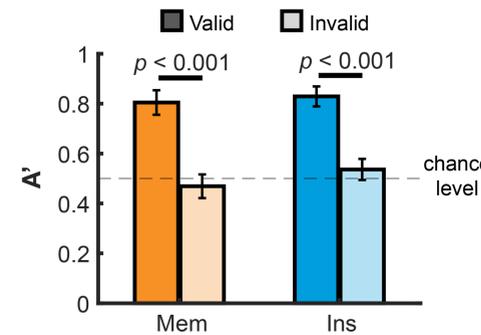
Memory-Guided Attention

Attentional state is selected based on learned stay/switch cues



Behavioral Results

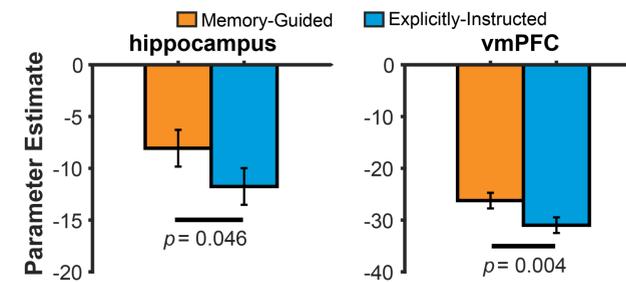
N = 29



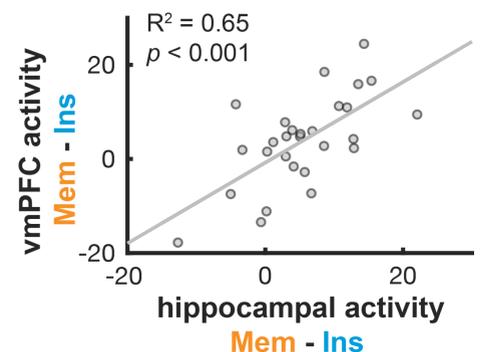
Comparable performance across tasks.
Effective manipulation of attentional states.

fMRI Results – Univariate

N = 29

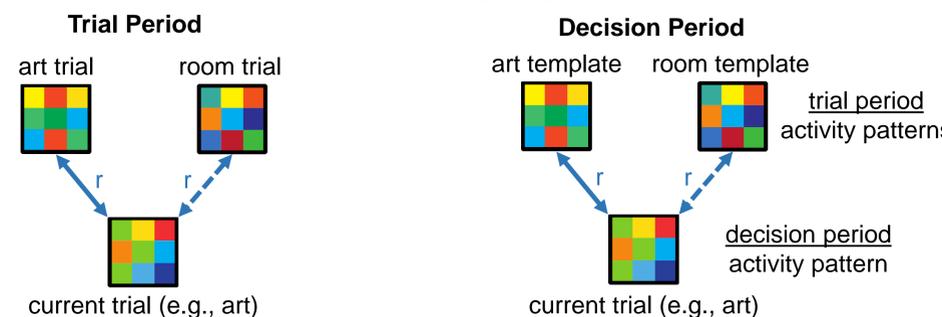


Hippocampal & vmPFC activity is higher for memory-guided vs. explicitly instructed attention.



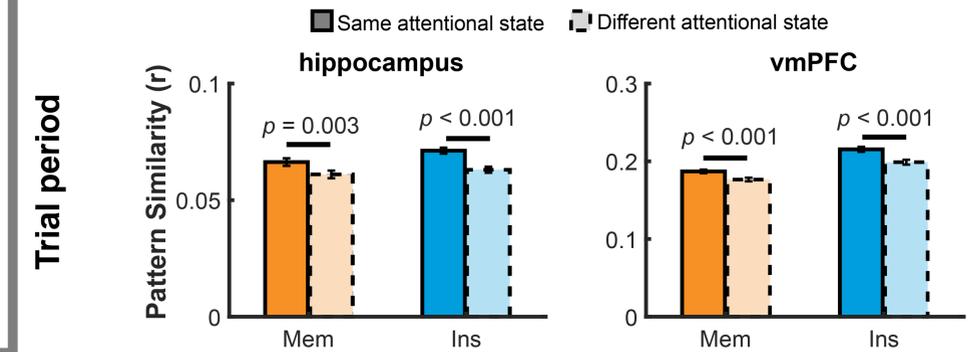
Activity enhancement for memory-guided attention is correlated across individuals in hippocampus & vmPFC.

RSA Methods

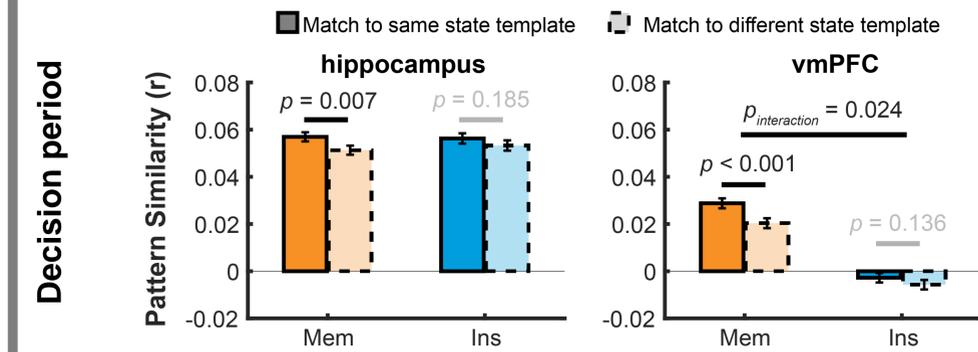


fMRI Results – RSA

N = 29

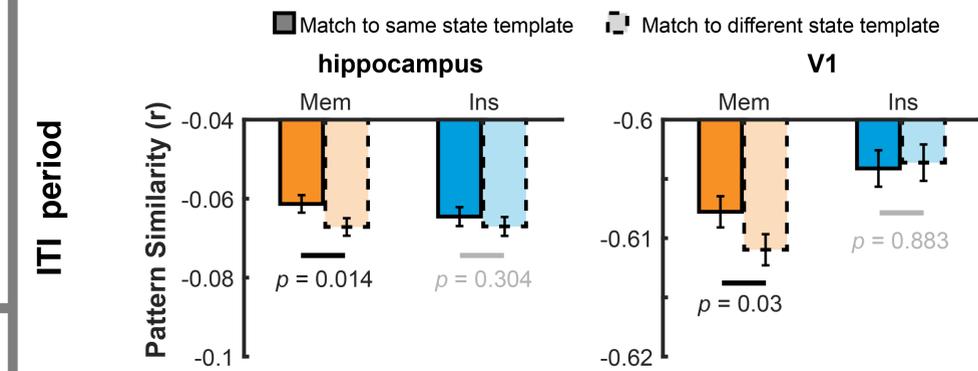


Hippocampus and vmPFC represent *current* attentional states.



Hippocampus and vmPFC represent *upcoming* memory-based attentional states.

Exploratory analysis: How early are preparatory attentional states established?



Hippocampus and V1 represent future attentional states even before the trial.

Conclusions & Future Directions

vmPFC and hippocampal activity is higher when attention is guided by memories compared to when explicitly instructed. These effects are correlated across individuals. vmPFC, hippocampus, and V1 represent memory-based attentional states, both prior to and during attentional guidance.

How do interactions between hippocampus, vmPFC, and V1 direct memory-guided attention?
How do these regions balance the demand between internal and external attention?

fMRI EPI Parameters

TR: 1.5 s
Vox. size: 2 mm isomorphic
TE: 30 ms
Phase enc. dir.: P>>A
Accel. Factor: 3
of slices: 69

ROIs

