

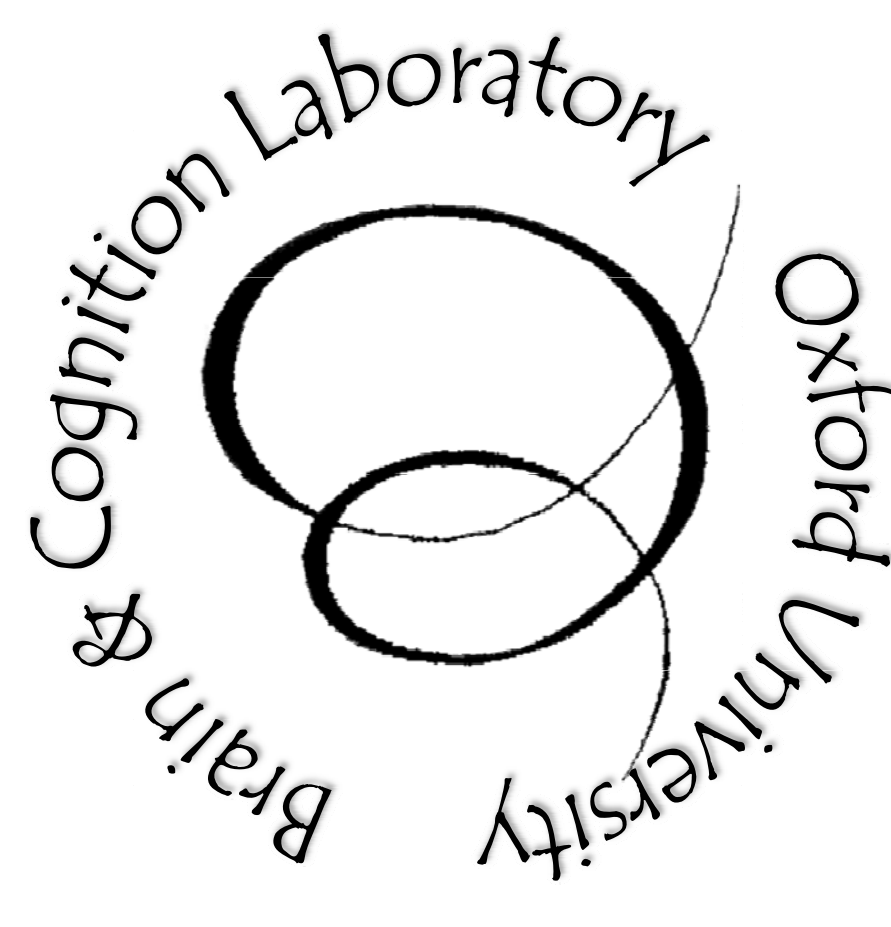
The Neural Control Mechanisms Underlying Memory-Guided Attention

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Experimental Questions:

Orienting spatial attention using long-term memory activates the hippocampus, and the same dorsal frontoparietal brain networks as when attention is guided by transient spatial cues (Summerfield et al., 2006; Kastner & Ungerleider, 2000; Chun, 2000). Previously, however, neural activity elicited by mnemonic cues has not been dissociated from activity elicited by targets. In this study we lengthened and varied cue-target stimulus onset asynchronies in a perceptual discrimination task with complex scenes to allow isolation of cue- and target-related processes in memory-guided orienting. Our key aims were:

1. To validate that the hippocampus and dorsal frontoparietal networks are activated by mnemonic cues.
2. To determine whether hippocampal and dorsal frontoparietal regions are engaged by mnemonic cues independently of target processing.

Findings & Conclusions:

1. Mnemonic spatial cues facilitated perceptual discrimination of targets embedded in natural scenes.
2. Mnemonic cues engaged the hippocampus, and the same dorsal frontoparietal networks identified by a previous study using mnemonic cues to guide orienting of spatial attention (Summerfield et al., 2006).
3. No cue-dependent differences in hippocampal or dorsal frontoparietal activity were observed during the target phase of the task.

References:

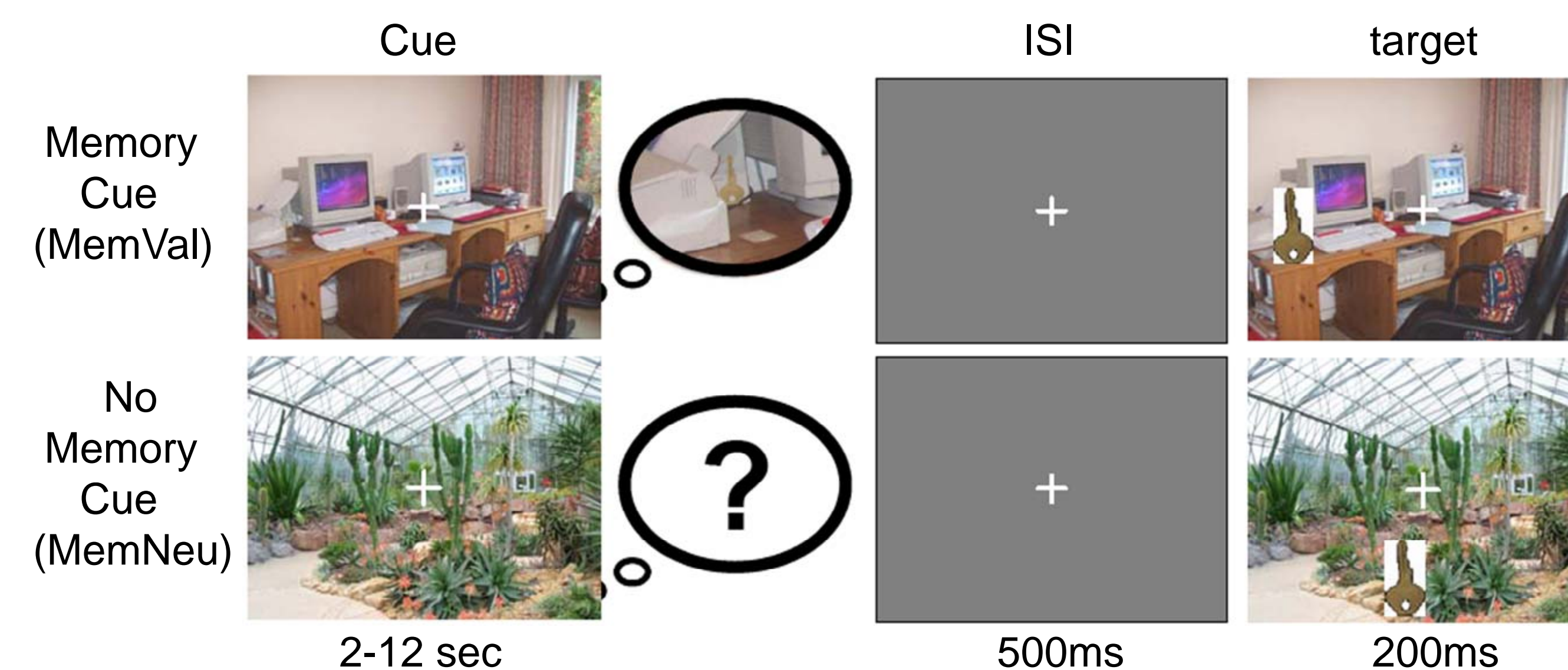
- Chun, M. M. (2000). Contextual cueing of visual attention. *Trends in Cognitive Sciences*, 4(5), 170-178.
- Kastner, S., & Ungerleider, L. G. (2000). Mechanisms of visual attention in the human cortex. *Annual Review of Neuroscience*, 23, 315-341.
- Summerfield, J. J., Lepsien, J., Gitelman, D. R., Mesulam, M. M., & Nobre, A. C. (2006). Orienting attention based on long-term memory experience. *Neuron*, 49(6), 905-916.

Methods:

Learning Task

Participants searched for and learned the location of targets (images of keys) in natural scenes 24-48 hours before completing the orienting task. Two-thirds of the scenes presented contained targets.

Orienting Task (completed in fMRI scanner)

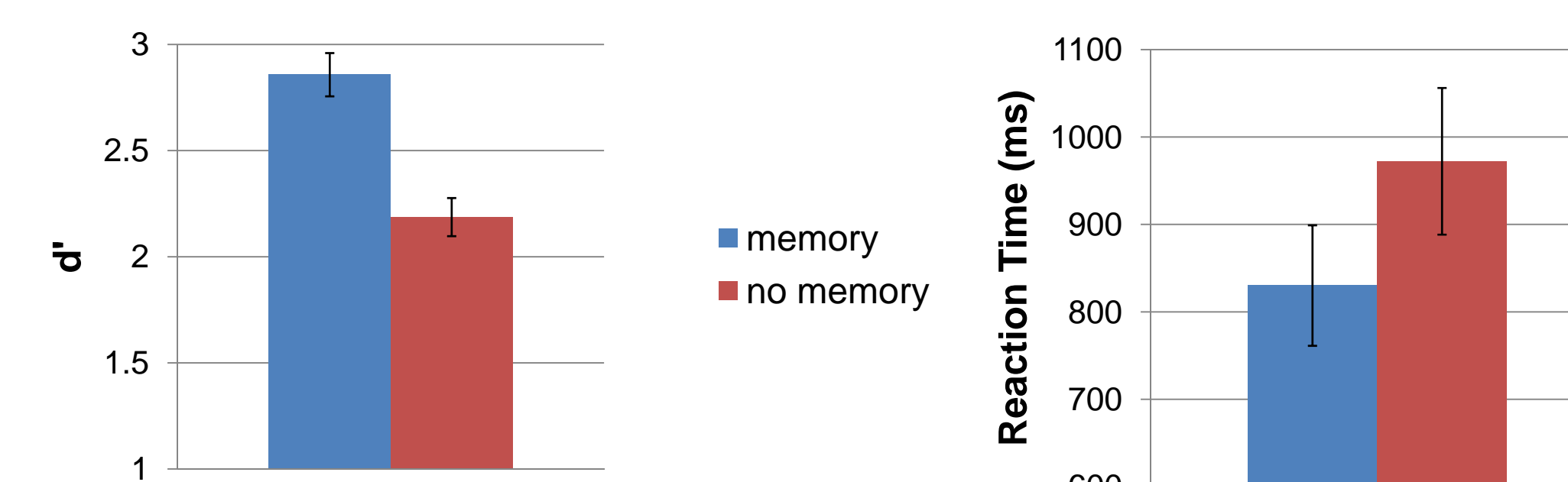


- Mnemonic cues guided the orienting of attention.
- No targets were present in cue scenes. Two-thirds of the cue scenes had contained targets in the learning task (MemVal condition). One-third of the cue scenes had not contained targets in the learning task (MemNeu condition).
- Participants responded (yes/no) as to whether a target key was present. 50% of MemVal and 50% of MemNeu trials contained targets.
- N = 20. Factors: cue (MemVal, MemNeu), target (present, absent).

fMRI Methods

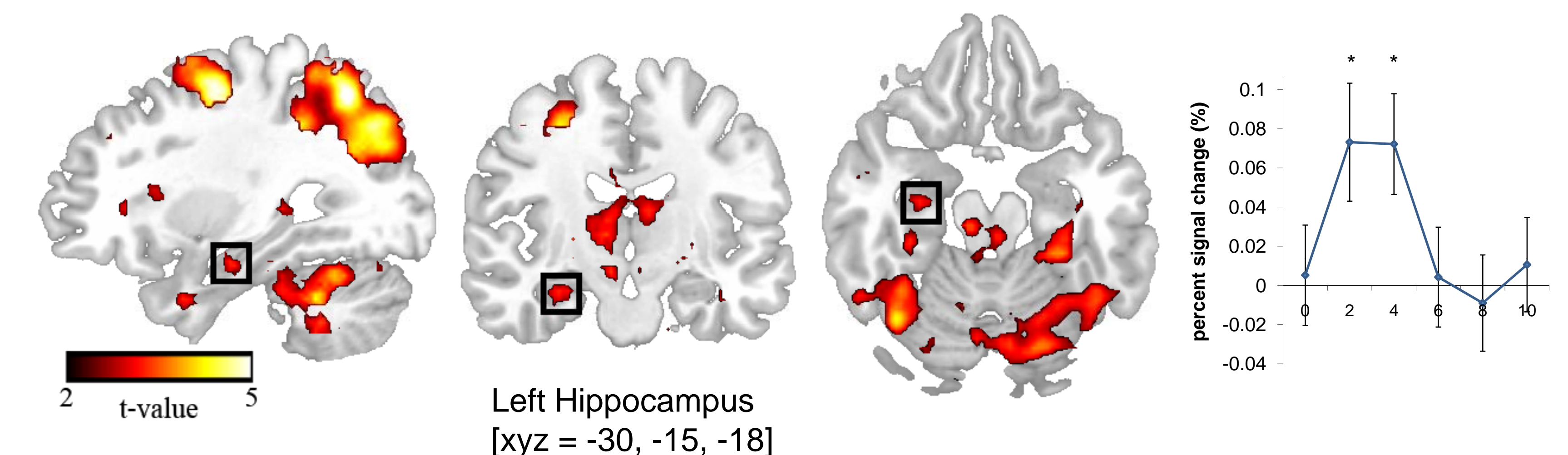
- 3T Siemens TIM Trio, 12 channel headcoil
- TR=3s, TE=30ms, 3mm³ voxels, 45 axial slices
- SPM5/MarsBar pre-processing and analysis, 7mm smoothing.
- Events of interest: MemVal - MemNeu GLM analysis, FIR analysis.

Behavioural Results:

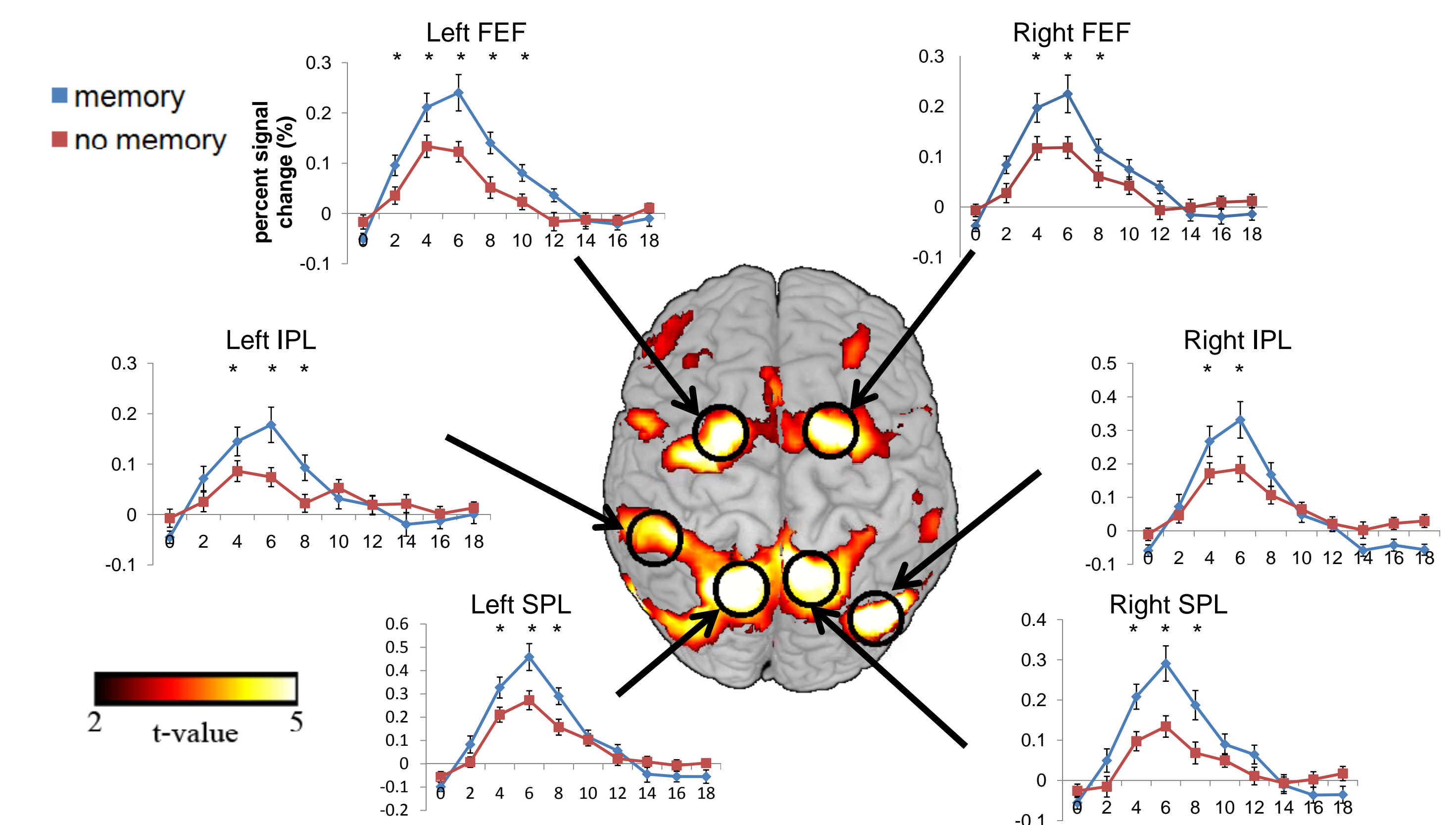


Long-term memory cues facilitated perceptual discrimination of targets (d' cuing effect: $t(14)=4.96$, $p<.001$) and reaction times (RT cuing effect: $t(14)=-3.14$, $p<.01$) in the orienting task.

fMRI Results:



Memory cues engaged the same left hippocampal region observed by Summerfield et al. (2006) significantly more than no memory cues (MemVal – MemNeu comparison, $P_{FDR}<0.05$). No cue-related differences were observed in the target phase (MemVal – MemNeu, all voxels $P_{FDR}>0.05$). FIR analysis of the time-course of hippocampal activity in the cue phase of MemVal trials is shown to the right ($*=p<0.05$).



Whole brain analysis of the cue phase (shown in center) revealed greater dorsal frontoparietal orienting network engagement by memory cues than no memory cues (MemVal – MemNeu comparison, $P_{FDR}<0.05$). The outer plots show FIR analyses of peak activations ($*=p<0.05$). No cue-related differences were observed in the target phase (MemVal – MemNeu, all voxels $P_{FDR}>0.05$).

Notes:

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