



# Reinstatement of Item-Specific Contextual Details During Retrieval Supports Recombination-Related False Memories

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## Background

- Flexible retrieval mechanisms may support both successful inference and subsequent false memories for contextual details (Carpenter & Schacter 2017)
- MTL (specifically anterior hippocampus) and prefrontal regions (posterior mPFC & IFG) support successful inference decisions (Zeithamova & Preston, 2010)
- After learning partially overlapping 'AB' and 'BC' associations, neural patterns of the non-overlapping items (i.e., 'A' and 'C') become more similar to one another in anterior hippocampus and posterior mPFC (Schlichting, Mumford & Preston, 2015)
- Retrieval may involve the reinstatement of encoding-related patterns in the hippocampus and other content-specific cortical regions (for review see Xue, 2018)
  - Such reinstatement tracks various aspects of participants' memories from free-recall of event details to ratings of recognition memory confidence (Oedekoven, Keidel, Berens & Bird, 2017; Ritchey, Wing, LaBar & Cabeza, 2013)

## Current Study

- Utilized a representational similarity analysis (RSA) to assess how flexible retrieval mechanisms that support successful inference affect neural representations of the original event contexts
- Targeted the *item-specific* reinstatement of the contextual information we hypothesize is being mistakenly retrieved and bound to the overlapping, yet incorrect event resulting in false memories
- RSA conducted within three regions of interest (ROIs): anterior hippocampus, posterior mPFC (i.e., flexible retrieval/associative inference regions; Schlichting et al., 2015) and a 'content-reinstatement' region, L. ITG (e.g., object information/objects in context – the color of the couch, for review see Bar, 2004)

## Hypotheses:

- Greater evidence for the reinstatement of overlapping, yet incorrect contextual details after successful relative to unsuccessful inference in the anterior hippocampus, posterior mPFC and L. ITG
- Reinstatement of the overlapping, yet incorrect contextual details in 'content-reinstatement' region should track participants' false memory scores

## References

Bar, M. (2004). Visual objects in context. *Nature Reviews Neuroscience*, 5, 617–623.

Carpenter, A.C. & Schacter, D.L. (2017). Flexible retrieval: When true inferences produce false memories. *Journal of Experimental Psychology: Learning, Memory & Cognition*, 43, 335–349.

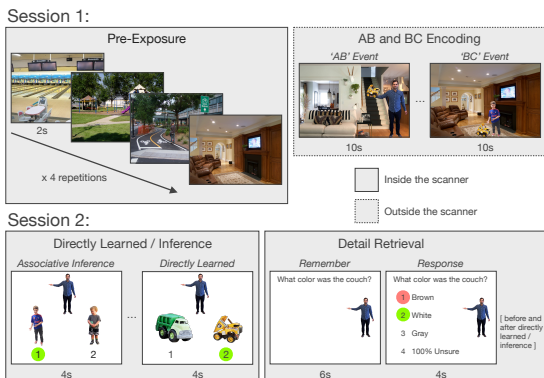
Oedekoven, C.S.H., Keidel, J.L., Berens, S.C. & Bird, C.M. (2017). Reinstatement of memory representations for lifelike events over the course of a week. *Scientific Reports*, 7, 14305.

Ritchey, M., Wing, E.A., LaBar, K.S., & Cabeza, R. (2013). Neural similarity between encoding and retrieval is related to memory via hippocampal interactions. *Cerebral Cortex*, 23(3), 2818–2828.

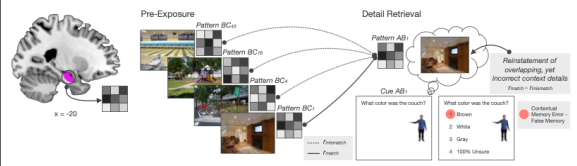
Schlichting, M.L., Mumford, J.A. & Preston, A.R. (2015). Learning-related representational changes reveal dissociable integration and separation signatures in the hippocampus and prefrontal cortex. *Nature Communications*, 6, 9151.

Zeithamova, D., & Preston, A.R. (2010). Flexible memories: Differential roles for medial temporal lobe and prefrontal cortex in cross-episode binding. *Journal of Neuroscience*, 30, 14676–84.

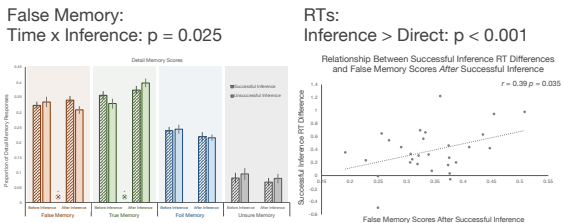
## Methods



Reinstatement of overlapping, yet incorrect context during detail retrieval trials following successful associative inference ( $match - mismatch$ )

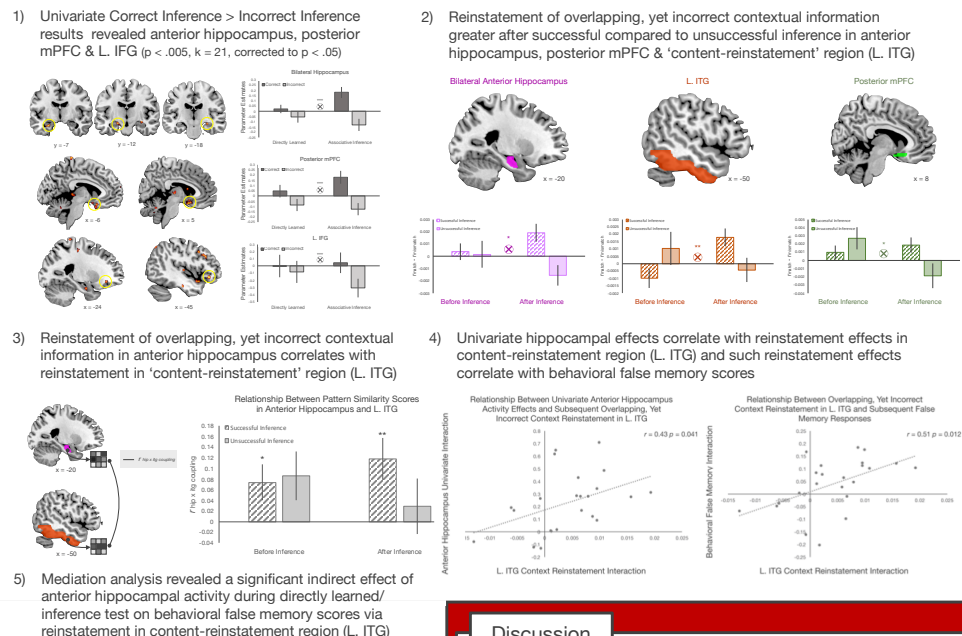


## Behavioral Results



Overall True Memory > False Memory > Foil Memory > Unsure Memory

## fMRI Results



## Discussion

- Current results provide evidence linking hippocampally-dependent flexible retrieval and cross-episode binding mechanisms that support successful inference to:
  - The reinstatement of contextual information from the overlapping, yet incorrect event
  - The misattribution of such reinstated contextual information to the overlapping, yet incorrect event
- Following successful inference, the neural representations of the partially overlapping, yet distinct events become more similar to one another in the anterior hippocampus, posterior mPFC and 'content-reinstatement' regions (L. ITG)
- Such results are in line with the constructive episodic simulation hypothesis and provide neuroimaging evidence linking flexible retrieval and recombination processes that support an adaptive function (i.e., associative inference) to subsequent memory errors