Gist and Detailed Mnemonic Discrimination of Highly Similar Scenes Along the Hippocampal Longitudinal Axis

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BACKGROUND

Longitudinal axis of the hippocampus (HPC)

- Anteroposterior gradient (APG) in episodic memory processing
  - Connectivity patterns found among (Aggleton, 2012; Ranganath & Ritchey, 2012)
    - > aHPC ~ anterior regions (e.g., vmPFC for schemas)
    - > pHPC ~ posterior neocortex (e.g., perceptual regions)
  - A model of HPC-APG (Poppenk et al., 2013, Robin & Moscovitch, 2017)
    - > aHPC ~ coarse, global representations
    - > pHPC ~ fine-grained, local representations

Mnemonic Similarity Task (MST) (Stark & Stark, 2017)
> Measures recognition and mnemonic discrimination of scene images
> At retrieval, presents a dissimilar scene (*foil*) or one exemplar of a highly similar scene (*lure*) not identical to studied items (*targets*)

RESEARCH OBJECTIVES

- Adopt the MST and show *multiple exemplars* per scene category at encoding and retrieval to measure detailed and gist-like memory
- Evaluate the interpretation of the HPC APG via our MMST task (Fig.1) in fMRI (Fig.2)

Goal: Measure aHPC & pHPC activations for gist vs detailed recognition
Hypotheses: a. aHPC > retrieval of gist-like memory
> via accurate foil recognition & inaccurate lure recognition
b. pHPC > retrieval of detailed memory
> via accurate recognition of targets & lures

METHODS

Study Phase | **Test Phase**

Multiple Mnemonic Similarity Task (MMST)

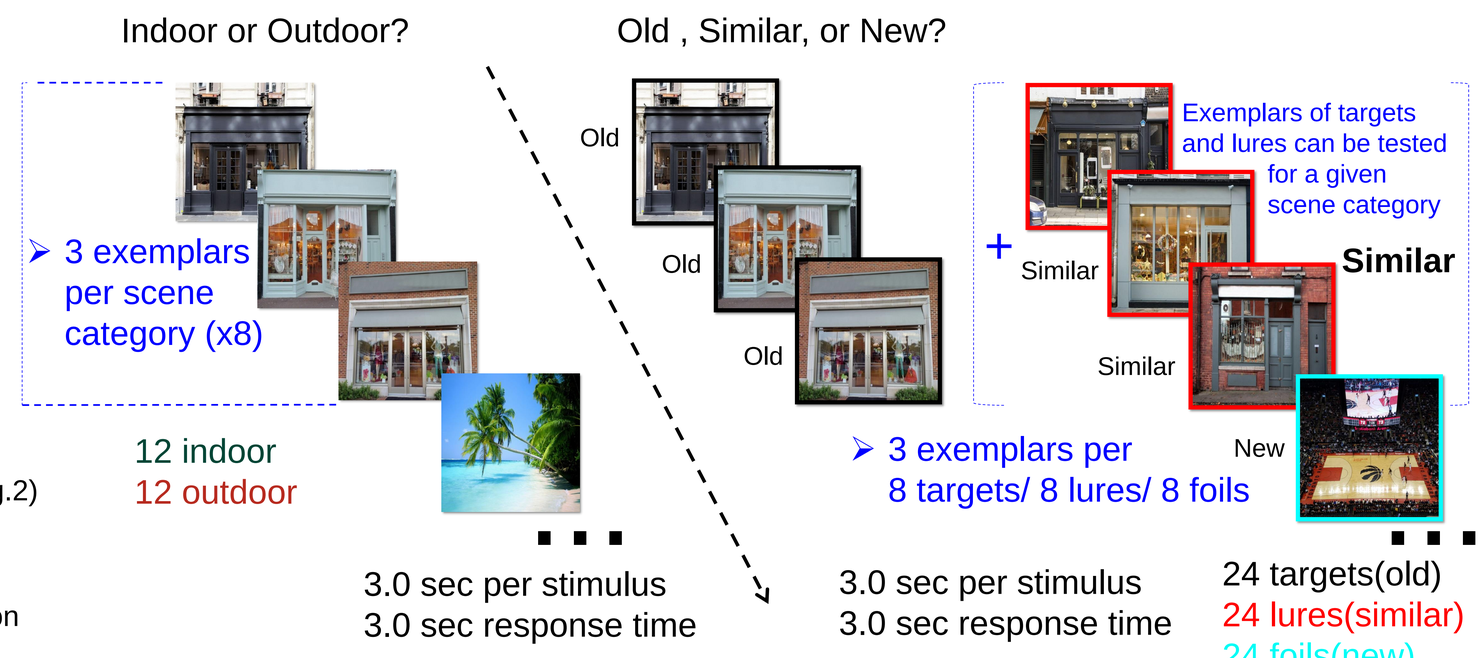


Figure 1. The MMST protocol

fMRI STUDY DESIGN

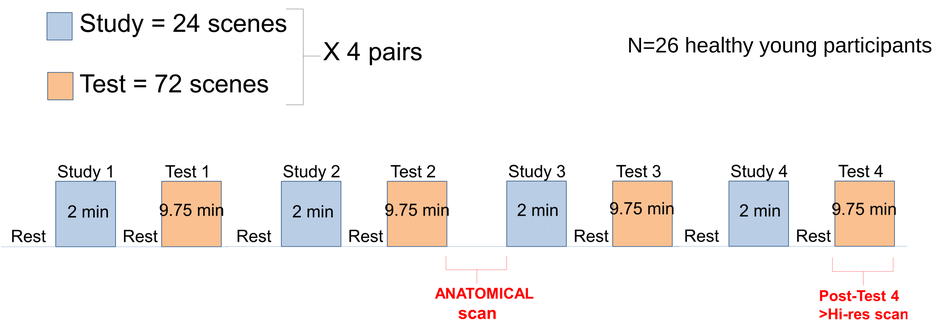


Figure 2 – Event related design using T3 fMRI scanner

REGION OF INTEREST (ROI) ANALYSIS

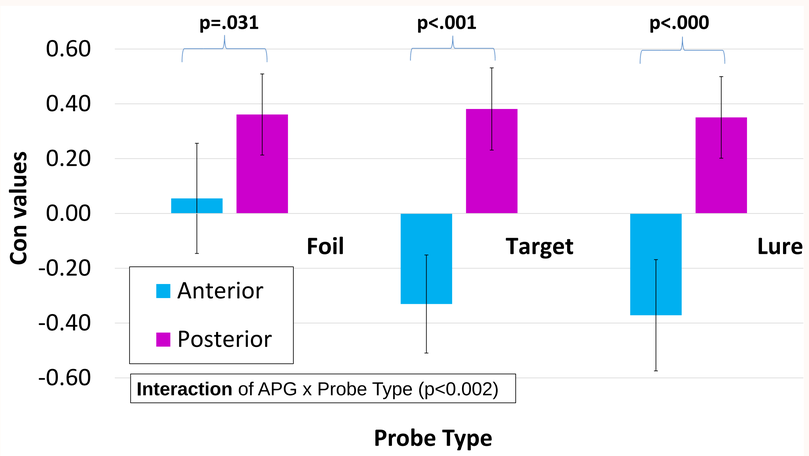


Figure 3. Accurate probe recognition across HPC APC

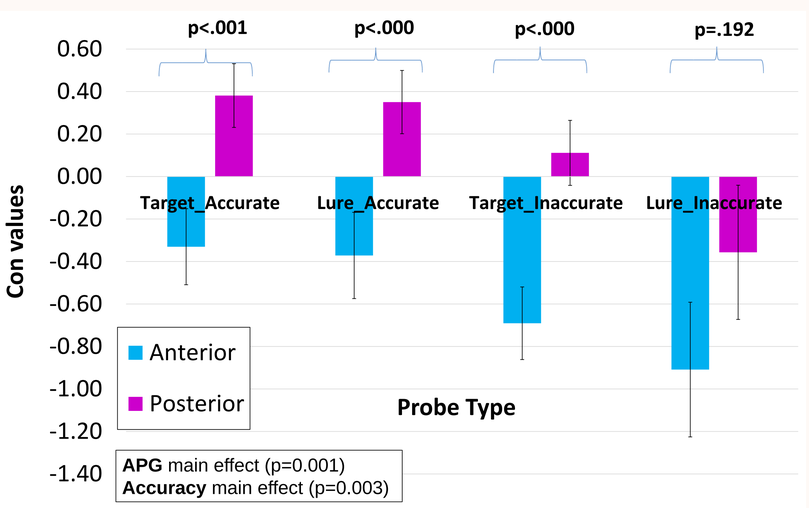
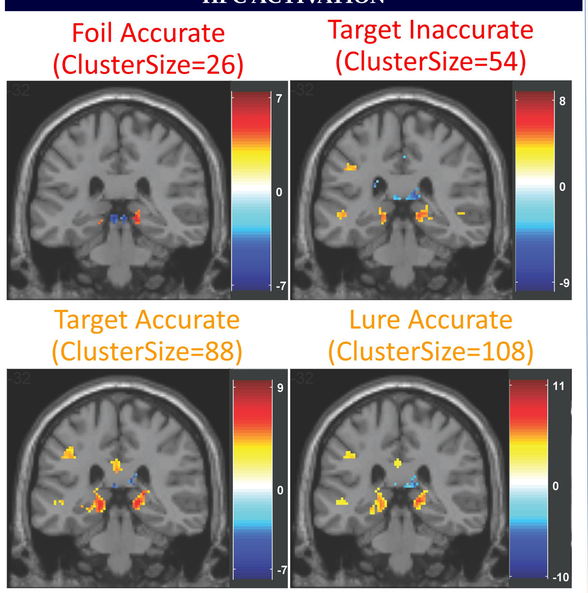


Figure 4. Inaccurate and accurate probe recognition across HPC APC

WHOLE BRAIN ANALYSIS: HPC ACTIVATION



R.HPC (16x,-32y,-2z), p = 0.001

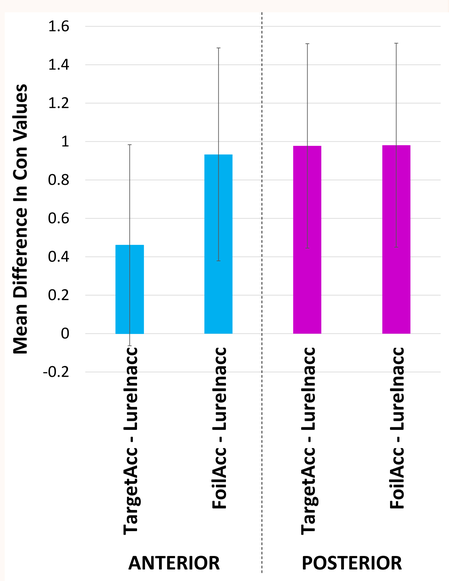


Figure 5. Mean difference in con values across HPC APC

DISCUSSION

Take Home Message

1. **The MMST reliably measured detailed memory via participants' percent correct responses to targets and lures identification (above chance lv. of 33%)**
   > Increasing multiple exemplars at both encoding and retrieval was shown to enhance similarity detection!
2. **The MMST also reliably measured gist-like memory via participants' poor accuracy (hits – false alarms) for lure discrimination**
   > Lure accuracy was significantly lower than target (p<0.01) & foil (p<0.01) accuracy
3. **In all accurate trials of all probe types, ROI activations showed significantly greater activations in the pHPC > aHPC** (p<0.01)
   > this was modulated by stimulus type (Fig.3)
4. **For targets and lures, their accurate recognition showed greater overall HPC activations than their inaccurate counterparts** (Fig.4)
5. **aHPC activations for inaccurate lures is closer to accurate targets** (difference between inaccurate lures and accurate targets is smaller than difference between inaccurate lures and accurate foils, see Fig.5)
   > unlike pHPC, the aHPC is sensitive to this difference, that is to errors for lures
   > the error is gist-based since aHPC can not differentiate well between accurate targets and inaccurate lures
   > supports role of **aHPC** for gist-like memory

REFERENCES: Aggleton, J.P. (2012). *Neurosci Biobehav Rev, 36*, 1579-1596. Poppenk, J., Evensmoen, H.R., Moscovitch, M., & Nadel, L. (2013). *Trends Cogn Sci, 17*, 230-240. Ranganath, C. & Ritchey, M. (2012). *Nat Rev Neurosci, 13*, 713-726. Robin, J. & Moscovitch, M. (2017). *Learn Mem Cogn, 40*, 459-475. Stark, S.M., & Stark, C.E. (2017). *Behav Brain Res, 333*, 109-117.