Decoding mental walkthroughs of spatial memories in an immersive virtual reality environment

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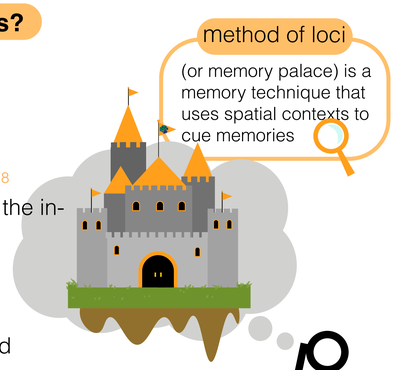
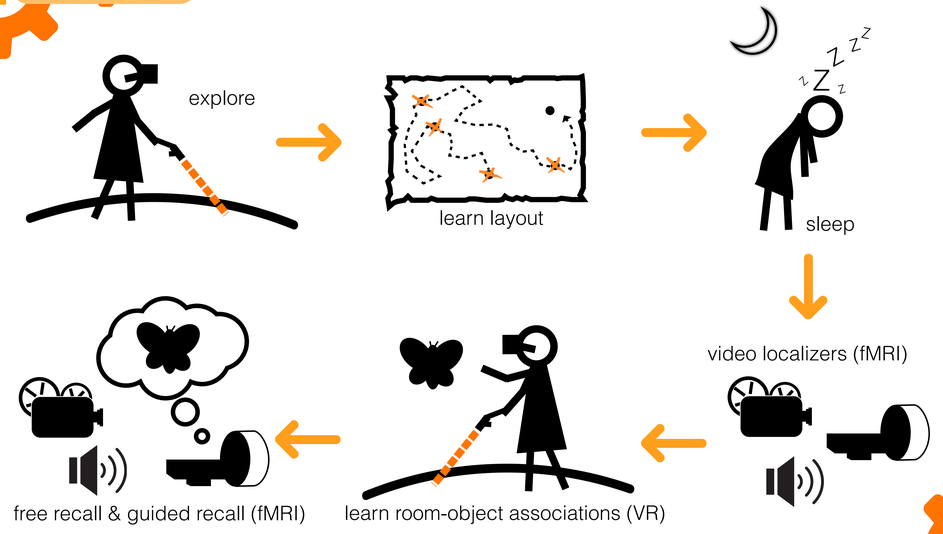
BACKGROUND

How are spatial schemas used in episodic memories?

- spatial contexts can be powerful memory cues
  Robin et al., 2015; Radvansky & Copeland 2006; Sheldon & Chu 2017
- posterior medial network regions are involved in representing contexts (e.g., scenes + schemas + spatial representations)
  Chen et al., 2017; Baldassano et al., 2017; Masis-Obando et al., 2022; Robin et al., 2018
- room representations form cognitive maps that are sensitive to the interconnectivity/structure of a context
  Brunec et al., 2017, 2018; Brunec & Momennajad 2021
- cognitive maps help navigation through spatial contexts and may help scaffold memory retrieval
- hippocampus may be involved in binding items to contexts and its activity between events relates to memory performance
  Ranganath 2010; Ben-Yakov & Henson 2018; Baldassano et al., 2017
- object retrieval may involve hippocampally-based mediation of associations between context-representing regions with object-representing regions

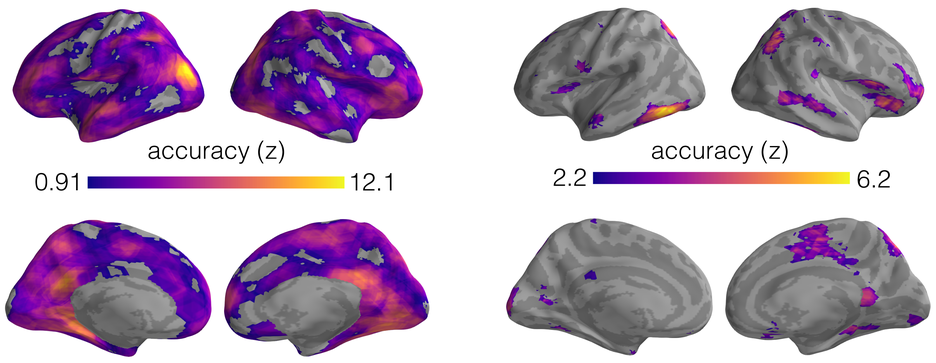


METHODS

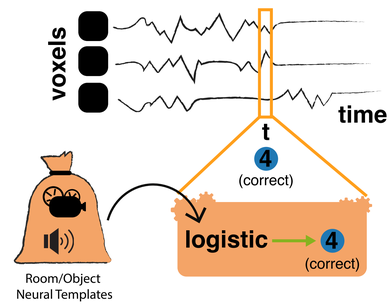


Results

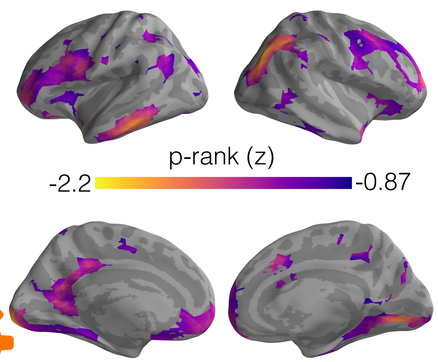
Classification



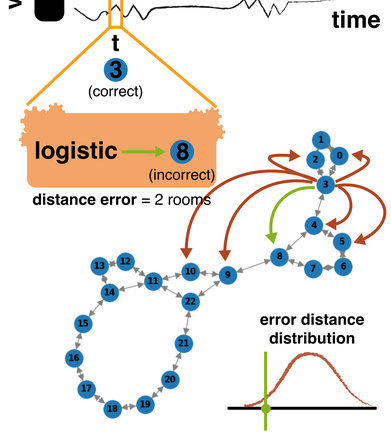
method



"fuzzy" classification



"fuzzy" method



percentile rank (p-rank) = P(X < distance error)

Takeaways

Classification

- strongest room decoding regions are not the strongest object decoding regions
- posterior medial regions strongly involved in classifying rooms

Fuzzy Classification

- awards points to regions for getting close to correct classification
- frontal cortex + parietal + visual regions make near-correct misses

rooms / objects

- visual regions involved: mentalizing room walk and objects may require imagery during free recall

Stimuli

23 rooms | 23 objects | 1.3s TRs | 25 participants

Next Steps

- leverage Hidden Markov Models to identify room-representations as strong ("tight") or weak compartments
- relate room-representations to objects
- identify hippocampal mediatory role

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