Overlap among neural representations of similar memories triggers repulsion in verbal recall

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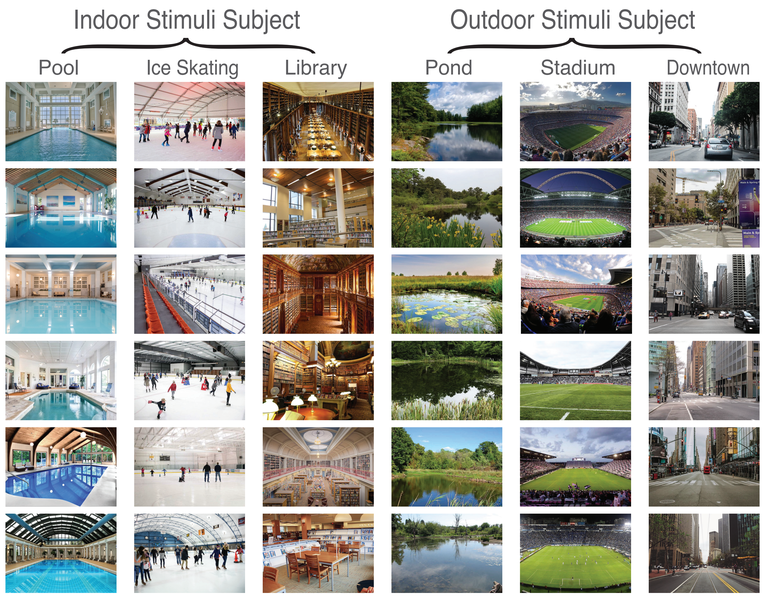
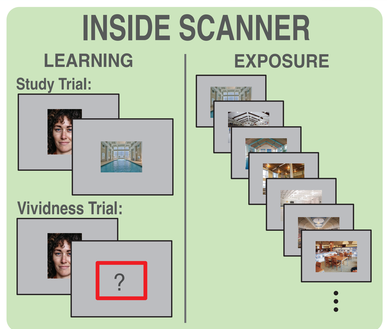
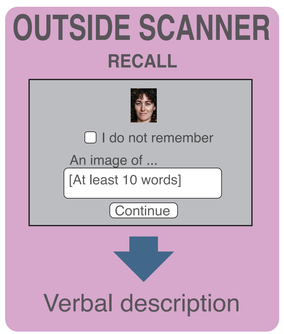
Introduction

- Highly similar events can trigger **repulsion** of corresponding memory representations[1,2]
- Repulsion has been observed in **hippocampal activity patterns (fMRI)**[1] and in **behavioral expressions of memory**[2,3,4]
- However, prior studies have not directly linked these measures
  - fMRI studies: complex, naturalistic scene images[1]
  - Behavior: simple, artificially-generated features (e.g., color)[2,3,4]
- In a preliminary behavioral experiment (see Poster C36), we used **Natural Language Processing (NLP)** to quantify verbal recall of highly similar naturalistic scene images
  - Evidence for repulsion in verbal recall
- **Goal of current study**: Use fMRI and NLP to test for relationship between neural and behavioral representations of highly similar (competing) memories

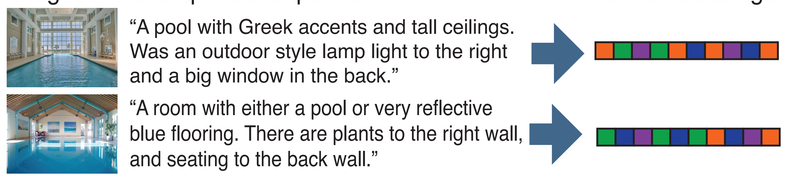
Methods

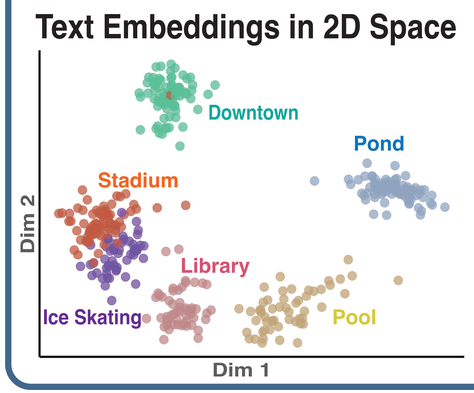


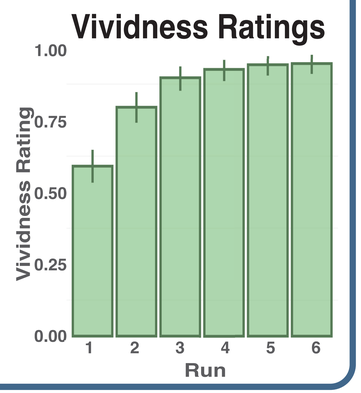




Behavioral Results

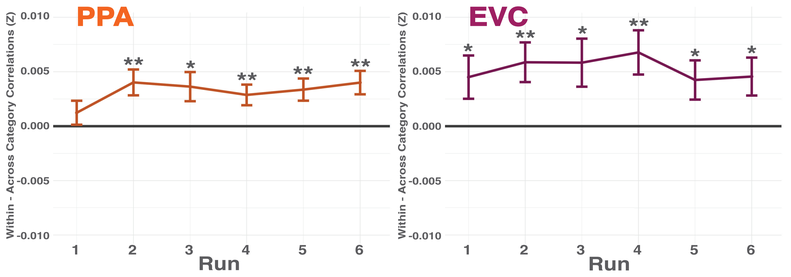




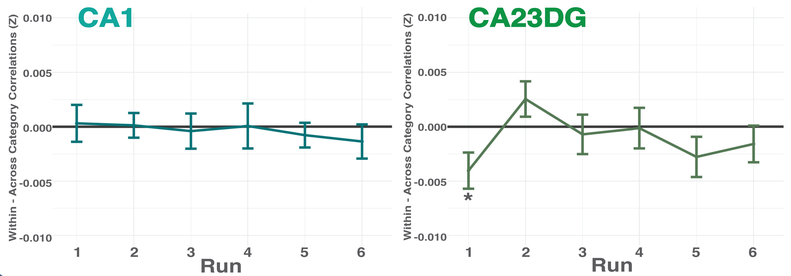


Representational Similarity

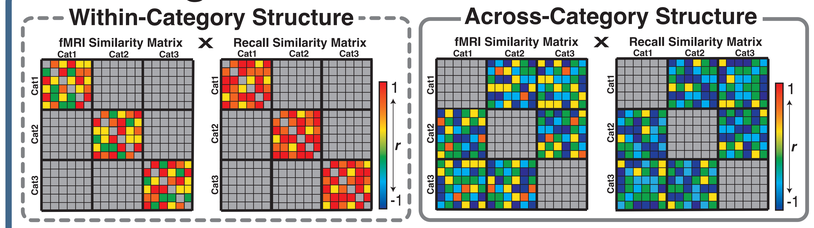
Pattern similarity in PPA and EVC is greater for stimuli *within* the same category than for stimuli *aross* categories



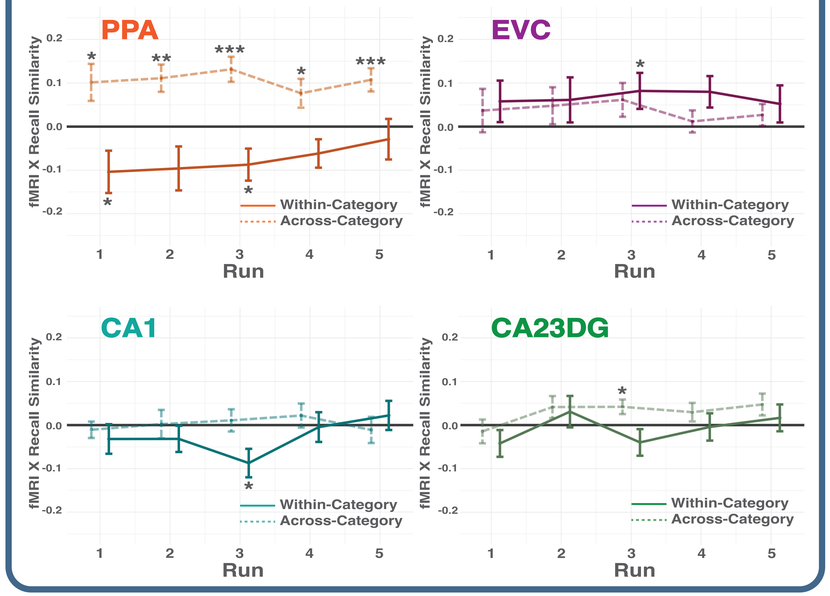
Pattern similarity in CA23DG tended to be lower for stimuli *within* the same category (consistent with repulsion)



Relating fMRI and Recall Structure



Within-category structure in PPA negatively correlated with within-category structure of subsequent verbal recall



Summary

- PPA and EVC activity patterns reflected similarity between visual categories (within-category similarity > across-category similarity)
- CA23DG tended to *invert* the representational structure in PPA/EVC, consistent with repulsion
- Within-category structure in PPA during learning was *negatievly related* to the structure of subsequent verbal recall
  - Suggests that PPA indexed fine-grained similarity between scenes, which in turn triggered repulsion in verbal recall

References

[1] Wanjia G, Favila SE, Kim G, Molitor RJ, Kuhl BA. Nature Communications. 2021 Aug 10; 12(1):4816. [2] Zhao Y, Chanales AJH, Kuhl BA. J Neurosci. 2021 Mar 31;41(13):3014-3024. [3] Chanales AJH, Tremblay-McGaw AG, Drascher ML, Kuhl BA. Psychol Sci. 2021 May;32(5):705-720. [4] Drascher ML, Kuhl BA. Psychon Bull Rev. 2022 Oct;29(5):1898-1912.

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