



Predictive models can learn the spatial transformation of fMRI activity patterns from perception to memory retrieval



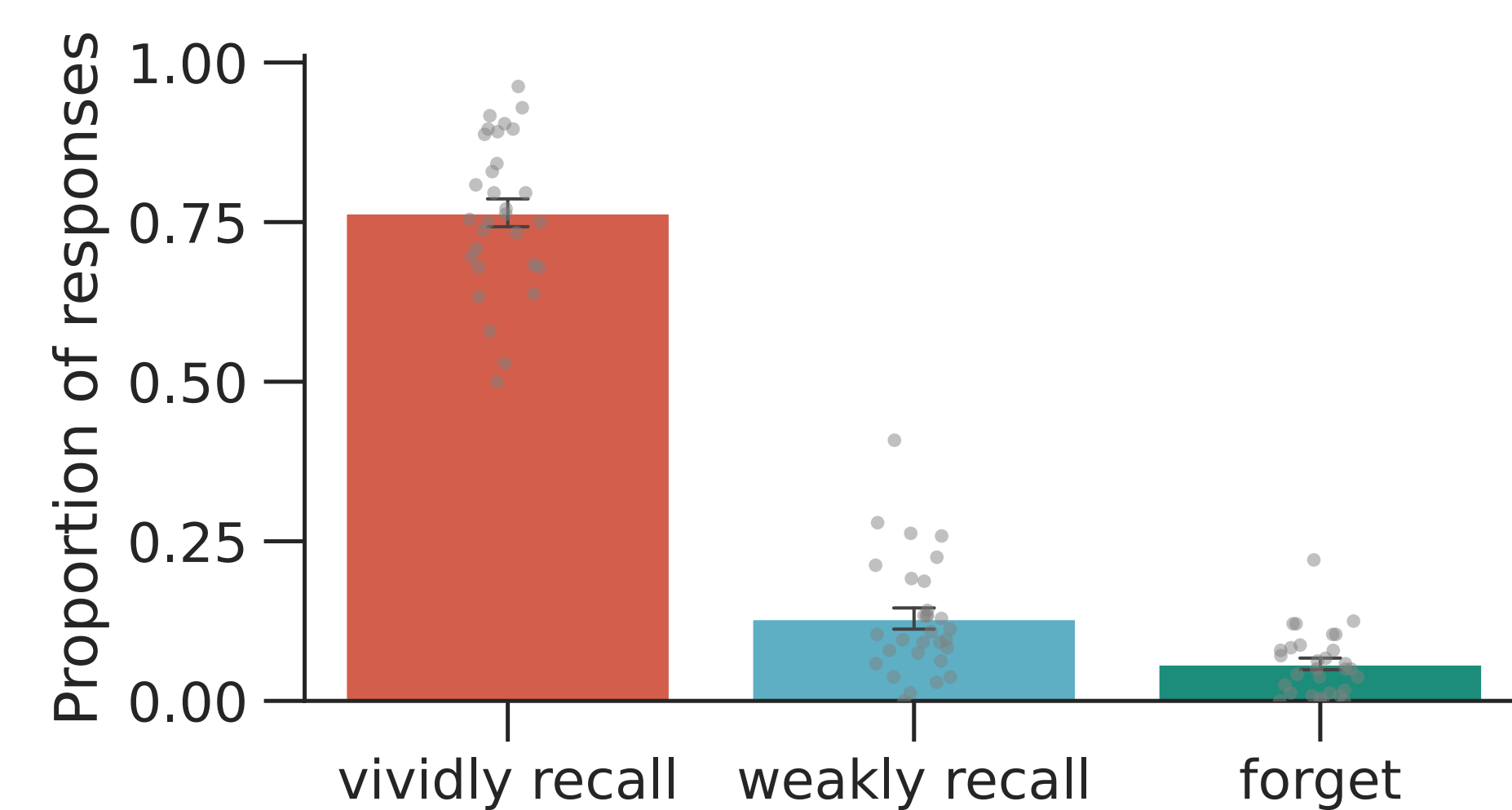
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Introduction

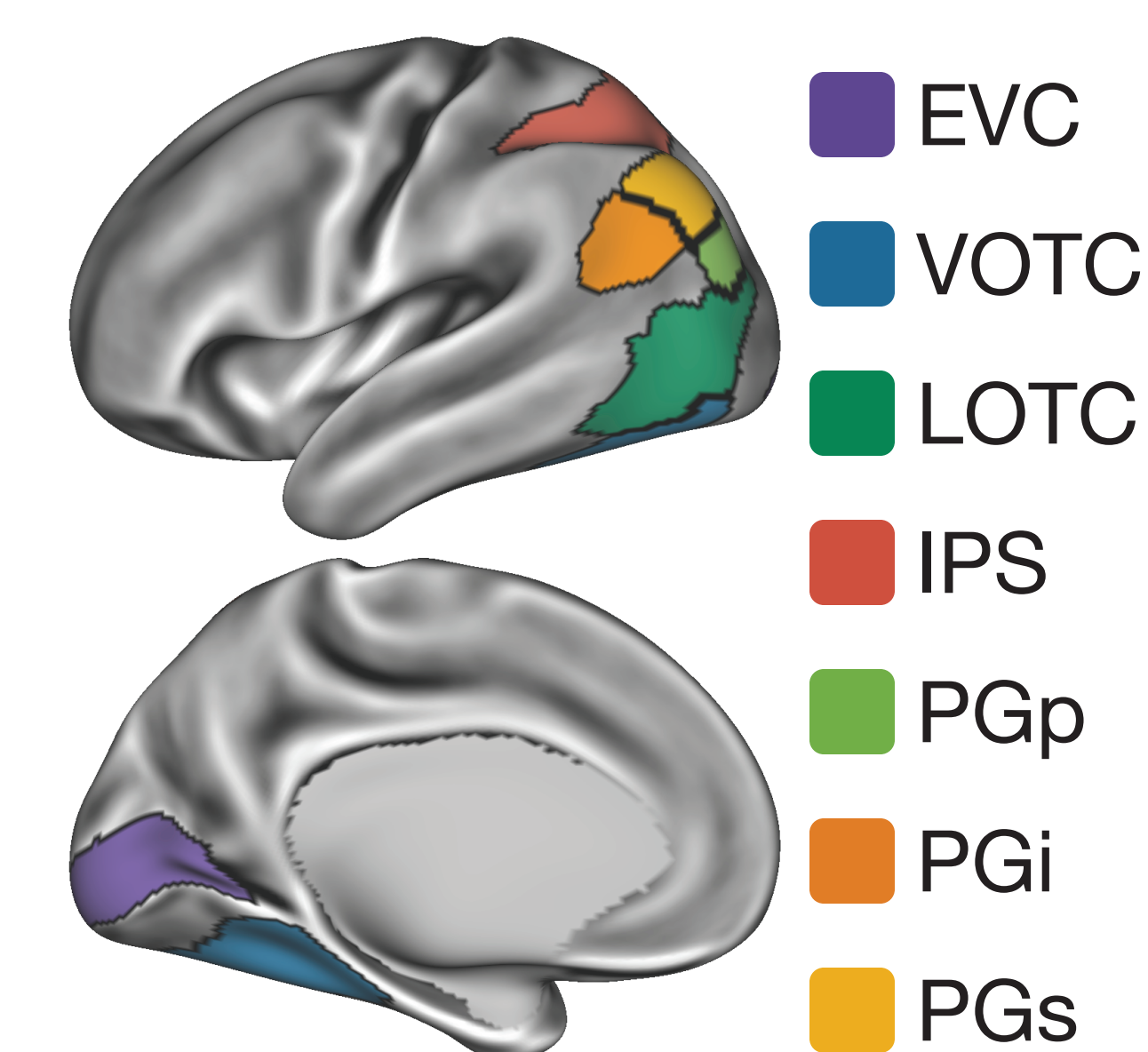
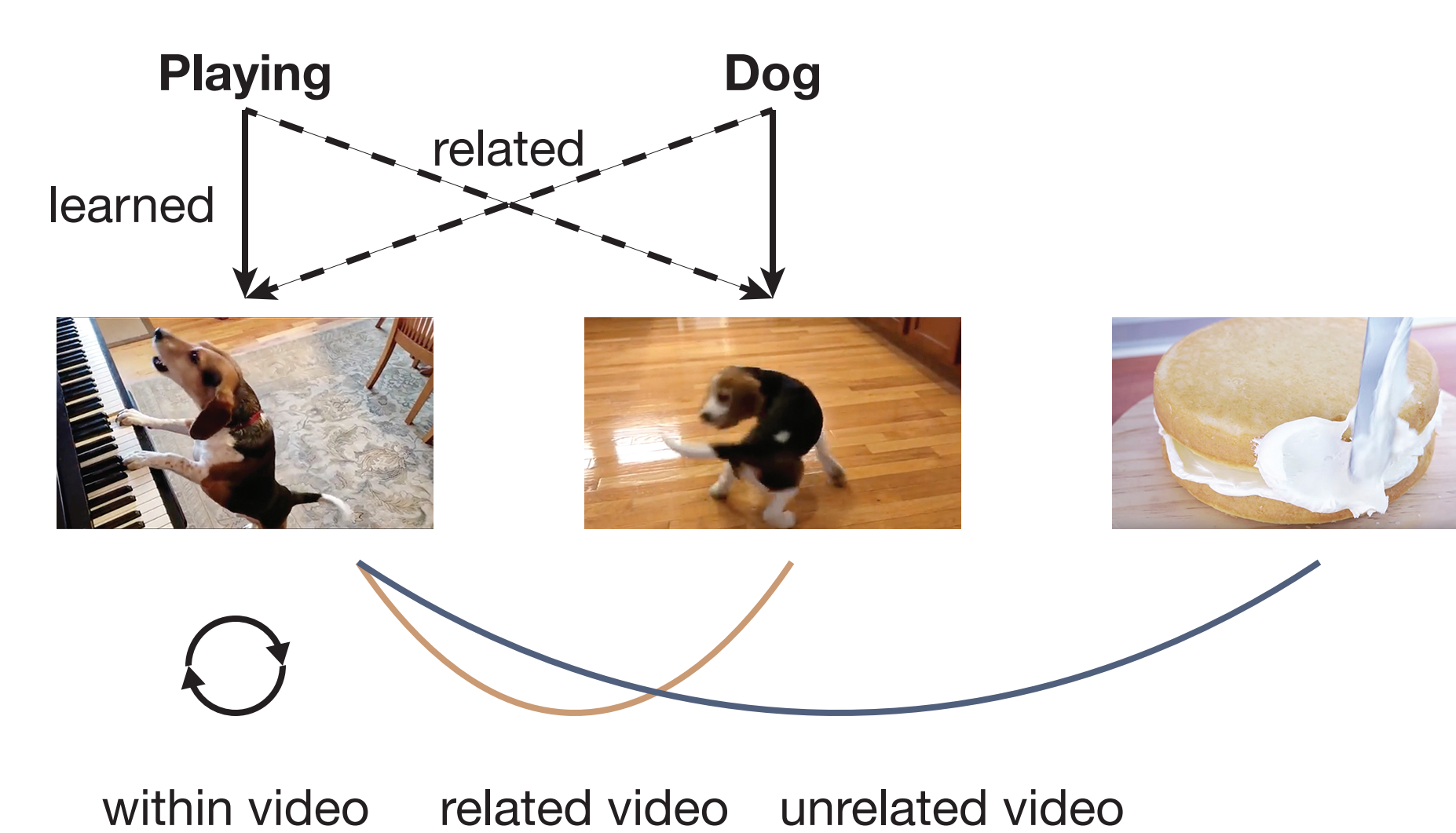
- Remembering an event from the past involves the reinstatement of initial perceptual experiences.
- Common neural measurements of reinstatement only test for the match between perception and memory retrieval.
- Recent studies indicate systematic differences in the brain regions that code for perception vs. memory^{[1][2]}.
- Whereas visual cortical areas are biased toward visual perceptual information, parietal cortex exhibits the opposite bias: stronger representations when information is retrieved from memory than when it is perceived^{[3][4]}.

Can the **transformation of individual memories** from perception (visual cortex) to memory retrieval (parietal cortex) be **predicted**?

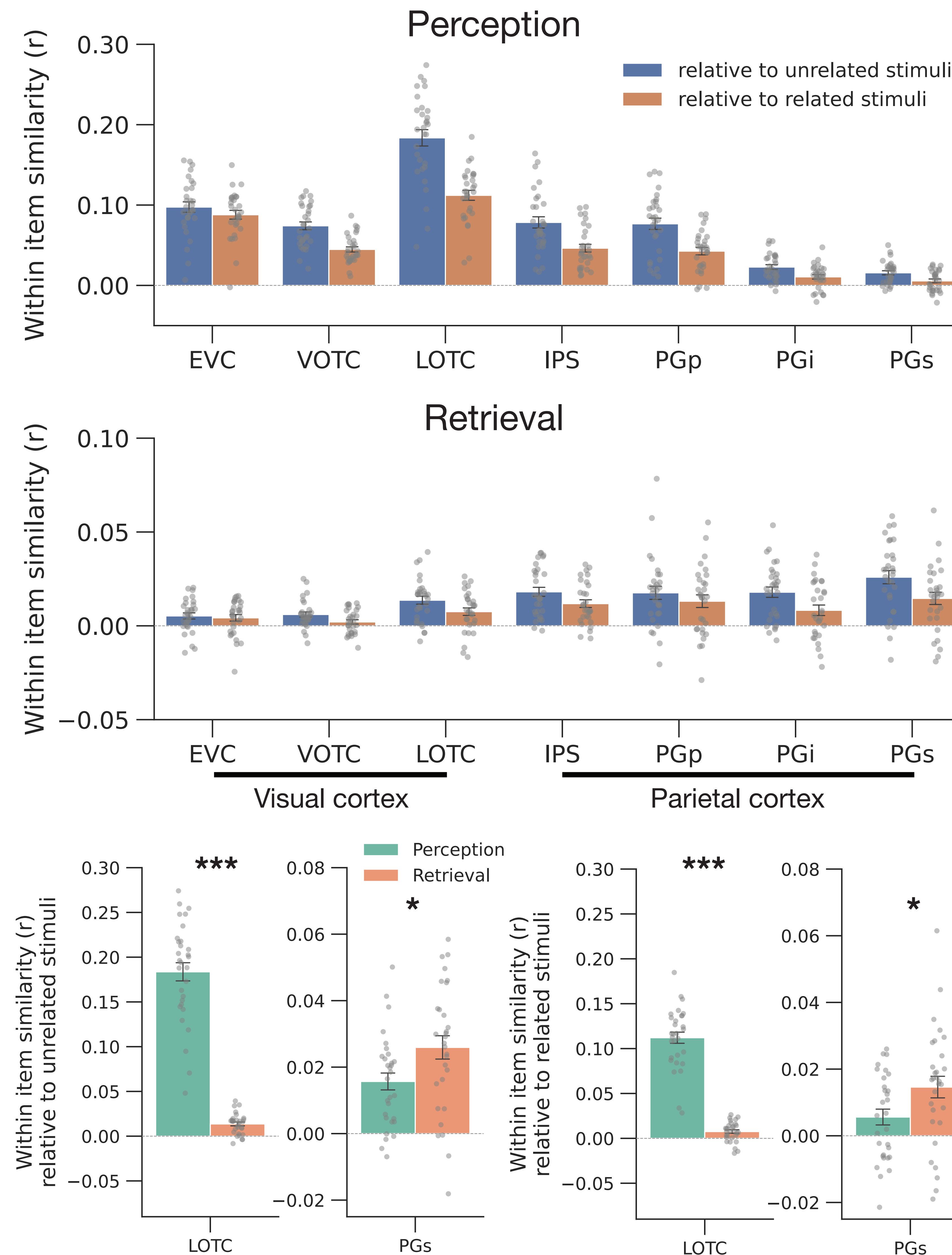
Design & behavior



- N=30
- 80 video stimuli
- Functional scan: 2mm isotropic resolution; TR=1.5s
- fMRI data preprocessed with fMRIPrep, then projected to the fsLR (32k) surface space



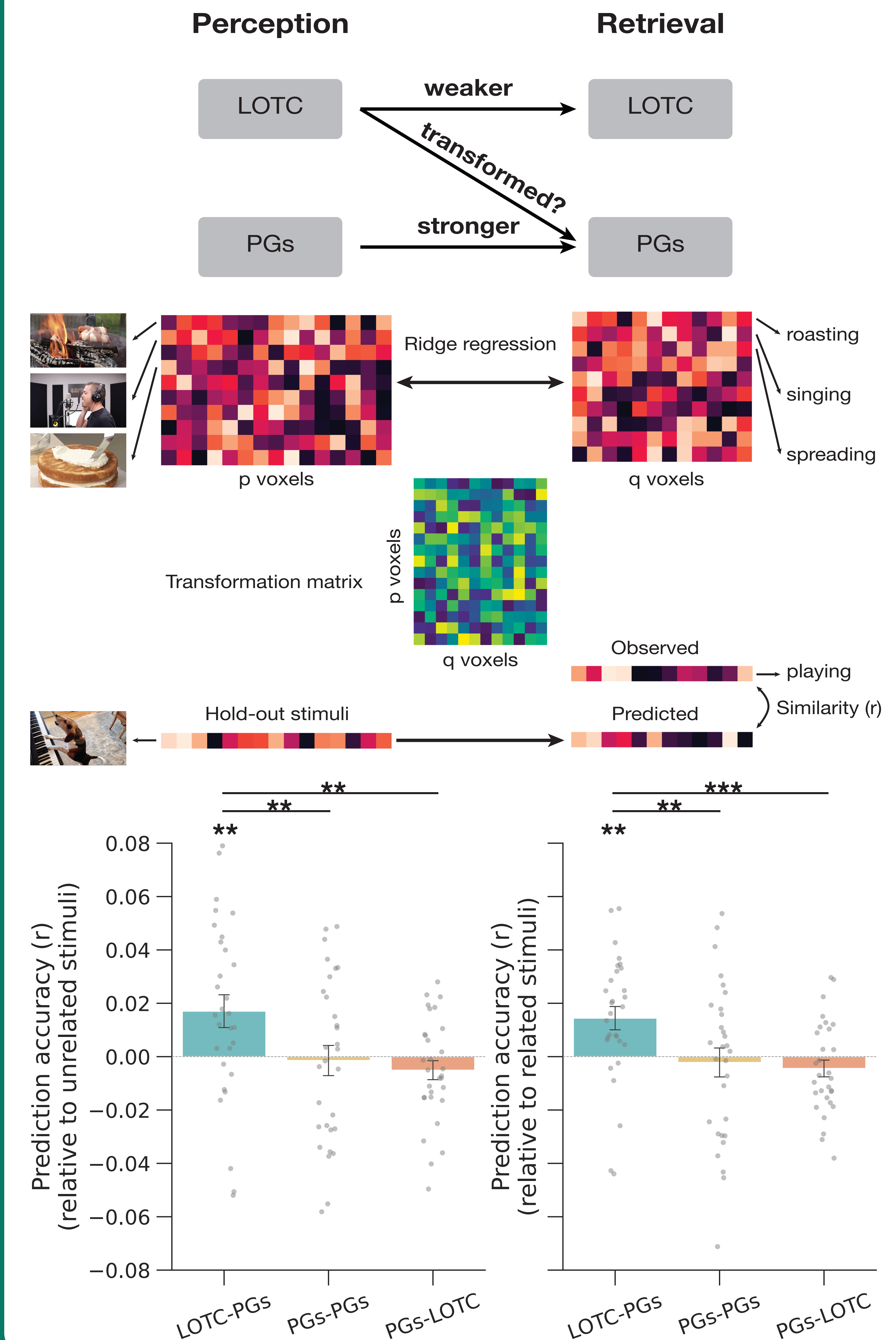
Item specificity



Summary

- Stimulus-specific representations were relatively stronger in visual cortex during perception and relatively stronger in parietal cortex during memory retrieval.
- Predictive models revealed that activity patterns in parietal cortex during memory retrieval could be reliably predicted from corresponding activity patterns in visual cortex during perception.
 - Generalized to unseen stimuli
- The transformation model (visual \rightarrow parietal cortex) outperformed within-region models (parietal \rightarrow parietal).
- Our findings are consistent with the idea that memory representations are a transformed version of their perceptual representations^{[5][6]}.

Predictive model



References:

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- [3] Xiao, X., Dong, Q., Gao, J., Men, W., Poldrack, R. A., & Xue, G. (2017). Transformed Neural Pattern Reinstatement during Episodic Memory Retrieval. *J. Neurosci.*
- [4] Favila, S. E., Samide, R., Sweigart, S. C., & Kuhl, B. A. (2018). Parietal Representations of Stimulus Features Are Amplified during Memory Retrieval and Flexibly Aligned with Top-Down Goals. *J. Neurosci.*
- [5] Favila, S. E., Lee, H., & Kuhl, B. A. (2020). Transforming the Concept of Memory Reactivation. *Trends Neurosci.*
- [6] Xue, G. (2022). From remembering to reconstruction: The transformative neural representation of episodic memory. *Prog. Neurobiol.*

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