Adaptive Memory Biases Revealed by Verbal Recall of Highly Similar Naturalistic Scene Images

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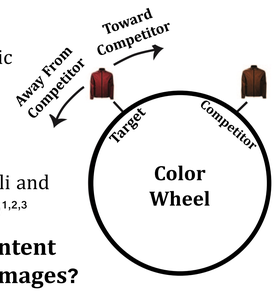
Background

- Memory similarity results in competition and interference-related forgetting
- To overcome interference, memory for diagnostic features of similar experiences become exaggerated[1,2,3]
- Exaggeration of diagnostic features reflects an *adaptive memory bias*
- Prior work has been limited to controlled stimuli and targeted reporting procedures (e.g., color wheel)[1,2,3]



Are there adaptive biases in memory content during verbal recall of naturalistic scene images?

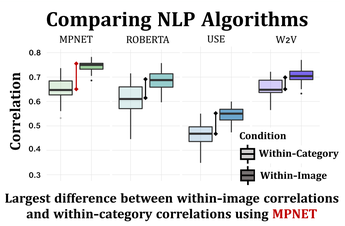
Natural Language Processing

"An indoor pool with white columns and seats in the back."

NLP → Text Embedding

"A pool with sunlight coming through windows at the end."

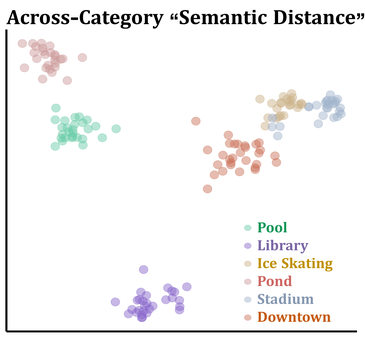
NLP → Text Embedding



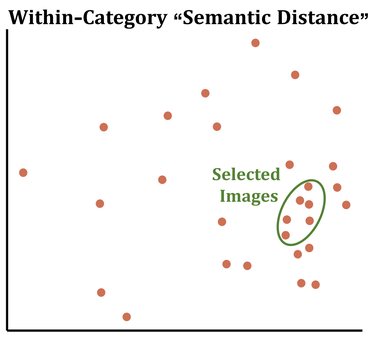
Largest difference between within-image correlations and within-category correlations using MPNET

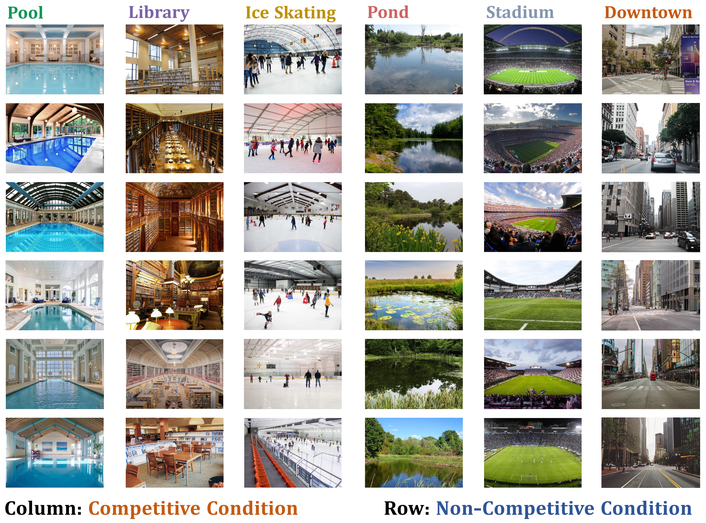
Selection of Stimuli

Across-Category "Semantic Distance"



Within-Category "Semantic Distance"



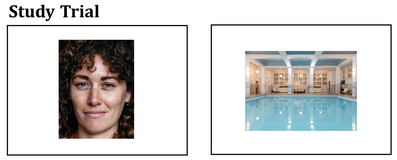


Column: Competitive Condition **Row:** Non-Competitive Condition

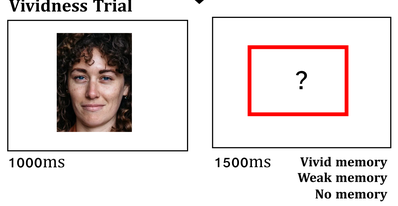
Over-Learning Paradigm (N = 120)

Learning Phase:

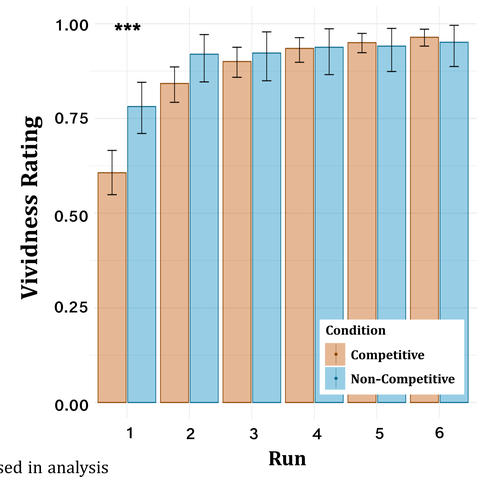
Study Trial



Vividness Trial



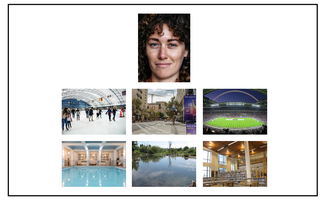
"Vividness" Over Learning



Post-Learning Phase:

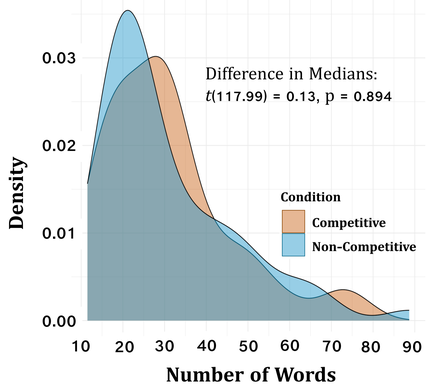
Written Recall Test

Multiple Choice Test*



*Only subjects with 100% multiple choice accuracy used in analysis

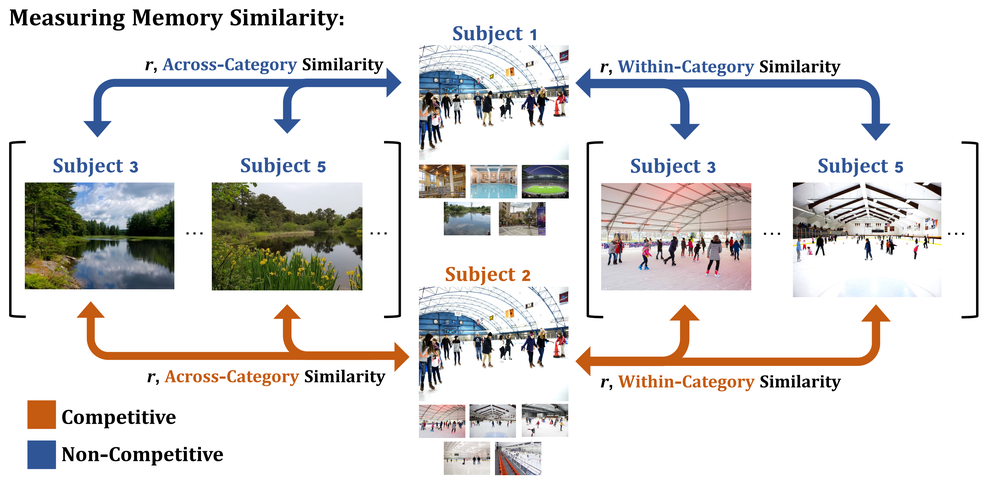
Number of Words Recalled



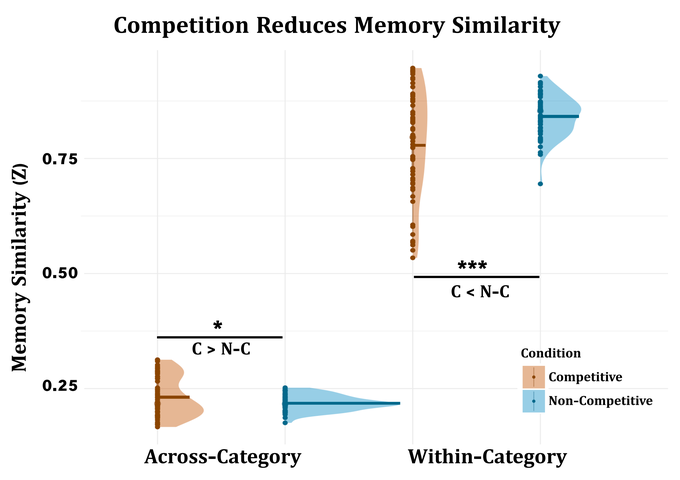
Representative Description Example: A large lake with a flat rock on the bottom left, algae near the top as well as trees surrounding the lake.

Reduced Similarity in Verbal Recall of Highly Similar Scenes

Measuring Memory Similarity:

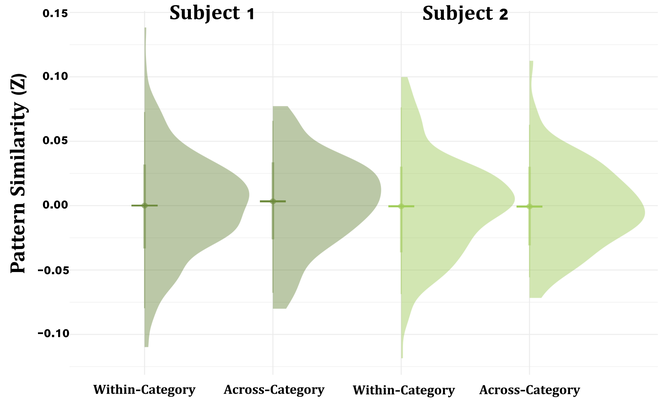


Competition Reduces Memory Similarity



Preliminary fMRI Data

Goal: Relate Variability in Hippocampal Pattern Similarity to Exaggeration of Verbal Recall



Summary

- Diagnostic features of similar scene stimuli are exaggerated during verbal recall, as measured using Natural Language Processing algorithms
- Competition specifically increases the distance between images in the *same* category – opposite to an interference or confusion effect
- Natural Language Processing (NLP) can be used to quantify overlap in verbal recall for naturalistic scene stimuli
- Future work will model the relationship between memory content and hippocampal repulsion[1,2,3,4,5] and/or content representations in parietal cortex[3]

References

[1] Chanales AJH, Tremblay-McGaw AG, Drascher ML, Kuhl BA. Psychol Sci. 2021 May;32(5):705-720. **[2]** Drascher ML, Kuhl BA. Psychon Bull Rev. 2022 Oct;29(5):1898-1912. **[3]** Zhao Y, Chanales AJH, Kuhl BA. J Neurosci. 2021 Mar 31;41(13):3014-3024. **[4]** Hulbert JC, Norman KA. Cereb Cortex. 2015 Oct;25(10):3994-4008. **[5]** Wammes J, Norman KA, Turk-Browne N. Elife. 2022 Jan 6;11:e68344.

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