Searching memory in time and space

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Introduction

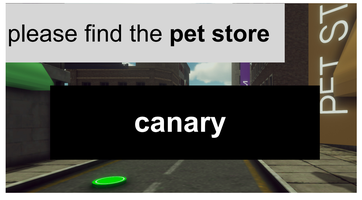
- Memory retrieval is clustered in time (Kahana et al. 1996) and space (Miller et al. 2013).
- Traditional memory studies test retrieval of word lists, with items having only temporal context. Studying retrieval of items encoded within a spatiotemporal context more closely mimics the organization of naturalistic memories.
- Traditional word list studies demonstrate increased theta, decreased alpha, and increased gamma band activity when an item will later be remembered in scalp EEG (Long et al. 2014).
- We aim to replicate findings of temporal & spatial clustering of memory retrieval in a naturalistic task environment that manipulates spatiotemporal context.
- We aim to analyze frequency fluctuations in scalp EEG to observe whether the introduction of spatial context in memory tasks results in similar neural markers of memory.

Task Design

Delivery Day

Navigation

Word Presentation



Repeat for 15 items

Free Recall

Please speak now

Cued Recall

Session

5 Delivery Days

Navigation/Word Presentation → Free Recall → Cued Recall

Cumulative Free Recall

Please recall items from the previous 5 delivery days

+

5 Delivery Days

Navigation/Word Presentation → Free Recall → Cued Recall

Cumulative Free Recall

Please recall items from the previous 5 delivery days

Town Layout

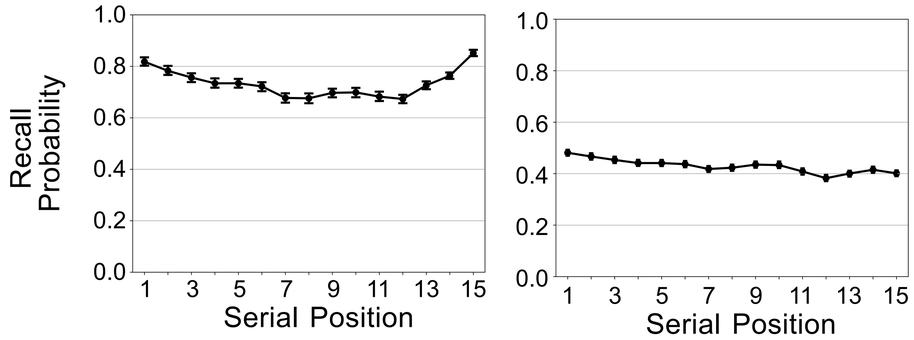
Subjects

- N = 22
- Subjects contributed between 4 & 8 sessions
- 129 sessions included in analyses

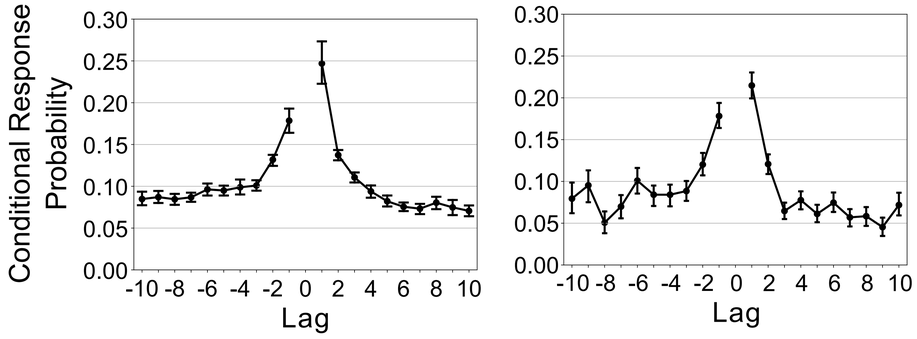
Behavioral Analyses

Free Recall | Cumulative Free Recall

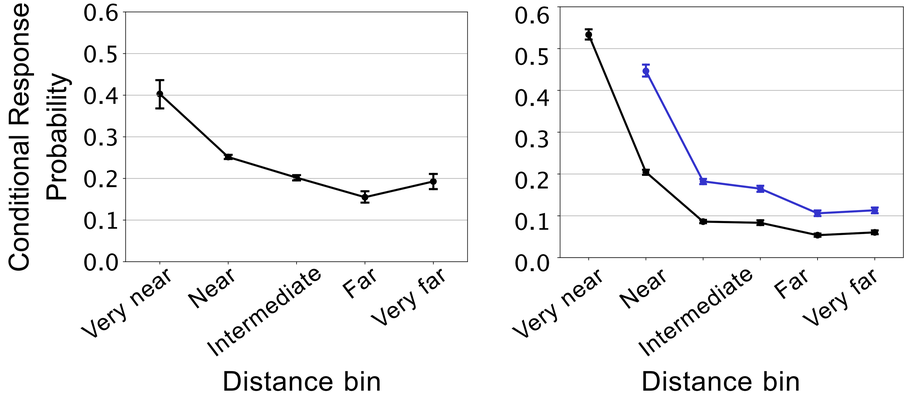
Serial Position Effect



Temporal Clustering

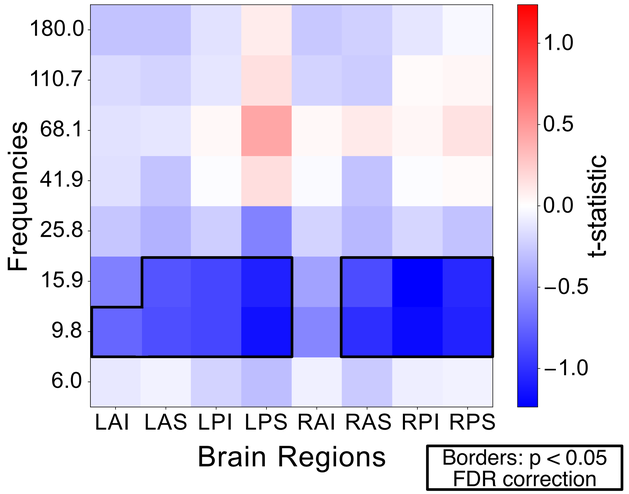


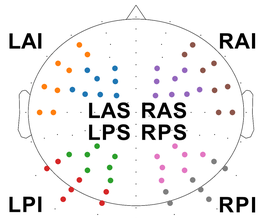
Spatial Clustering



Neural Analysis

Subsequent Memory Effect





Summary & Conclusions

- Evidence of strong spatial & temporal clustering in a task requiring spatial & episodic memory search
- Pattern of neural activity for remembered vs. forgotten items similar to traditional word list tasks

References

1. Miller, J. F., Lazarus, E., Polyn, S. M., & Kahana, M. J. (2013). Spatial clustering during memory search. Journal of Experimental Psychology: Learning, Memory and Cognition, 39 (3), 773–781.
2. Kahana, M. J. (1996). Associative retrieval processes in free recall. Memory & cognition, 24(1), 103-109.
3. Long, N. M., Burke, J. F., & Kahana, M. J. (2014). Subsequent memory effect in intracranial and scalp EEG. Neuroimage, 84, 488-494.

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