

Background and Motivation

- Evidence shows that medial temporal lobe (MTL) theta band power relates to both semantic and temporal organization of recalled memories (Solomon et al., 2019).
- However, the role of MTL theta in explicit categorical organization of memories, and the potential interaction between categorical clustering and temporal clustering of retrieval, has not yet been examined.
- Specifically, how does MTL theta relate to retrieval of items in the same category (semantically similar), while controlling for the items' similar temporal contexts?**

Methods - Categorized Free Recall Task

- We used a categorical free recall task performed by patients with epilepsy with implanted electrodes

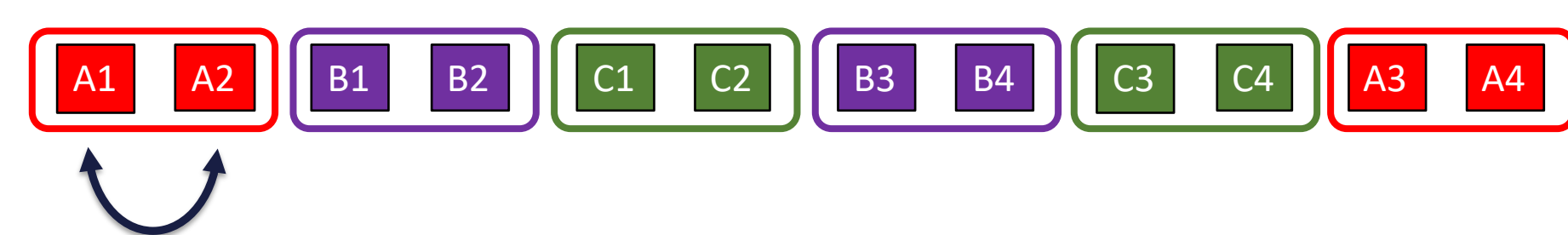


Example

Refrigerator Oven Grater Strainer Skirt Shirt Ladle Whisk Shoes Jeans Washer Freezer

- Specifically we marked transitions between successively recalled words, and measured **theta (4-8 Hz) power in the MTL in the 1 second preceding vocalization of both recalled words.**

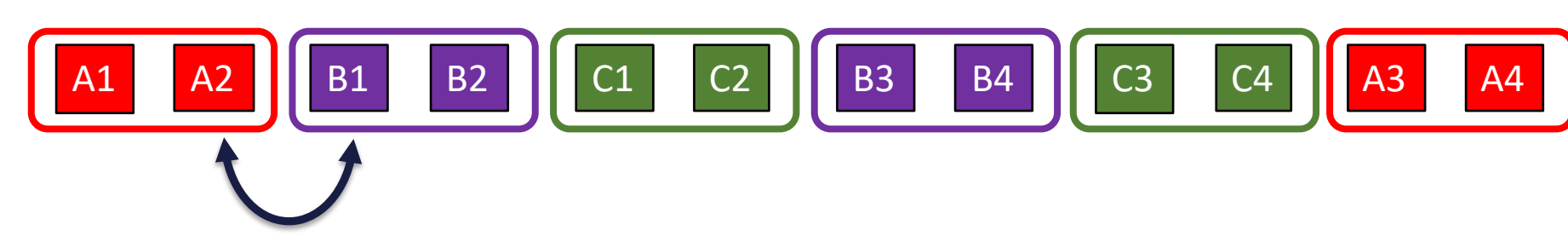
Adjacent Same-Category



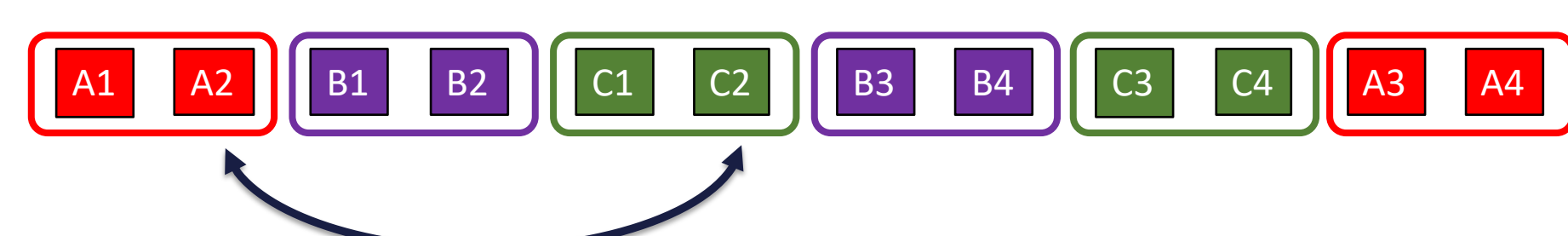
Non-adjacent Same-Category



Adjacent Different-Category

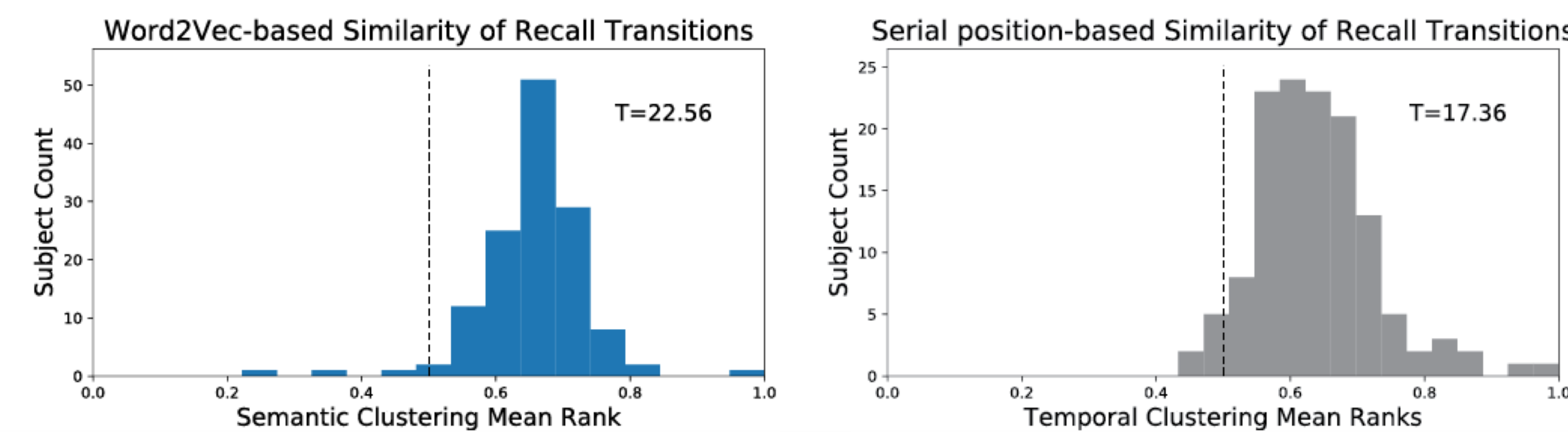


Non-adjacent Different-Category

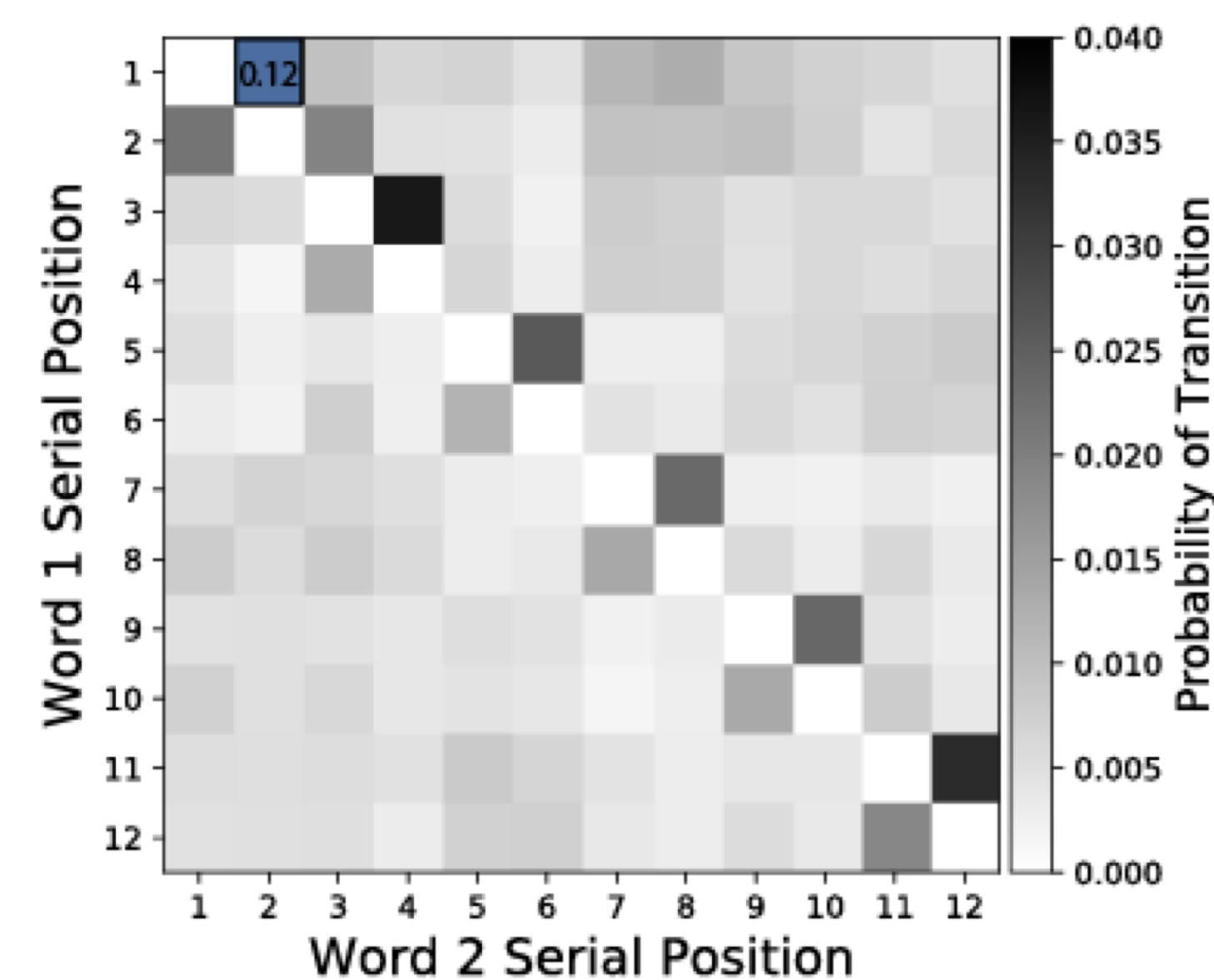


Semantic and Temporal Clustering of Retrieval

Subjects recall words together that are **semantically and temporally similar**



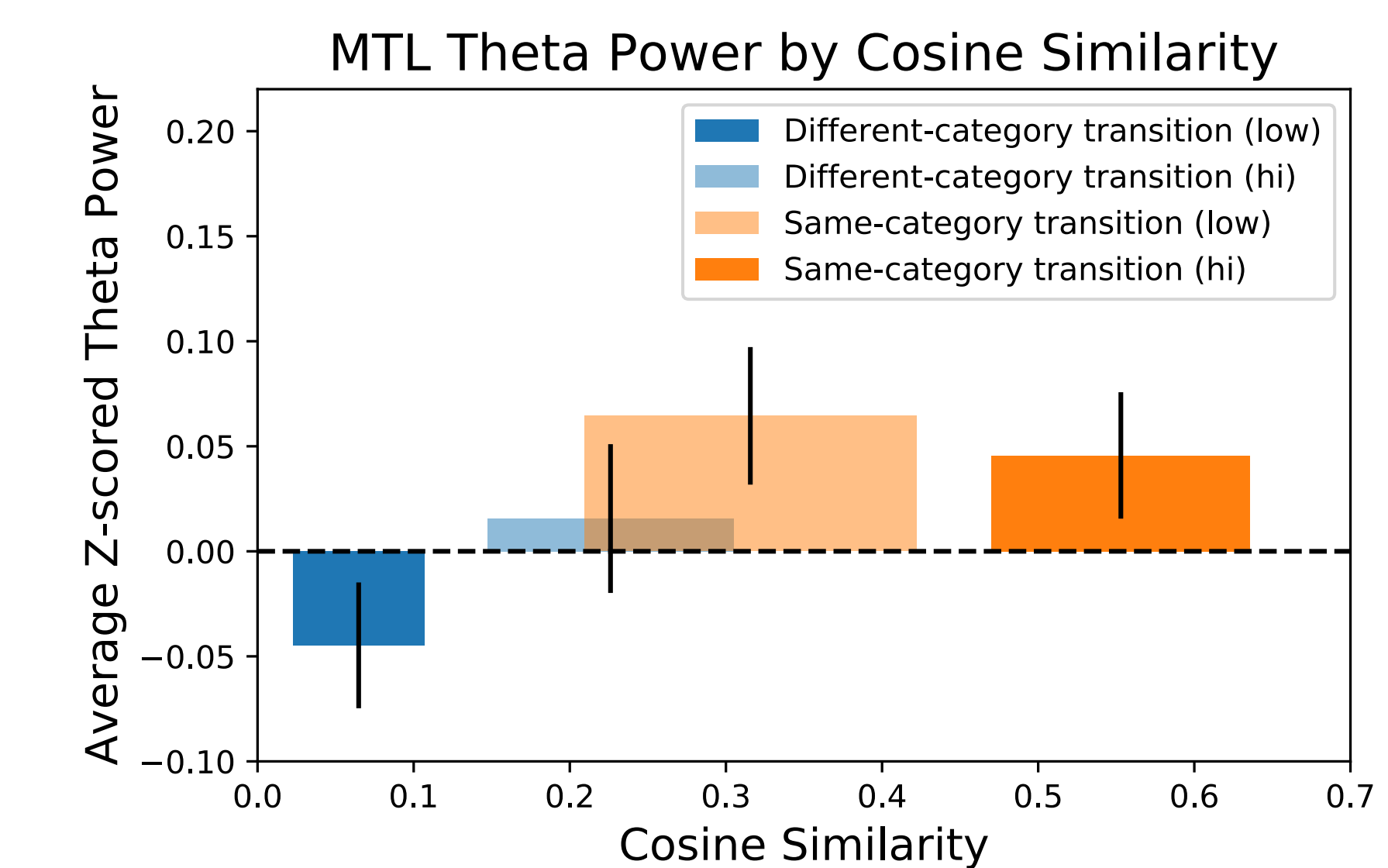
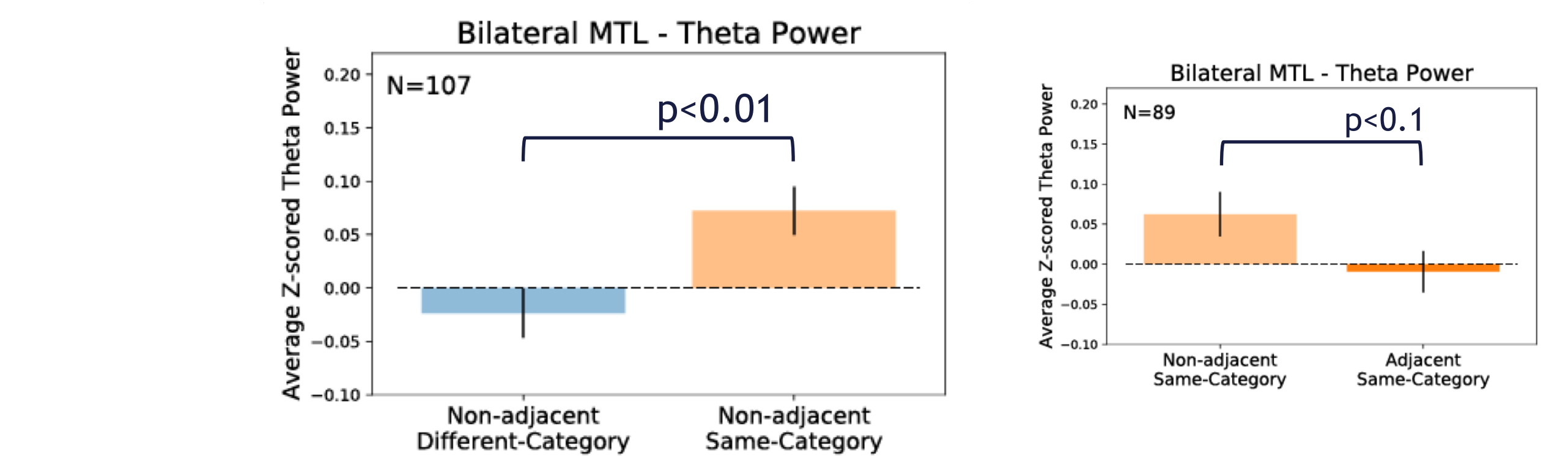
Serial Positions of Transitions



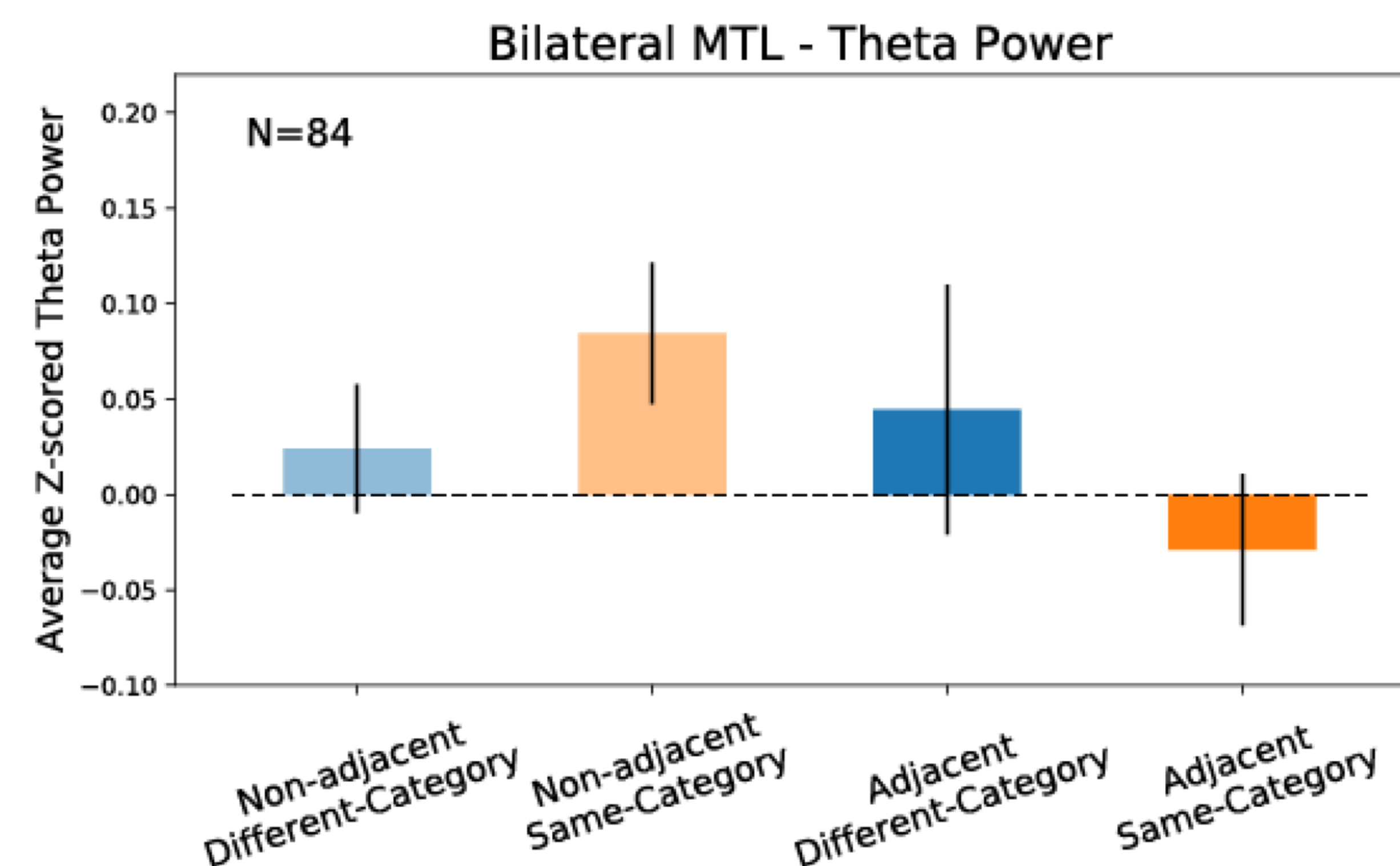
Category pairs are recalled together, more often in the forward direction

Theta Power Increases before Non-adjacent Same-Category Transitions

Theta power in the MTL is greater prior to same-category transitions, but only for non-adjacently encoded words



Theta Power Preceding Different Transition Types



Summary

- Theta band power in the MTL increases before retrieval of semantically similar words, relative to words that are from different categories.
 - However, this effect is not observed for same-category words that were encoded in adjacent serial positions.
- These results suggest two hypotheses:
 - Semantic category-related context is coded in part by MTL theta oscillations
 - Same-category words encoded consecutively are retrieved during recall as a single memorandum rather than two separate items.

References

Solomon, E. A., Lega, B. C., Sperling, M. R., & Kahana, M. J. (2019). Hippocampal theta codes for distances in semantic and temporal spaces. *Proceedings of the National Academy of Sciences of the United States of America*, 116(48), 24343–24352.