

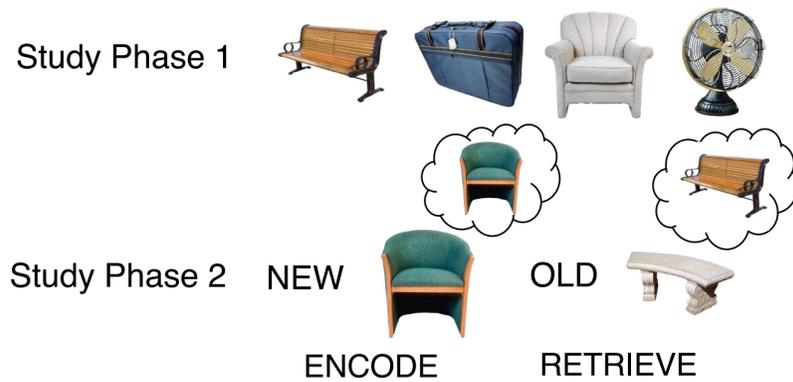
Introduction

- Theta fluctuations in the hippocampus dissociate memory encoding and memory retrieval Hasselmo et al, 2002
- Cortical activity can be used to distinguish encoding and retrieval on sub-second time scales Long & Kuhl, 2019; 2021

Question

What features underlie the cortical dissociation between memory encoding and memory retrieval?

Mnemonic State Task



General Methods

- 100 participants
- 2000ms/stimulus
- 18 stimuli/ study phase
- 6 - 12 experimental runs
- Memory post test
- 63 electrodes

Resting State Task

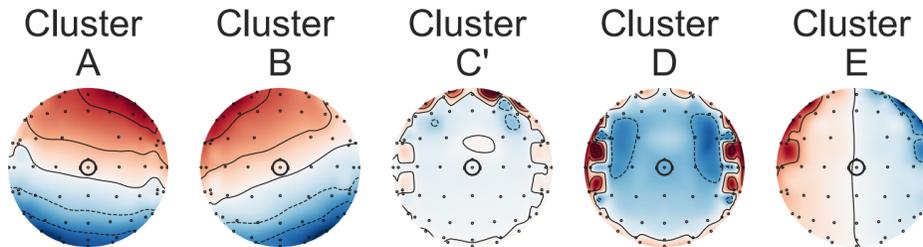
- 8 blocks
- Audio cues
- Eyes closed/open
- Left/right saccades
- Up/down saccades
- Blinks

General Approach

Identification of **microstates**: global patterns of scalp topography
Frontoparietal power connectivity in low frequencies

Default Mode microstate dissociates encoding and retrieval

Five microstate 'clusters' were identified in the resting data

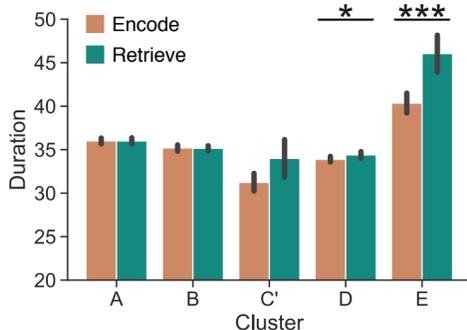


- A: auditory network
- B: visual network
- C': saliency network
- D: dorsal attention network
- E: default mode network

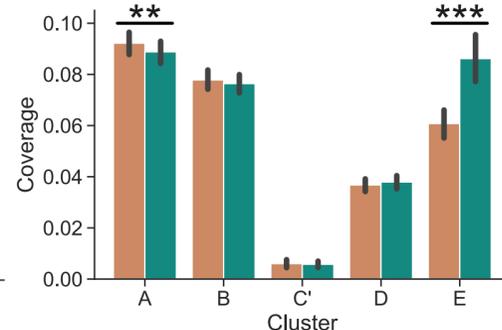
Microstate Methods

- K-means clustering applied to whole-brain voltage data to identify microstates
- Pearson correlation between identified clusters and mnemonic task data at each time point

Duration: How long (in ms) a microstate persists



Coverage: Percentage of total trial time a microstate occurs



Retrieve trials are characterized by longer durations of Clusters D and E, less coverage of Cluster A, and greater coverage of Cluster E

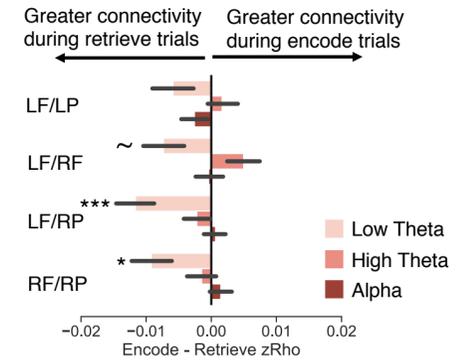
Summary

- Longer duration and greater coverage of Microstate E, putative Default Mode Network cluster, during retrieval compared to encoding
- Elevated frontoparietal low theta power connectivity during retrieval
- Posterior regions show consistent low theta power connectivity across the stimulus interval during retrieval
- Anterior regions show temporal dissociations in connectivity across the stimulus interval

Frontoparietal connectivity differences during encoding vs. retrieval

Power Connectivity Methods

- Low theta (3-4Hz), high theta (6-8Hz), alpha (10-14Hz) power at each time point in the mnemonic state task
- Trial-level Pearson correlation across time points between electrode pairs in two regions
- Average zRho value across all electrode pairs

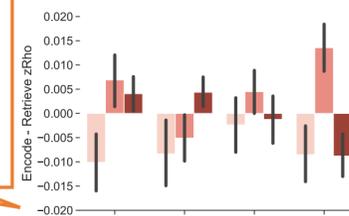


~ p < 0.1 * p < 0.05 *** p < 0.001

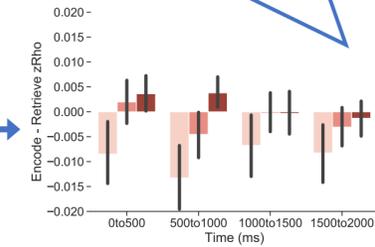
Greater low theta frontoparietal connectivity for retrieve compared to encode trials

Changes in power connectivity over time

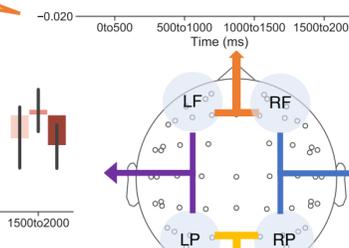
Elevated high theta connectivity late in the interval during encoding



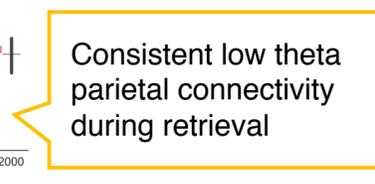
Consistent low theta right hemisphere connectivity across the trial during retrieval



Minimal left hemisphere connectivity changes across the interval



Consistent low theta parietal connectivity during retrieval



References

Custo, A., Van De Ville, D., Wells, W. M., Tomescu, M. I., Brunet, D., & Michel, C. M. (2017). Electroencephalographic Resting-State Networks: Source Localization of Microstates. *Brain Connectivity*, 7(10), 671-682.
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