

Long-term Memory-guided Attention & Alpha-band Oscillations: Implicit Access to Spatial information

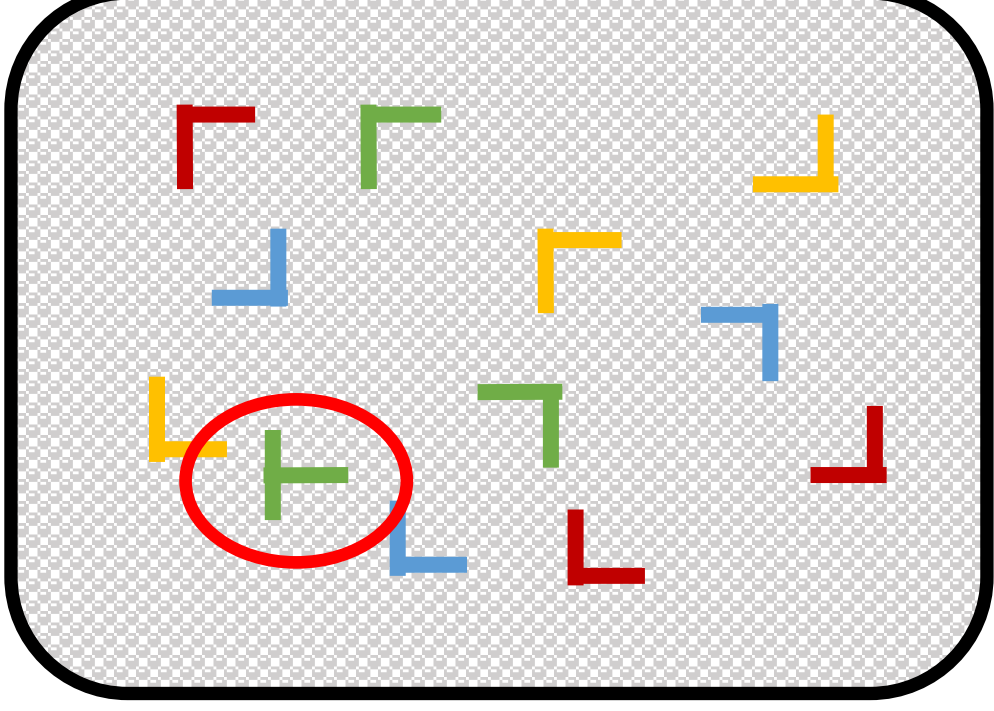


M. Fischer^{1,2}, M. Moscovitch^{1,2}, C. Alain^{1,2}

¹Rotman Research Institute, Baycrest ²Department of Psychology, University of Toronto, Toronto, Canada
Contact: mfischer@research.baycrest.org

Previous Literature

Configuration-target location association



- ✓ Target detected faster for old configurations vs. new configurations (Chun & Jiang, 1998).
- ✓ Target detected faster when participants **deliberately** associate sound-clip with tone location (right/left ear) (Zimmermann et al., 2017).

What is Missing?

- Does associative learning between context and target occur in naturalistic listening situations?
Absence of conscious recall ≠ implicit process

Aims:

1. Test whether incidental associations between tone and sound-clip can guide auditory attention.
2. Use EEG to index implicit processes involved in orienting attentional resources.

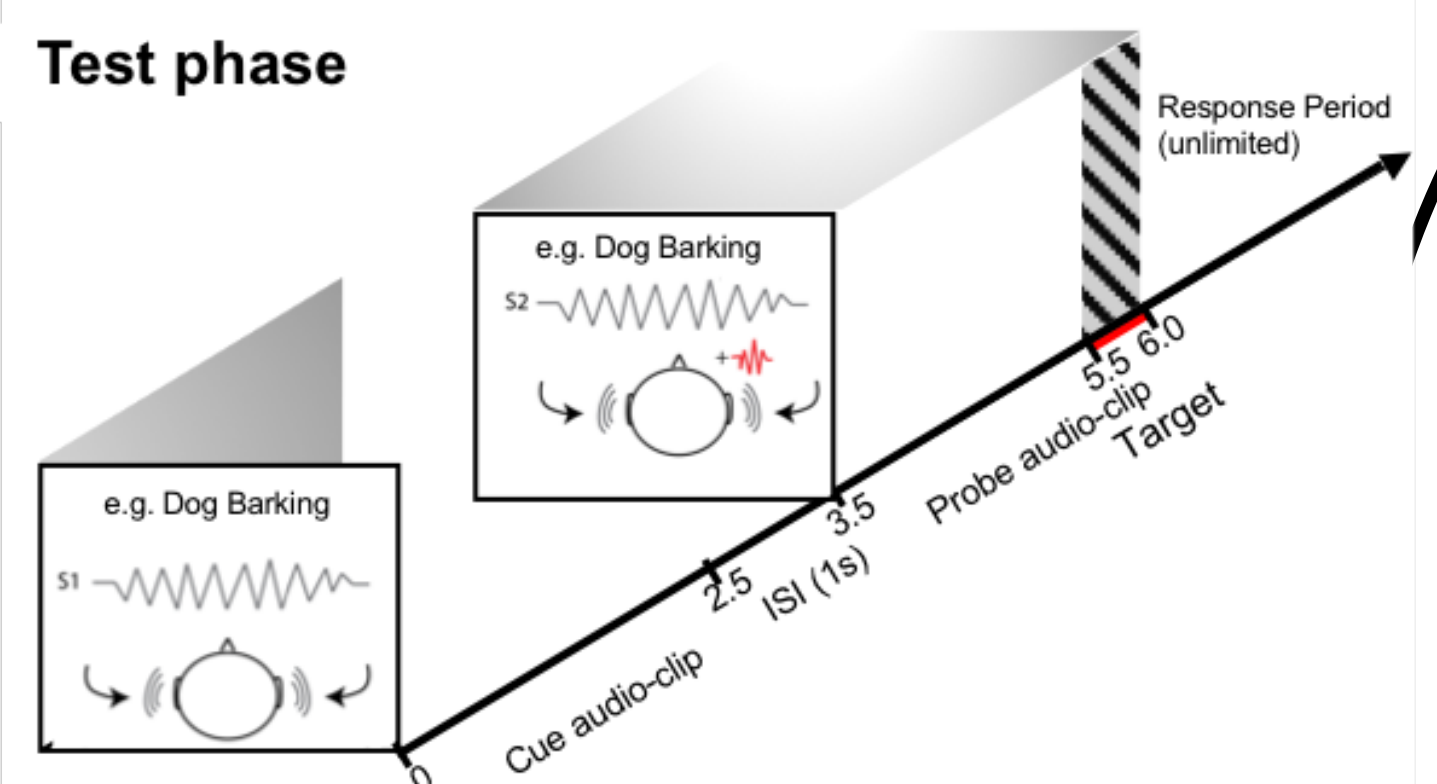
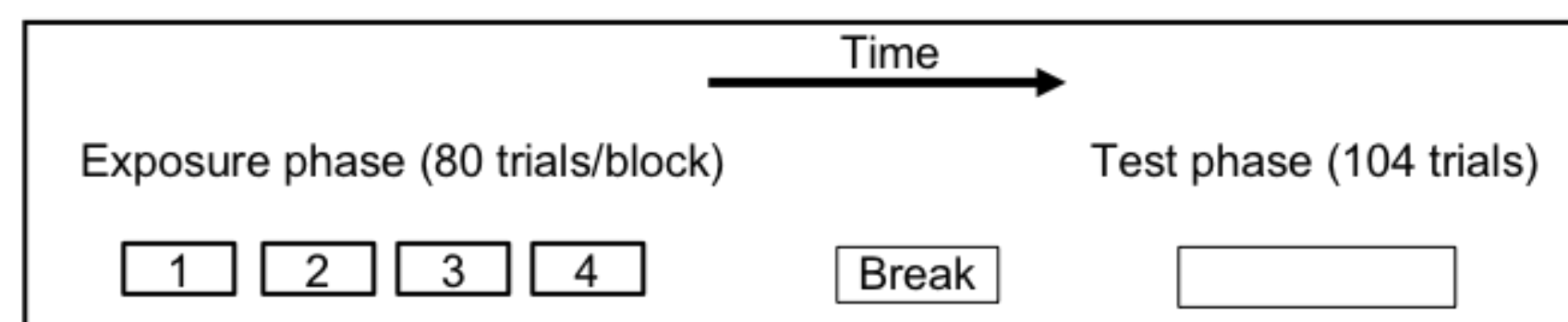
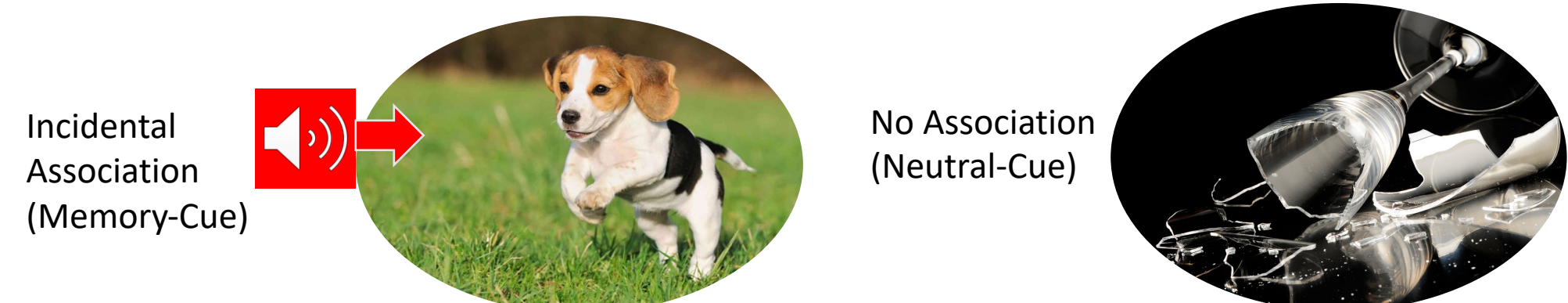
Methods

Stimuli

- 80 (old) & 20 (new) 'real-world' sound-clips
- Lateralized (right or left ear, or none) pure tone target embedded in clip

Participants (N=26)

- Normal hearing
- 18-35 yrs ($M = 26.1$ $SD = 4.3$)



Task

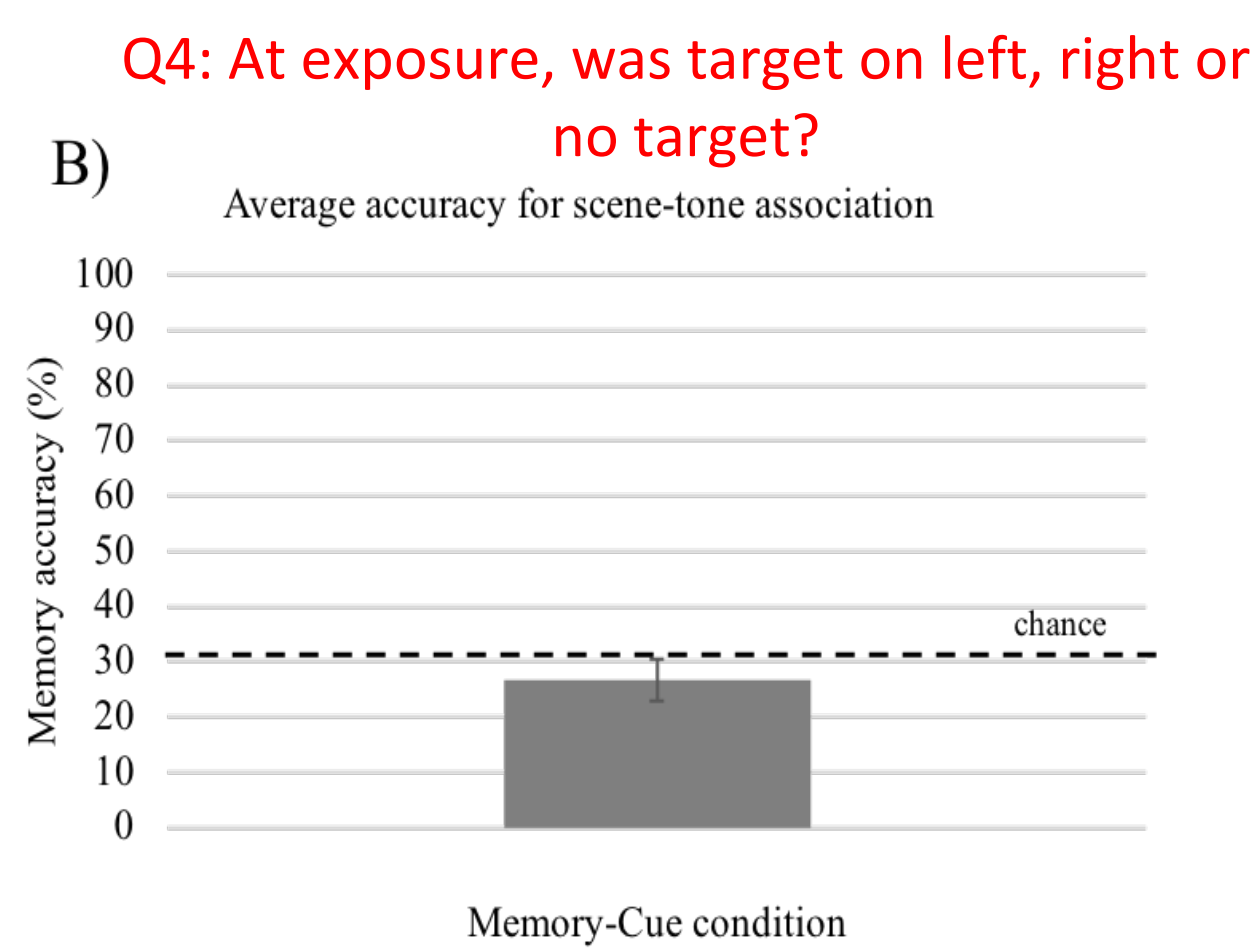
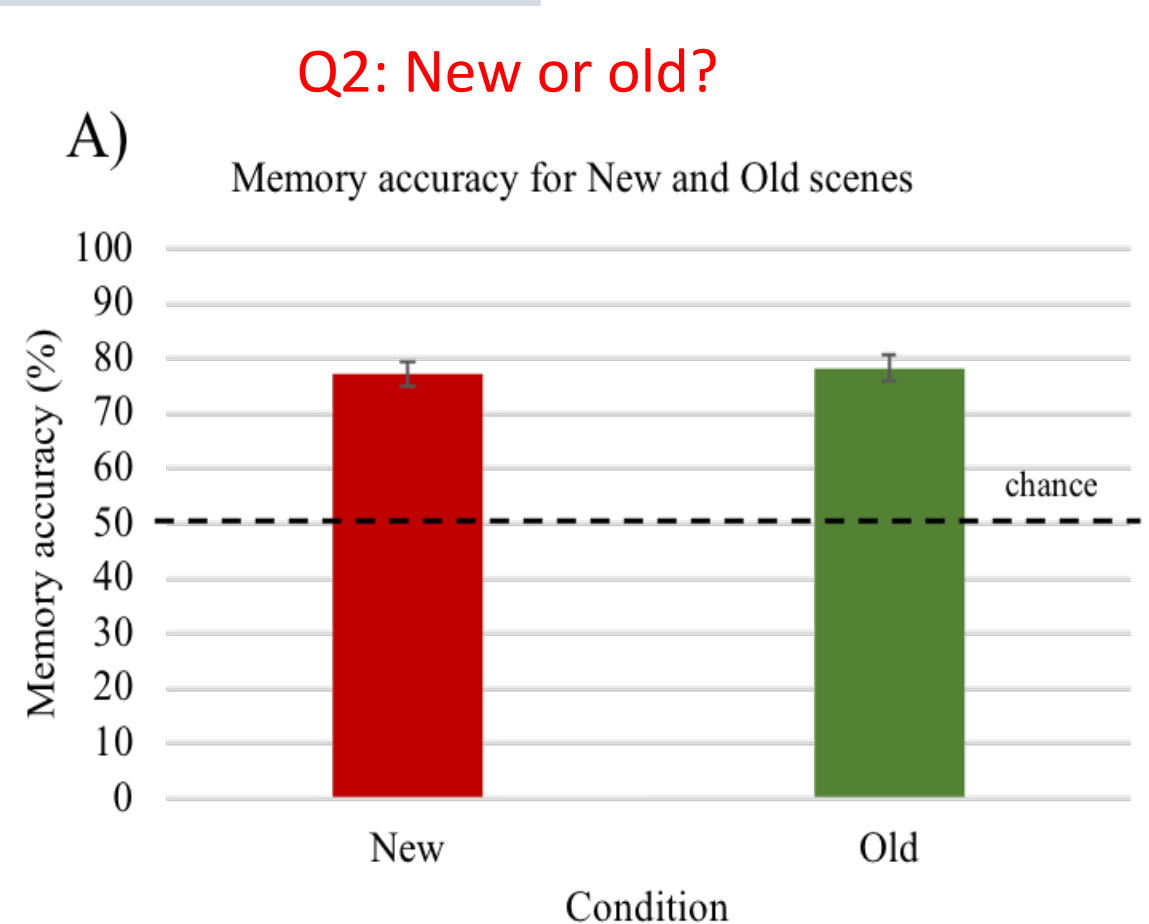
Exposure phase (incidental learning)

- Classify sounds (manmade/natural)

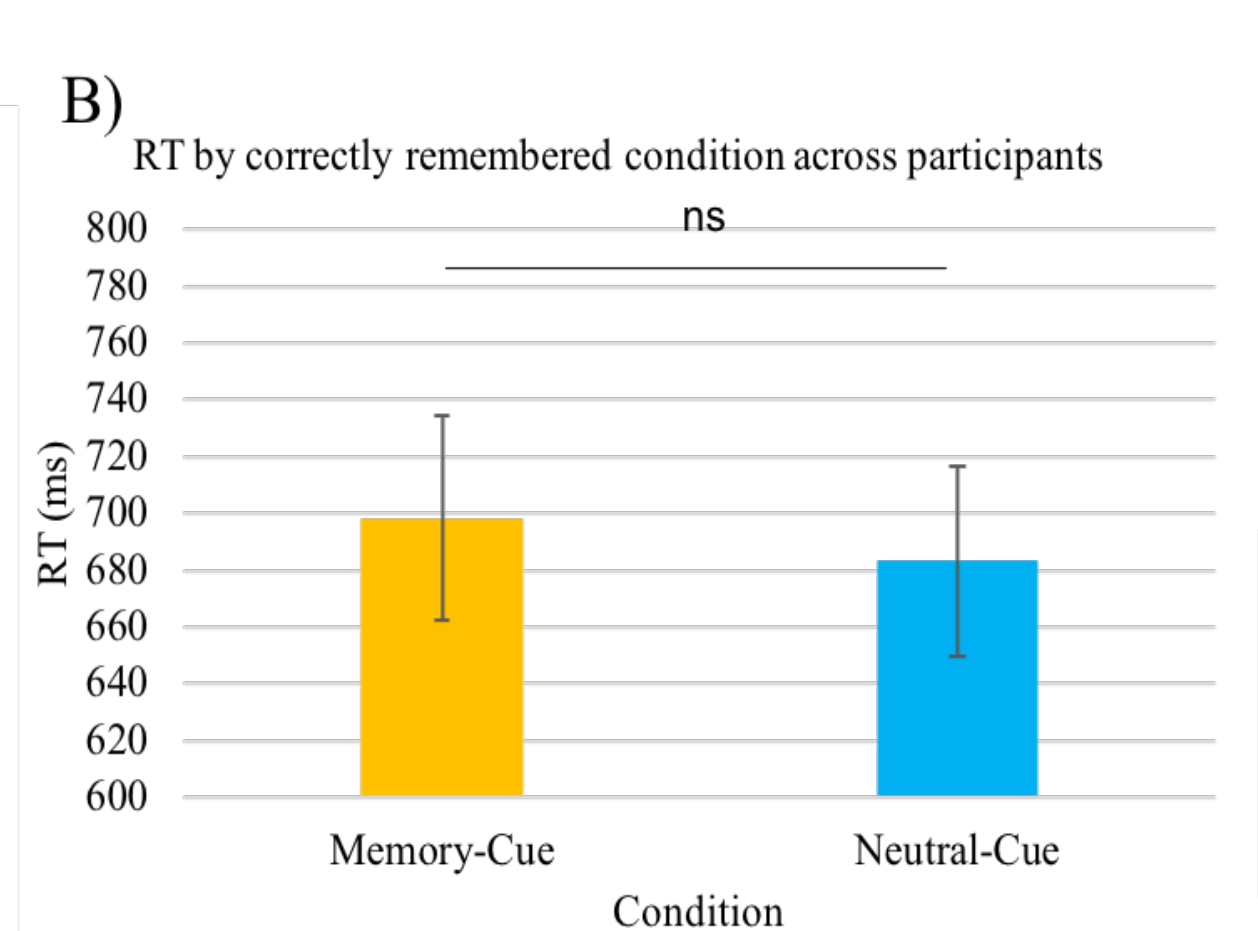
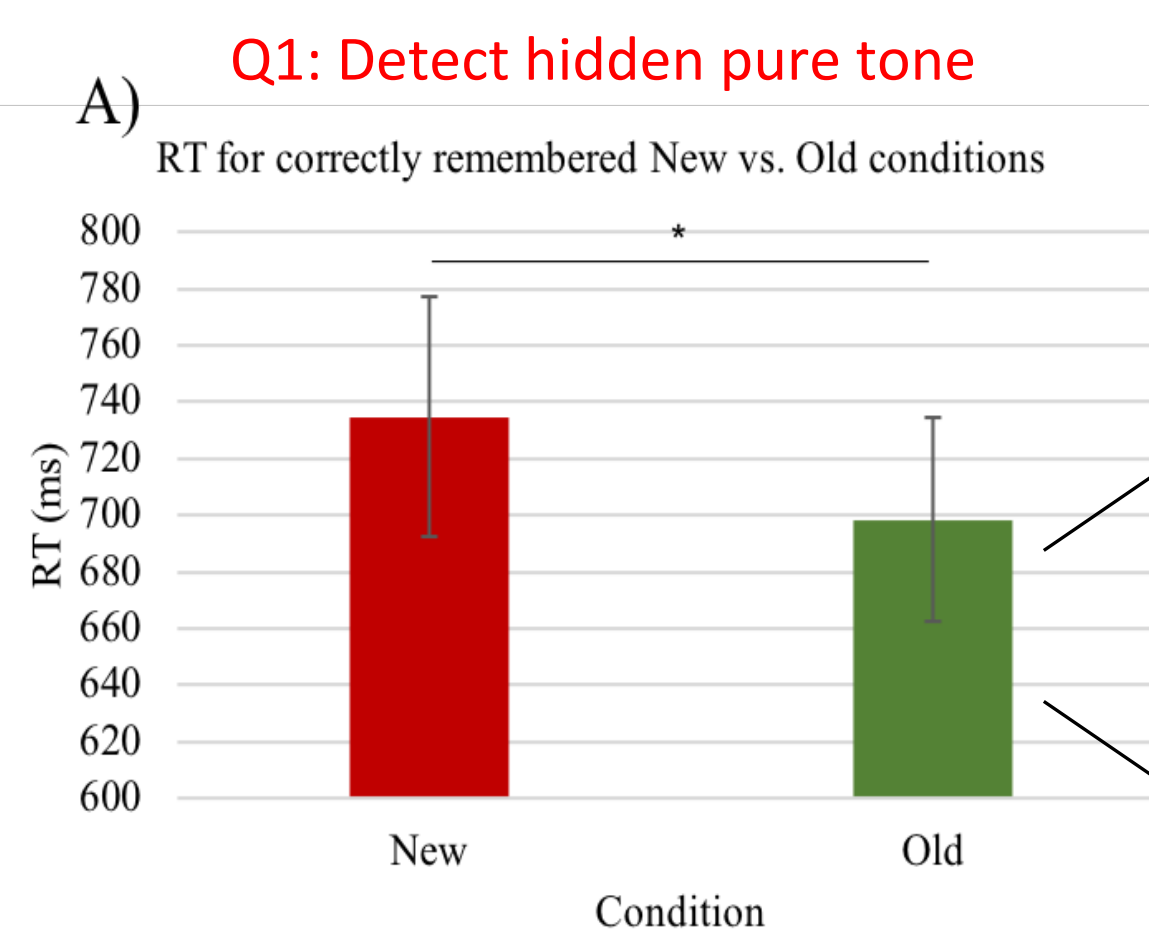
Surprise test phase (retrieval)

1. Detect hidden pure tone
2. Old or new?
3. If old, recollected or merely familiar?
4. At exposure, was target on left, right or no target?

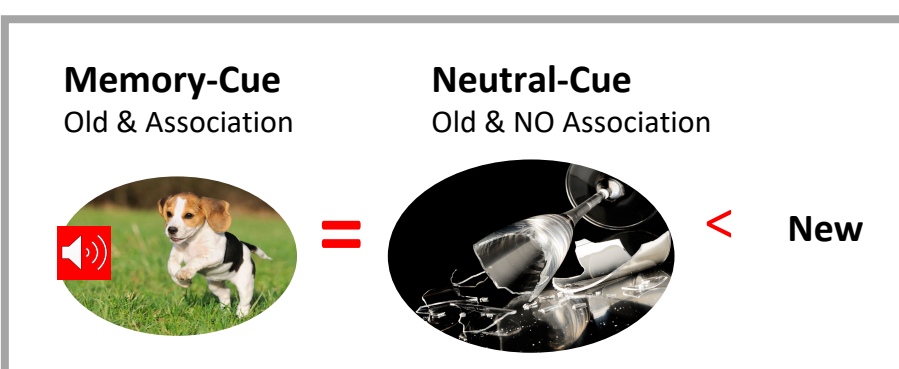
Results Behavioural



Memory for the scene is good but memory for the location or presence of the tone is not

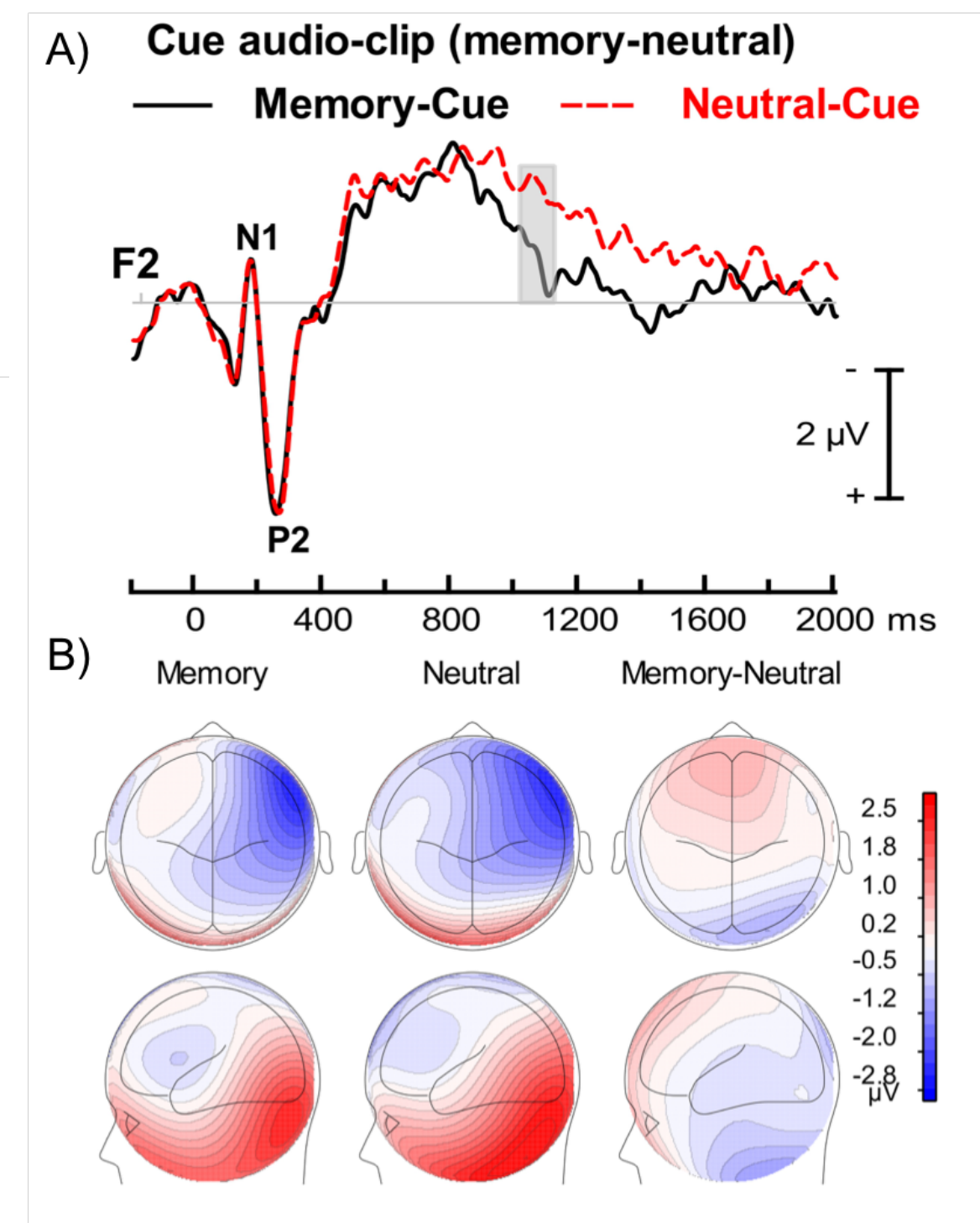
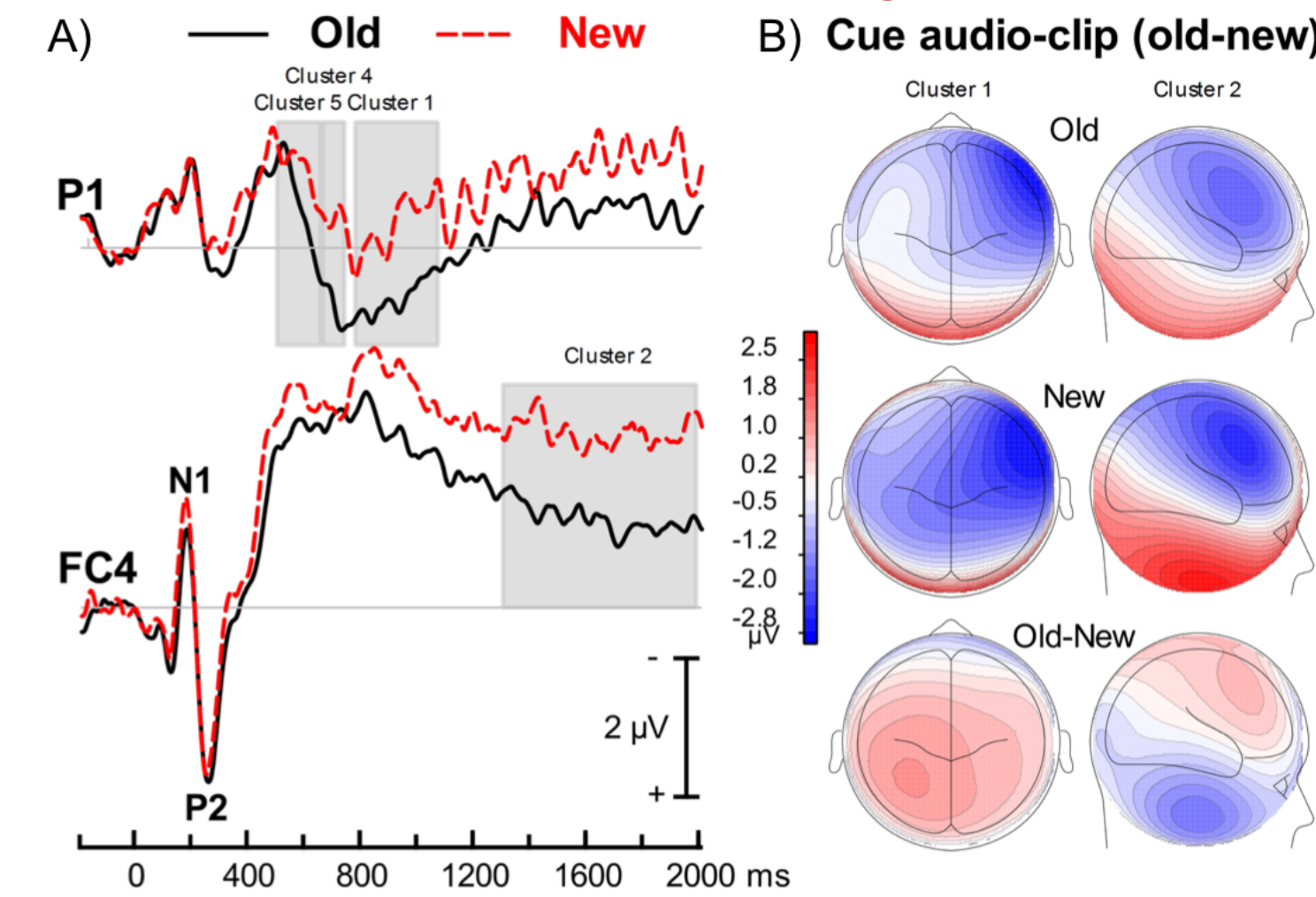


Memory enhances processing of tone by speeding responses but does not facilitate lateralized allocation of attention.



EEG Results

Cue-audio clip

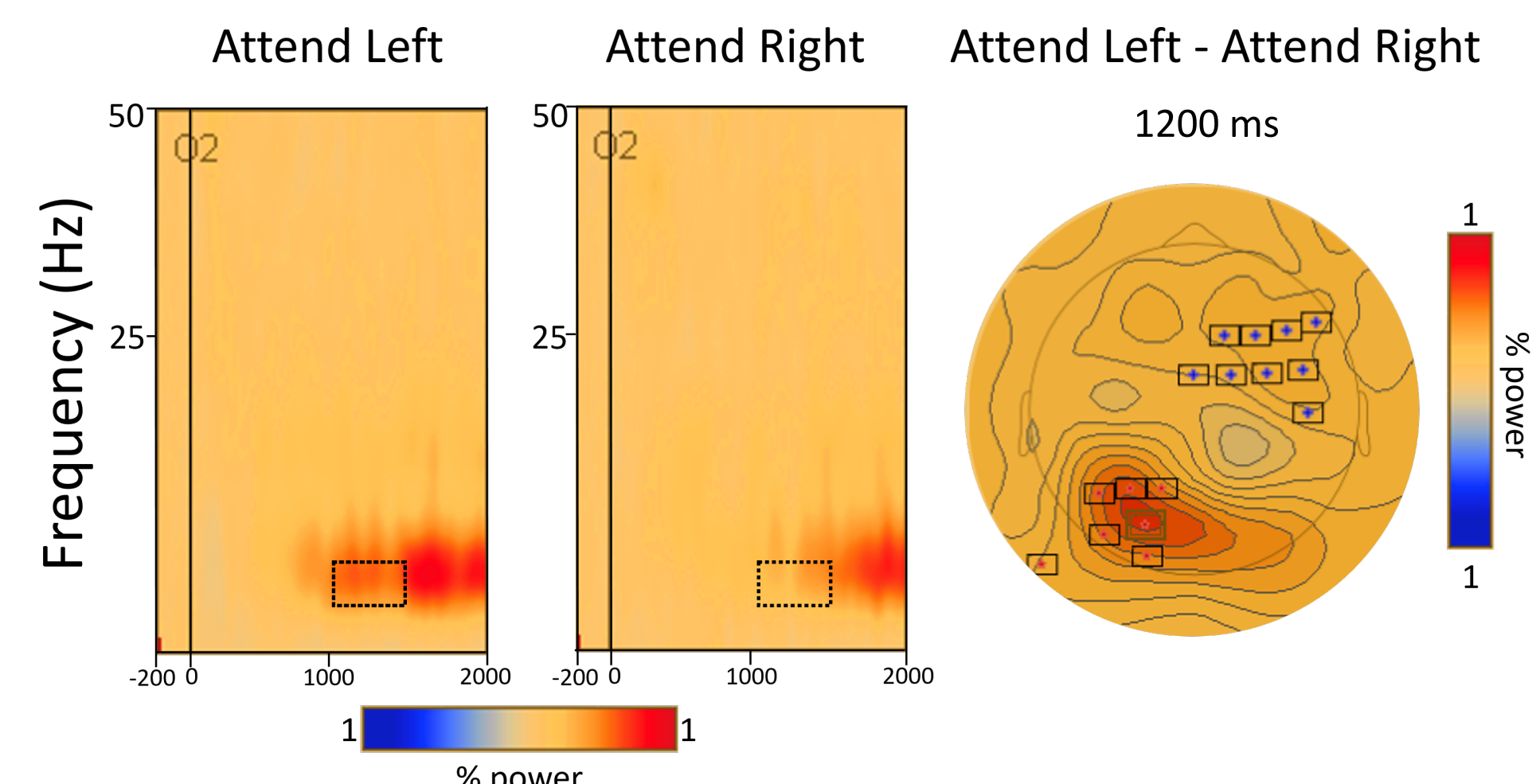


Cue-audio clip

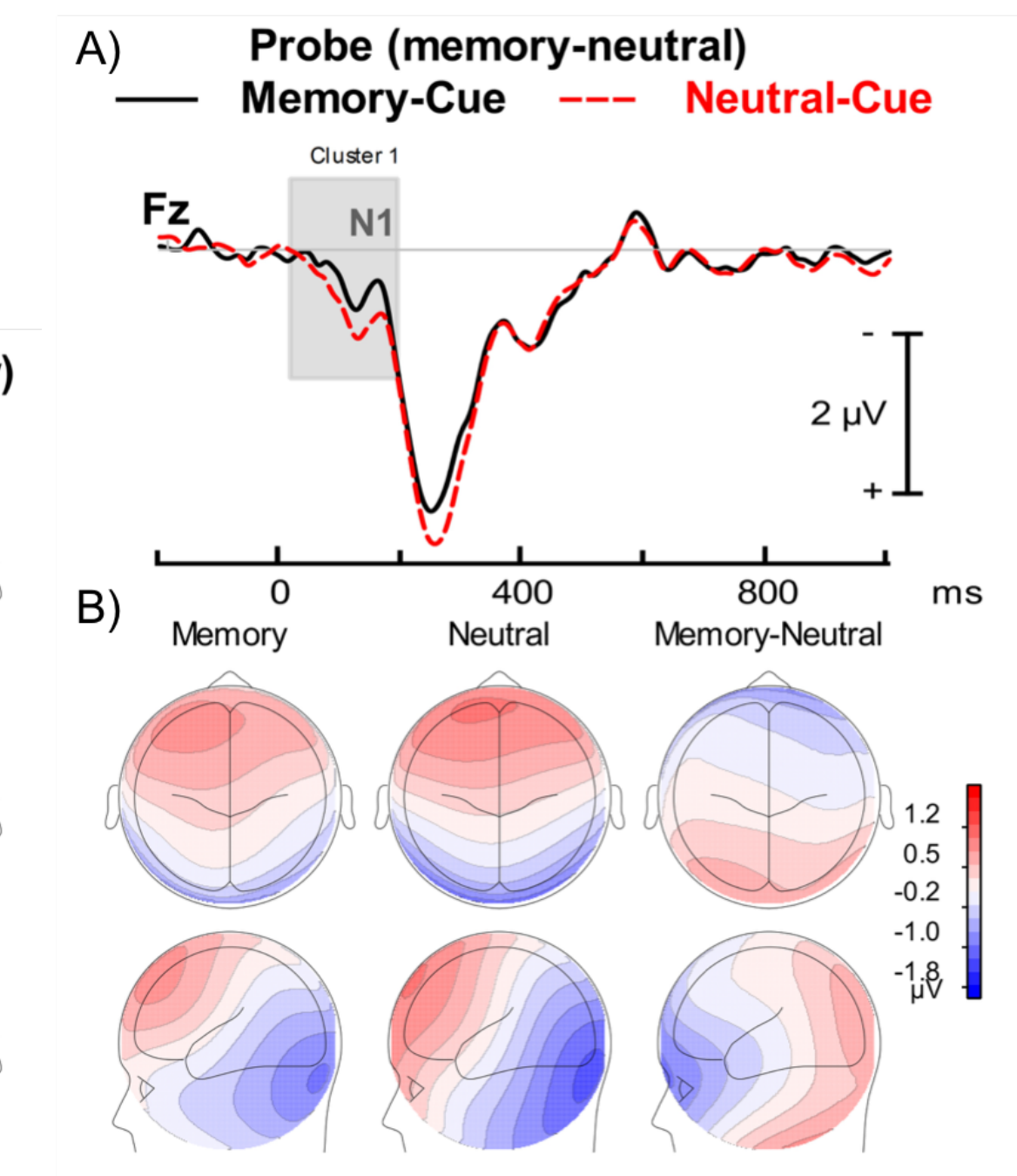
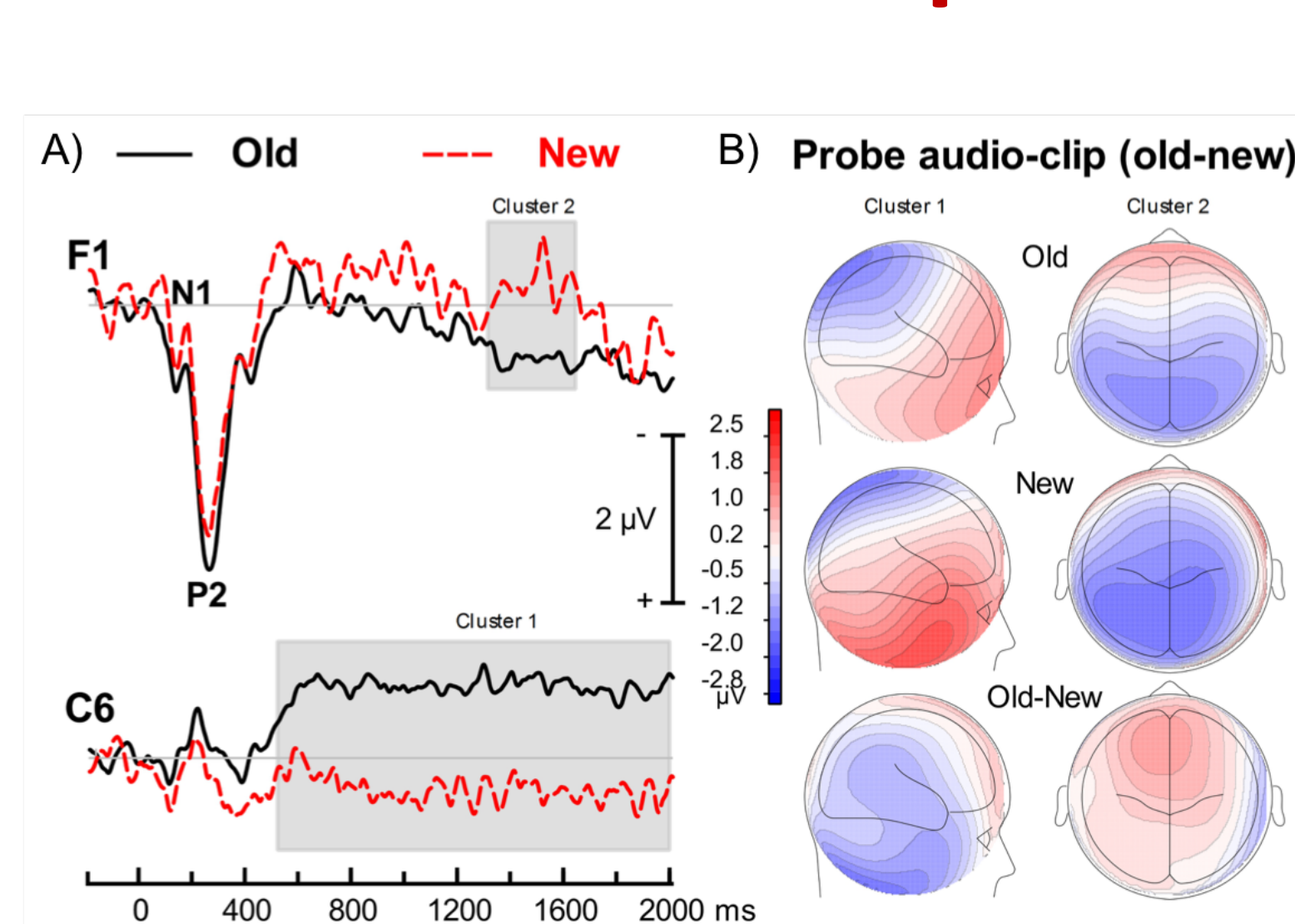
- Old vs. New: 5 Clusters over frontal, fronto-central, and parietal areas
- Memory vs. Neutral: 1 Cluster over frontal and fronto-central areas

Time-Frequency

Alpha (8-12 Hz)
2 clusters $p < 0.05$



Probe-audio clip



Probe-audio clip

- Old vs. New: 2 Clusters over left and midline frontal, right central, temporal, and parietal areas
- Memory vs. Neutral: 2 Clusters over frontal and right parietal areas

Conclusion

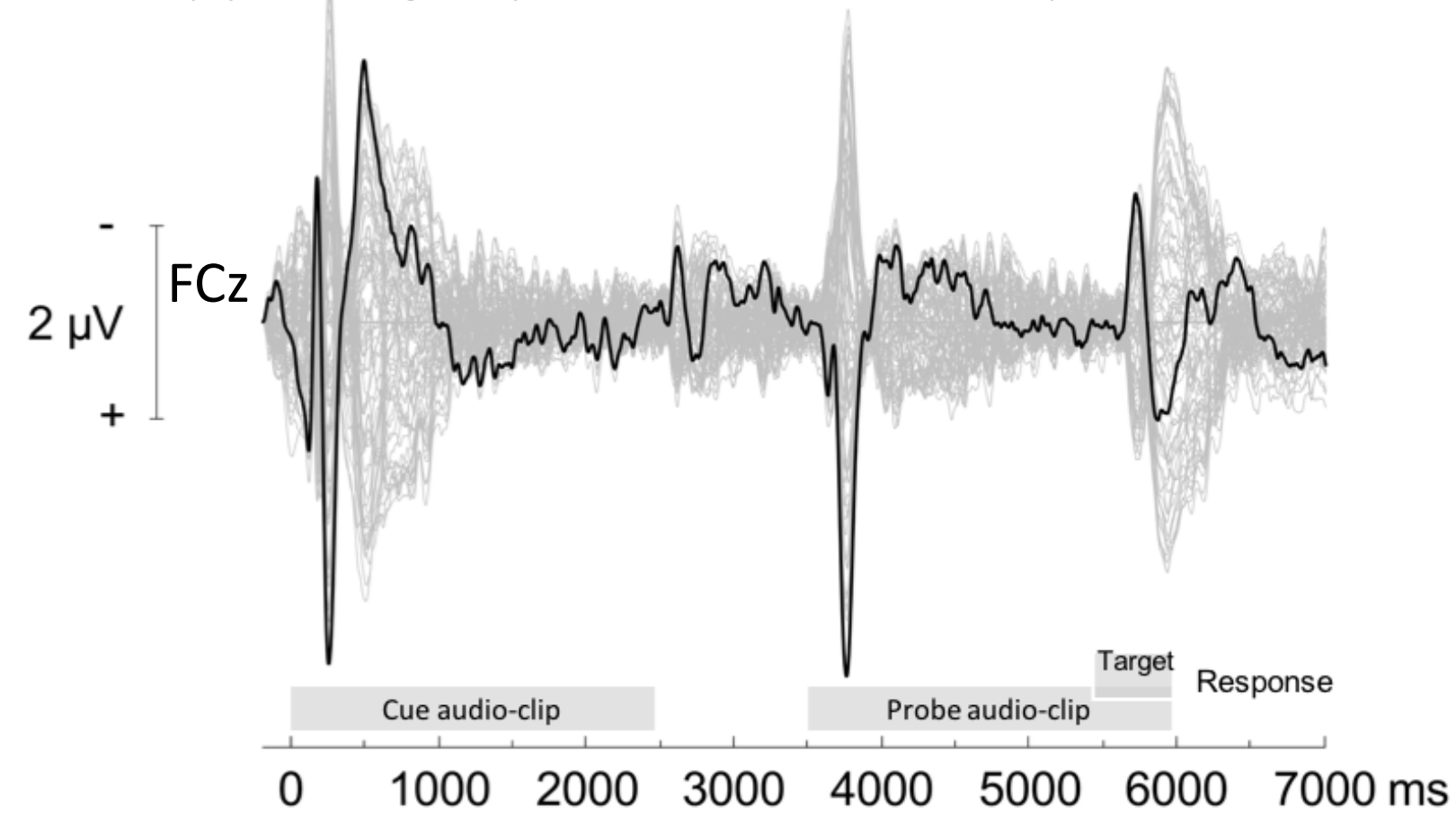
- ✓ The study highlights the importance of **attention at encoding** on memory-guided attention at retrieval.
- ✓ Alpha power differences for Left vs. Right suggest that target presence was implicitly encoded and may index top-down attention from a parietal source.
- ✓ The results suggest that implicit associations were formed and used for anticipatory mediation of auditory attentional resources, but that expression of learning depends on attention at encoding.

EEG Analyses

Time-domain analyses at two different time windows:
cue audio-clip and probe audio-clip

- old vs. new
 - memory-cue vs. neutral-cue
- ERPs will show a difference during the sustained potential, indicating that information related to the clip was being maintained.
- ERPs will show a difference during the sustained potential, indicating anticipatory mediation of auditory attentional resources.

Butterfly plot of group mean event-related potentials (ERPs)



Current Directions

- Can we manipulate attention at learning to better understand the effect of attention at encoding on memory-guided attention?
- Dynamic imaging of coherent sources (DICS): Can we bridge the gap between acoustic information and complex cognitive processes?

References

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Thank you to...

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