Implicit memory for cued sound location is associated with alpha activity localized in parietal cortices

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Intro & Aim

✓ Long-term memory (LTM) of learned target locations can facilitate target detection [1,4].

What mechanisms enable perceptual facilitation by LTM?

1. Test whether *implicit memory* can guide auditory attention and enable perceptual facilitation at retrieval.
2. Use EEG to index implicit processes involved in memory retrieval.
3. Situate empirical findings within a broader theoretical context → current working models of memory and attention.

Methods

Stimuli

- 80 (old-exposed) & 24 (new-only at test) **'real-world' sound-clips**
- **Lateralized** (right or left ear, or none) pure tone target embedded in *bilaterally-presented* clip

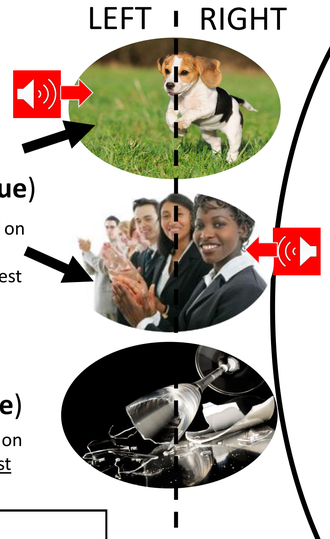
Participants

(N = 90 [47F]; a priori power = .99)

- Normal hearing
- 18-35 yrs

Conditions

LEFT | RIGHT

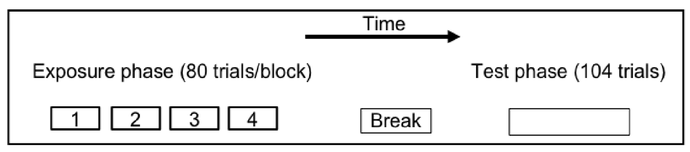


Incidental Association (**Memory-Cue**)

Target embedded on *same* side at encoding and at test

No Association (**Neutral-Cue**)

Target embedded on *random* side at test



Task

Target varied pseudo-randomly in:

1. **Onset** (1300ms, 1800ms, 2300ms)
2. **Frequency** (500Hz or 1Hz)

Exposure phase (4 blocks)

Classify target tone as **low/high**

Surprise test phase

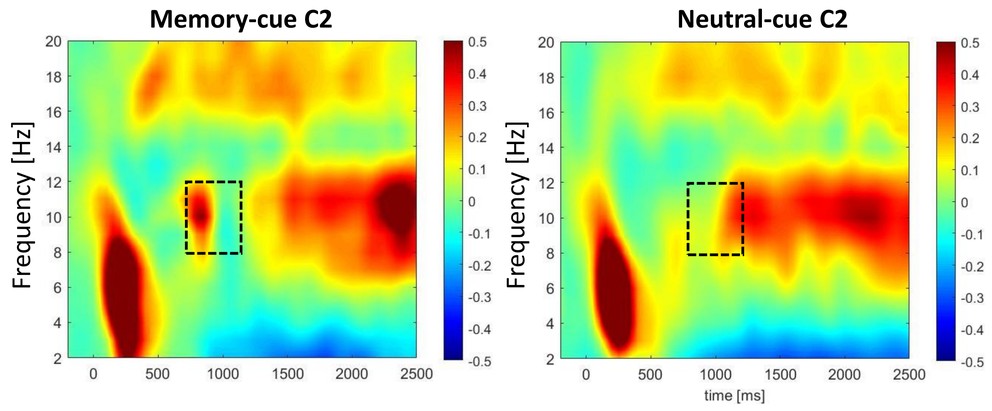
(single trial)

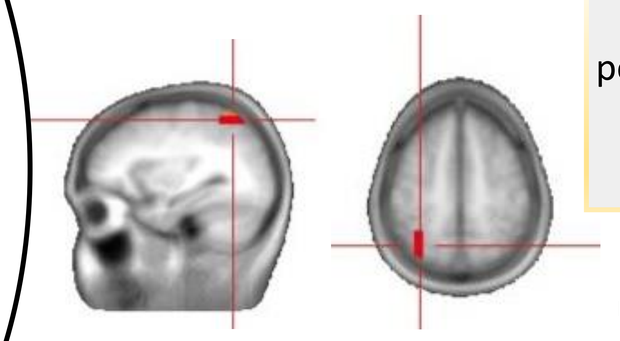
1. Localize *faint* lateralized target tone (L/R).
2. Is clip old or new?
3. If old, at <u>exposure</u>, was target tone on left/right/no target?

Results – EEG Cue

Alpha (8 – 12 Hz) time-frequency

between 900ms – 1200ms



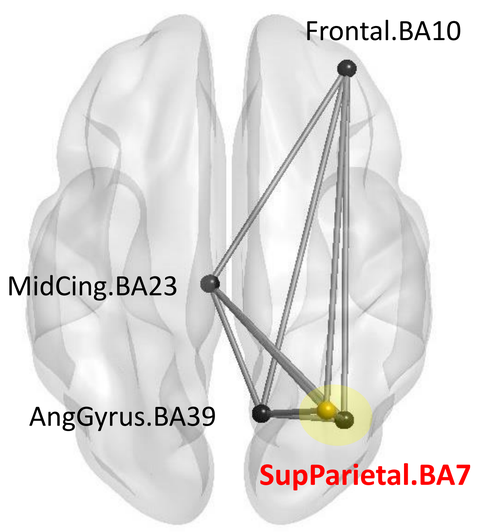


Superior Parietal.BA7, $p < .05$

Difference in alpha power source localized to right superior parietal lobe (SPL).

Greater source activity for memory-cue trials compared to neutral-cue ones.

Working Model of Memory-guided attention

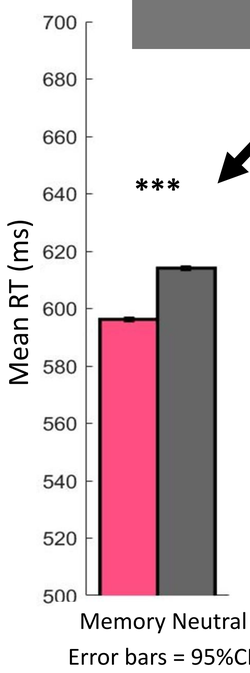


- Empirical findings <u>overlap with working model</u> of memory-guided attention based on fMRI meta-analysis [5].
- Consistent with <u>Attention to Memory (AToM) model.</u> SPL allocates top-down attention to memory retrieval [2].

Fischer et al. (2020b), A systematic review and meta-analysis of memory-guided attention: Frontal and parietal activation suggests involvement of fronto-parietal networks.

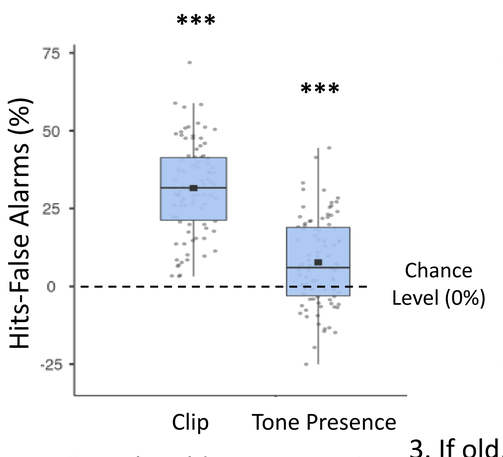
Results – Surprise Test Phase

Perceptual facilitation observed: Memory guides attention to lateralized target.



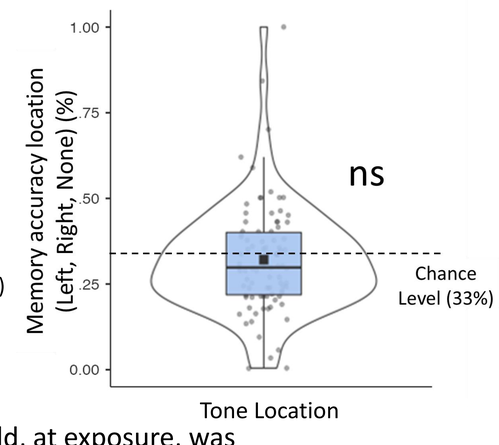
1. Localize *faint* lateralized target tone.

Memory for the scene and presence of the tone is good…



2. Is clip old or new?

… explicit memory for the exact location of the tone is not.

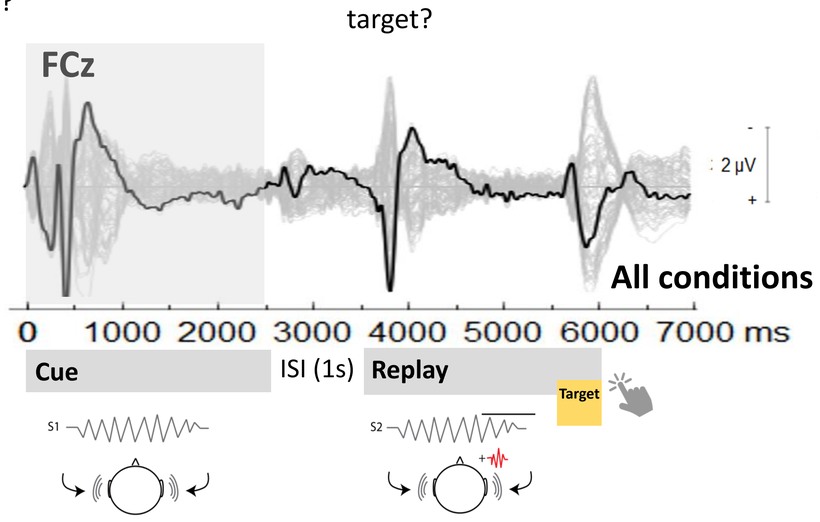


3. If old, at <u>exposure</u>, was target tone on left/right/no target?

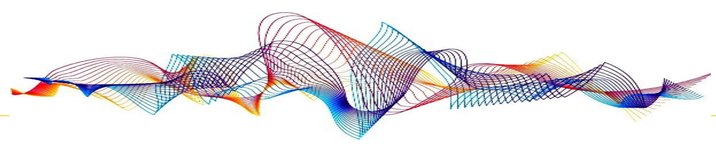
EEG Analyses

(N = 64)

Analysis window: Anticipation of expected targets



Discussion



- *Implicit* auditory LTM can facilitate target detection. This behavioural effect:
  1. Did not rely on an *explicit* memory for the location of the tone.
  2. Was accompanied by a **<u>punctual change in alpha power…source localized to the right superior parietal lobe.</u>**
- Findings suggest engagement of attention by LTM and are consistent with models of current memory & attention [2,5].

Future Directions

- Does the recovery of target-associated context involve hippocampal pattern completion? (*Connectivity analyses*)
- How are theta/beta/gamma power affected? (*Time-frequency and cross-frequency coupling*)

References

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5. Fischer, M., Moscovitch, M., & Alain, C. (2020b). A systematic review and meta-analysis of memory-guided attention: Frontal and parietal activation suggests involvement of fronto-parietal networks. *WIREs Cognitive Science*, *12*(1), e1546.

Thank you to…
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