

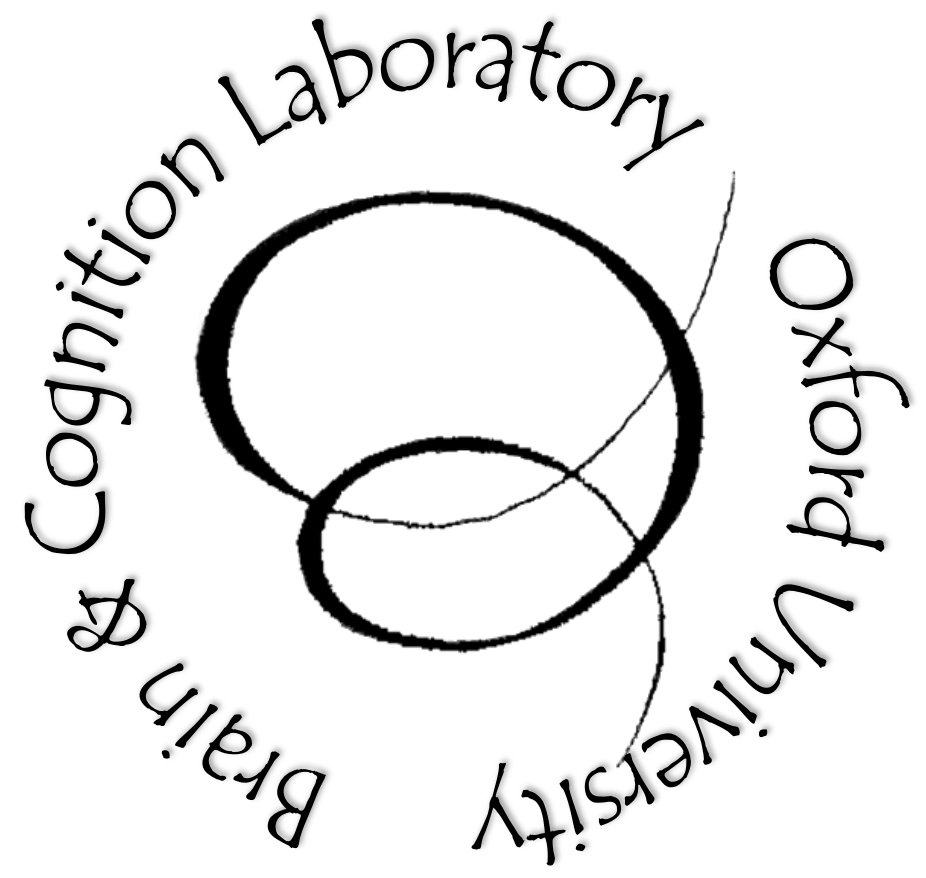
Orienting Attention Based on Long-Term Memory Improves Perceptual Discriminations

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Experimental Questions:

A previous study has shown that it is possible to orient attention based on long-term memory (LTM) to the location of target objects within complex natural scenes (Summerfield et al, 2006; see also Chun & Jiang, 2003; Brockmole & Henderson, 2006).

The mechanisms by which memory-based orienting can enhance performance remain unknown.

Here we conducted two experiments to:

1. Replicate performance benefits of memory-based orienting in speeded detection (Experiment 1) and perceptual discrimination (Experiment 2) tasks.
2. Test whether memory based orienting can enhance perceptual stages of processing, by using ERPs.

Findings & Conclusions:

1. Performance based on LTM improved both response times and sensitivity to detect targets.
2. These behavioral effects were accompanied by significant biasing of neural analysis of target stimuli during visual perceptual analysis of the scenes.

References:

- Summerfield, J. J., J. Lepsien, et al. (2006). Orienting Attention Based on Long-Term Memory Experience. *Neuron* 49(6): 905-916.
- Chun, M.M., and Jiang, Y. (2003). Implicit, long-term spatial contextual memory. *J. Exp. Psych. Learn. Mem. Cogn.* 29, 224-234.
- Brockmole, J. R., & Henderson, J. M. (2006). Using real-world scenes as contextual cues for search. *Visual Cognition*, 13, 99-108.

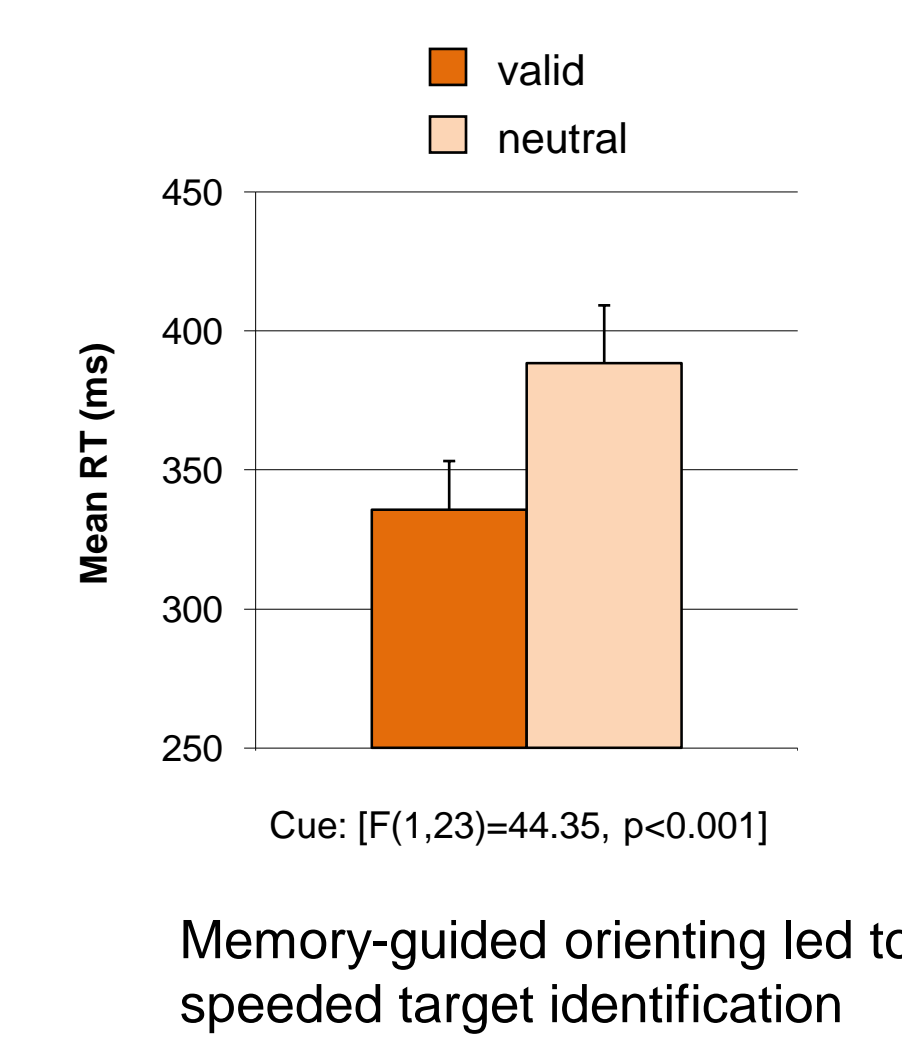
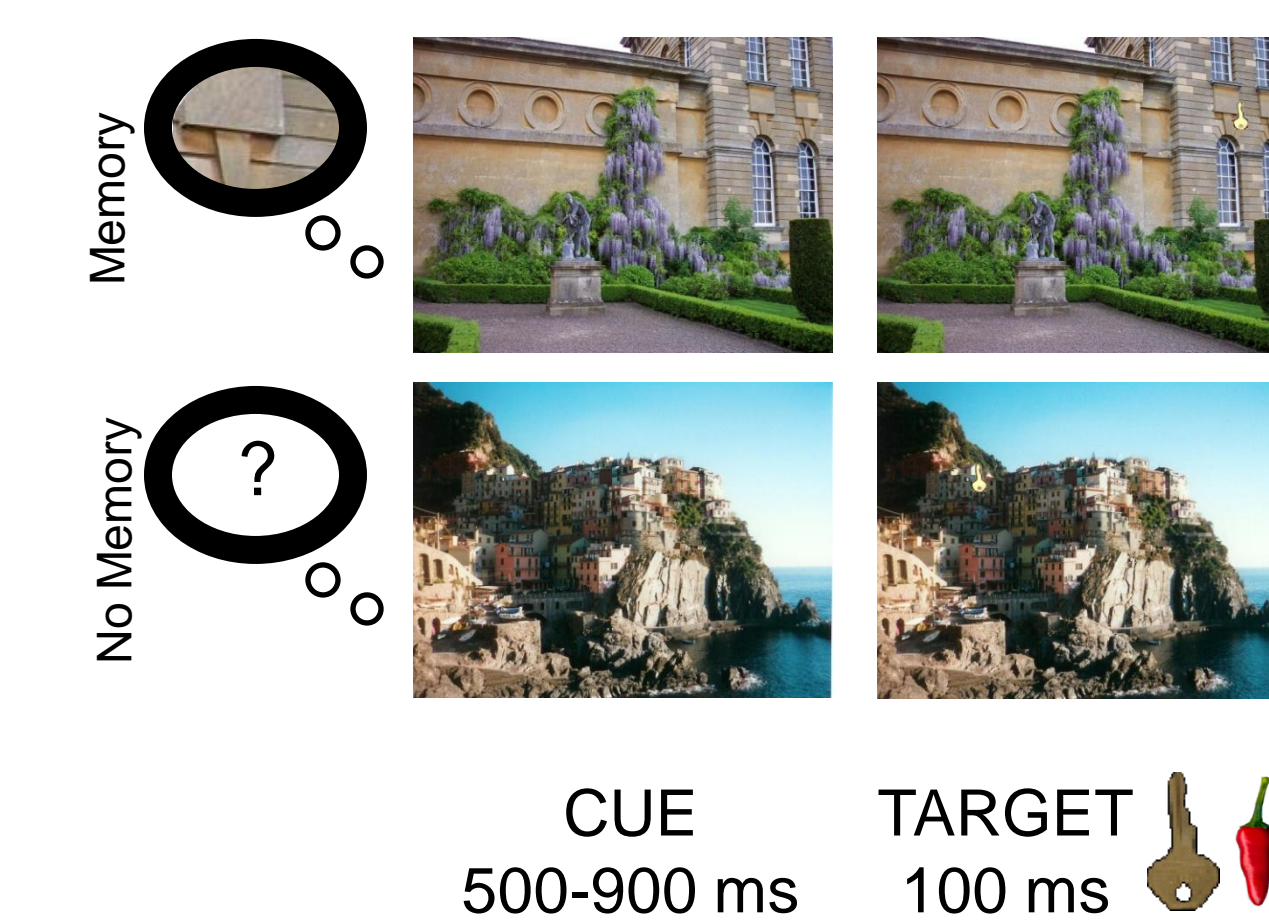
Experiment 1

Learning Task



Participants overtly searched for and learned target locations in various natural scenes

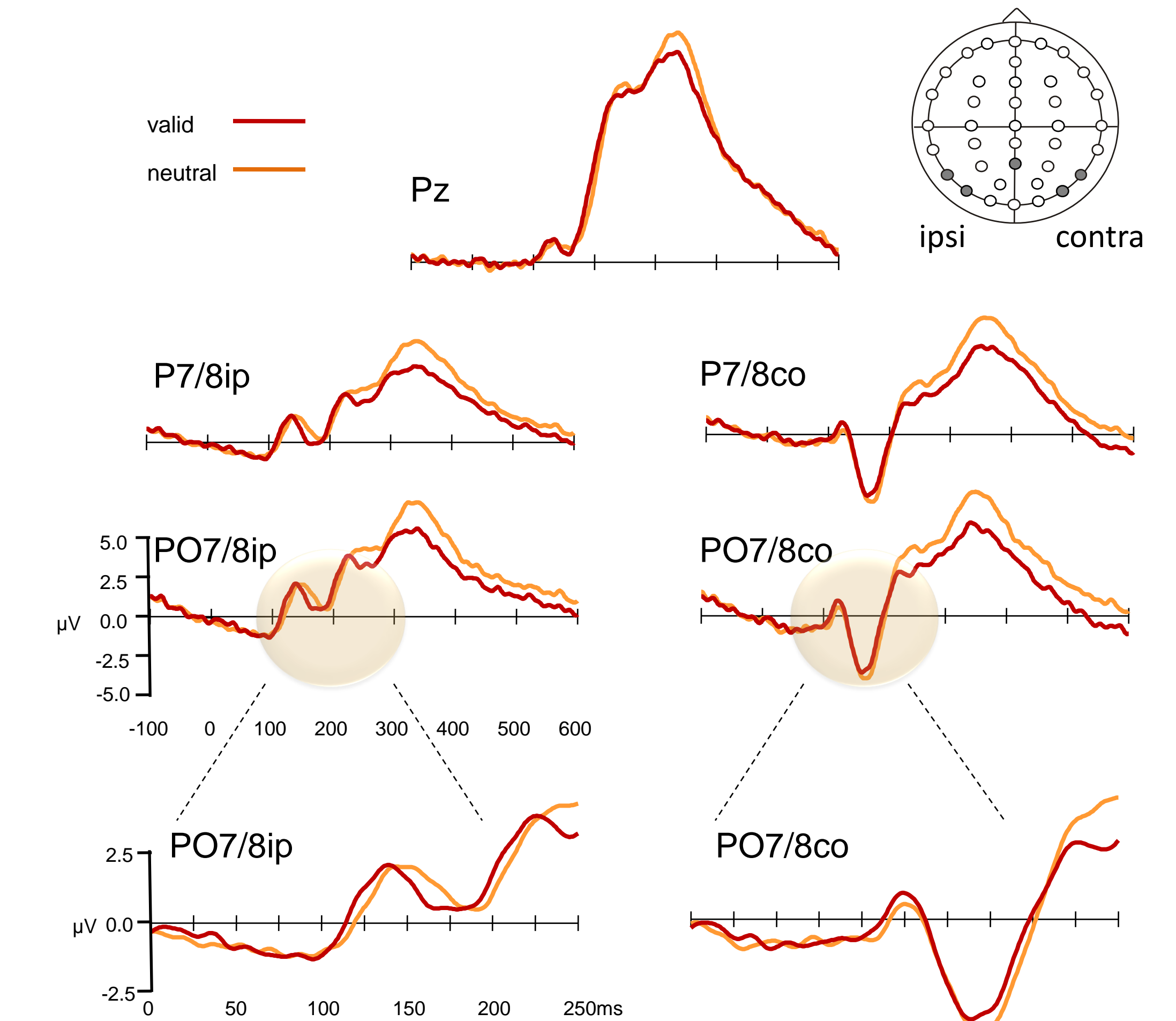
Orienting Task: speeded detection



N = 24; 180 learned scenes (80 Valid, 80 Neutral, 20 Catch)

Participants covertly attended to rapidly presented scene stimuli and detected brief appearance of target (gold key).

Targets could either be in a remembered location (valid), or in a new location in scenes in which no memory was formed (neutral).



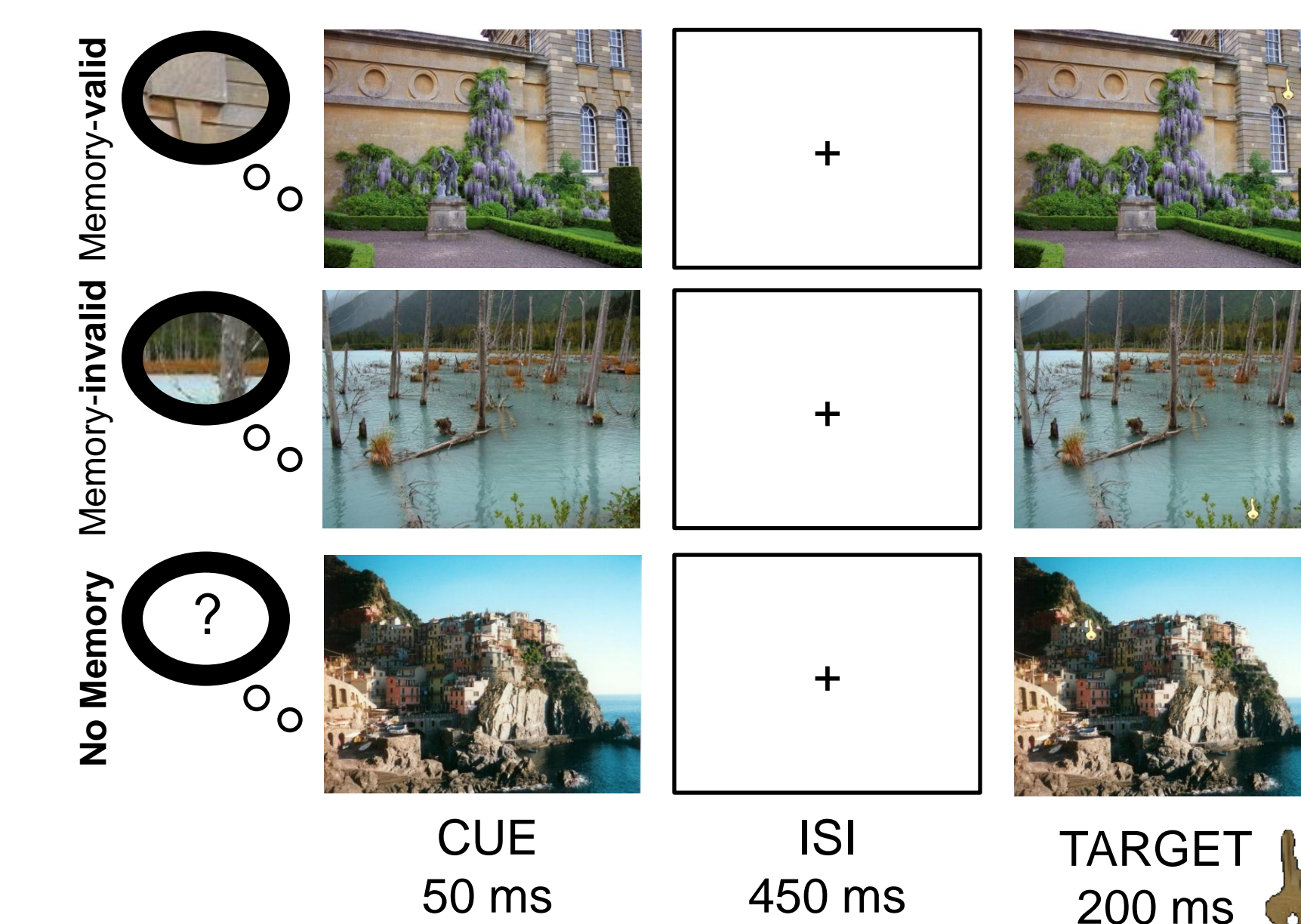
P1 and N1 mean amplitude were analysed by repeated-measures ANOVAs: cue (valid, neutral), hemisphere (ipsi/contralateral), electrode location (O1/2, PO3/4, PO7/8, P7/8).

P1 was significantly larger for valid than neutral trials over contralateral electrodes [F(1,23)=5.30 p=0.03]. **N1 was significantly larger for neutral trials at contralateral electrode sites, and significantly larger for valid trials at ipsilateral sites** [cue x hemisphere: F(1,23)=11.05 p=0.003].

EEG was acquired from 40 channels at 1000Hz (AFZ ground, R mastoid reference, 0-40Hz filter) and re-referenced offline to the average mastoids. ERPs elicited by valid and neutral targets were epoched offline (-100, 600ms). Trials with eye movements, blinks or errors were excluded.

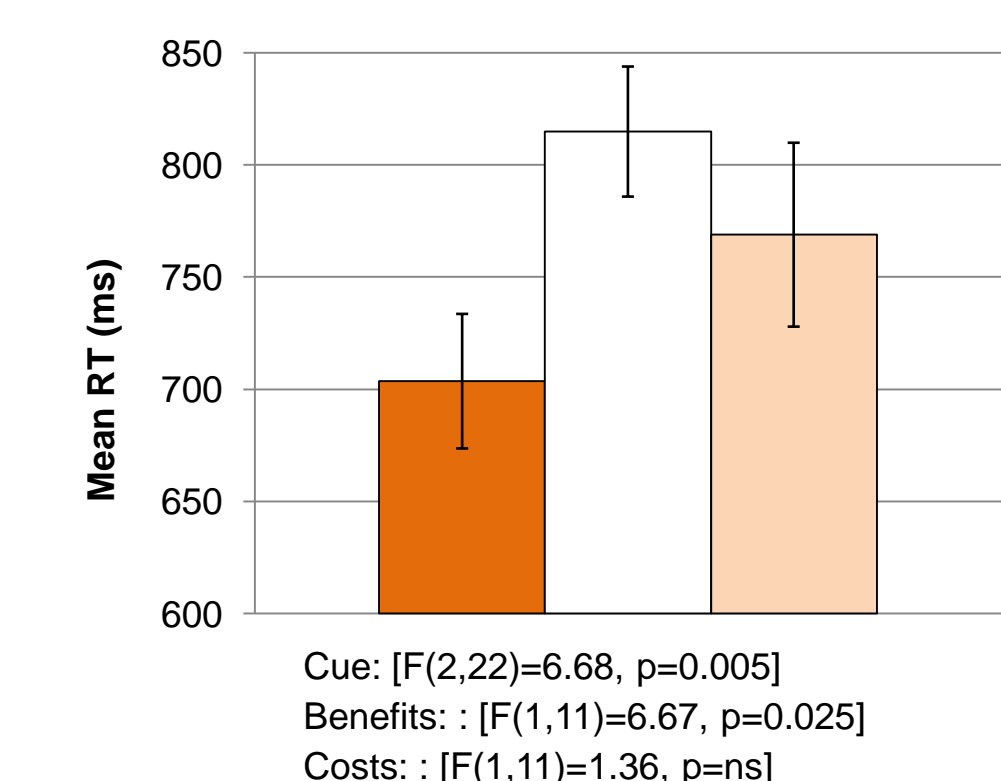
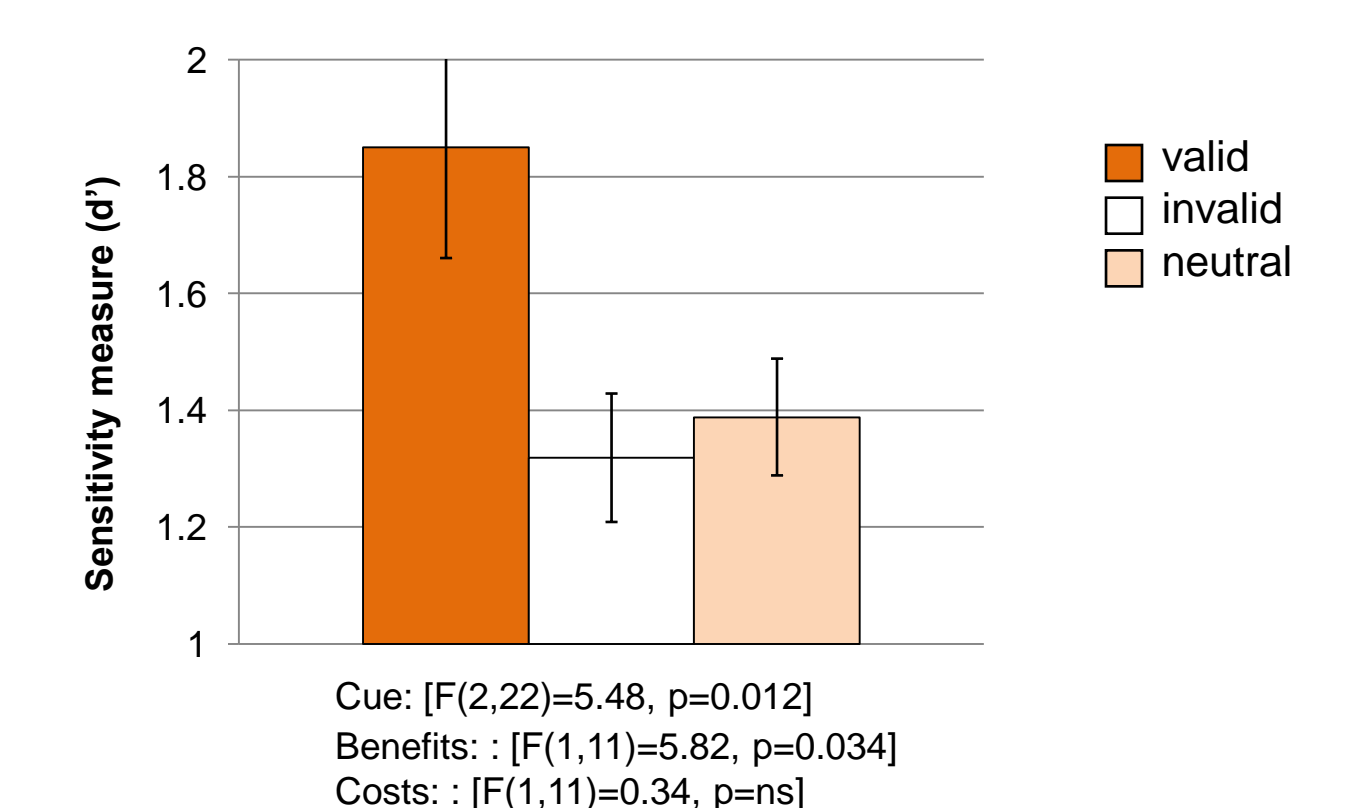
Experiment 2

Orienting Task: perceptual discrimination



- Learning phase was the same as in Experiment 1.
- Participants covertly attended to rapidly presented cue scene and indicated whether a target (gold key) was present/absent in a successive target scene.
- When present, targets could be in a remembered location (valid), in a different location than learned (invalid), or in a new location (neutral).

Memory-guided orienting increased sensitivity and speed of identification. There was no invalidity cost.



N = 12; 120 scenes (20 trials in each condition)

Factors: Response (present, absent) x Validity (valid, invalid, neutral)