

Spatial and temporal (non)binding of audio-visual stimuli: effects on motor tracking and underlying neural sensory processing

Olivia M Lapenta^{1,2}, Ashleigh Clibborn¹, Ayah Hammoud¹, Peter E Keller¹, Sylvie Nozaradan^{1,4}, Manuel Varlet^{1,3}

1 The MARCS Institute for Brain, Behaviour and Development - Western Sydney University

2 Psychological Neuroscience Lab, Center for Research in Psychology - University of Minho

3 School of Psychology - Western Sydney University

4 Institute of Neuroscience - Université Catholique de Louvain



BACKGROUND AND GOALS

Human synchronisation with moving objects strongly relies on visual input. However, auditory information has an important role since environments are intrinsically multimodal. Therefore, we compared the steady-state evoked potentials of spatially or temporally congruent and incongruent AV stimuli and evaluated how congruency affects the motion tracking of visual stimuli.

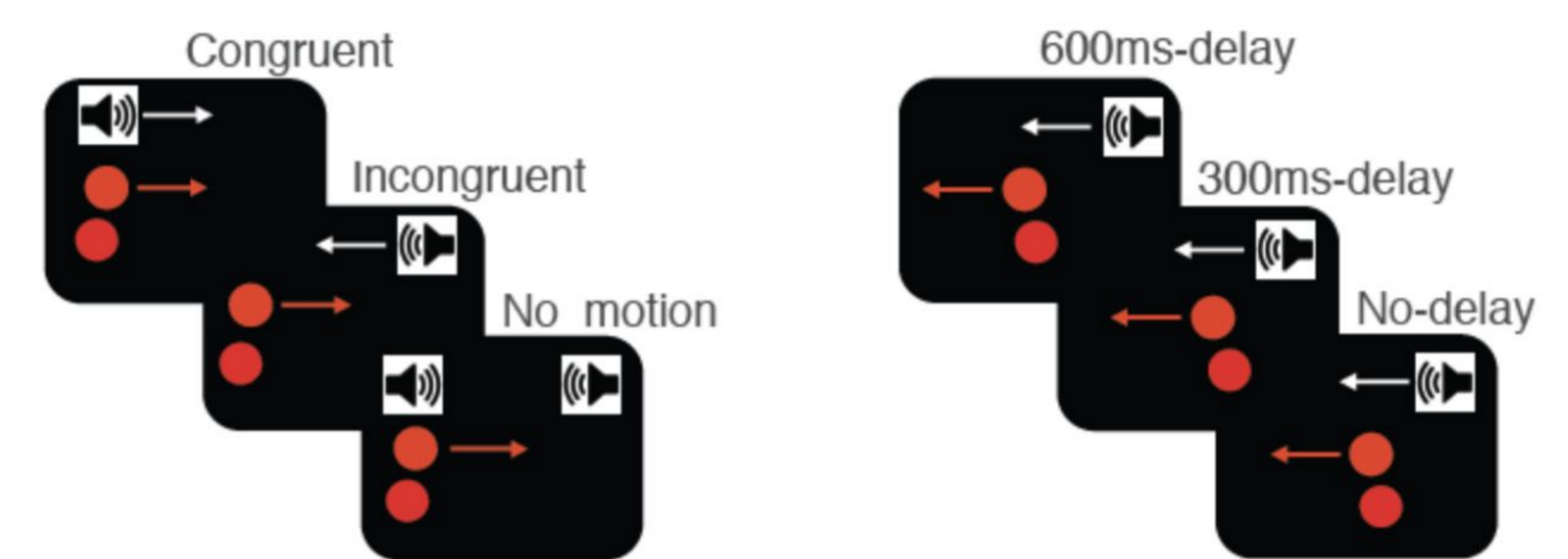
METHODS

EEG frequency tagging during the tracking of a red flickering (rate $f_v = 15$ Hz) dot oscillating horizontally on a screen. The simultaneous auditory stimulus (rate $f_a = 32$ Hz) was lateralised between left and right audio channels to induce perception of auditory movement. AV congruency was spatially (E1 - no motion, same direction or opposite direction) or temporally (E2 - no delay, medium delay or large delay) manipulated in two different experiments.

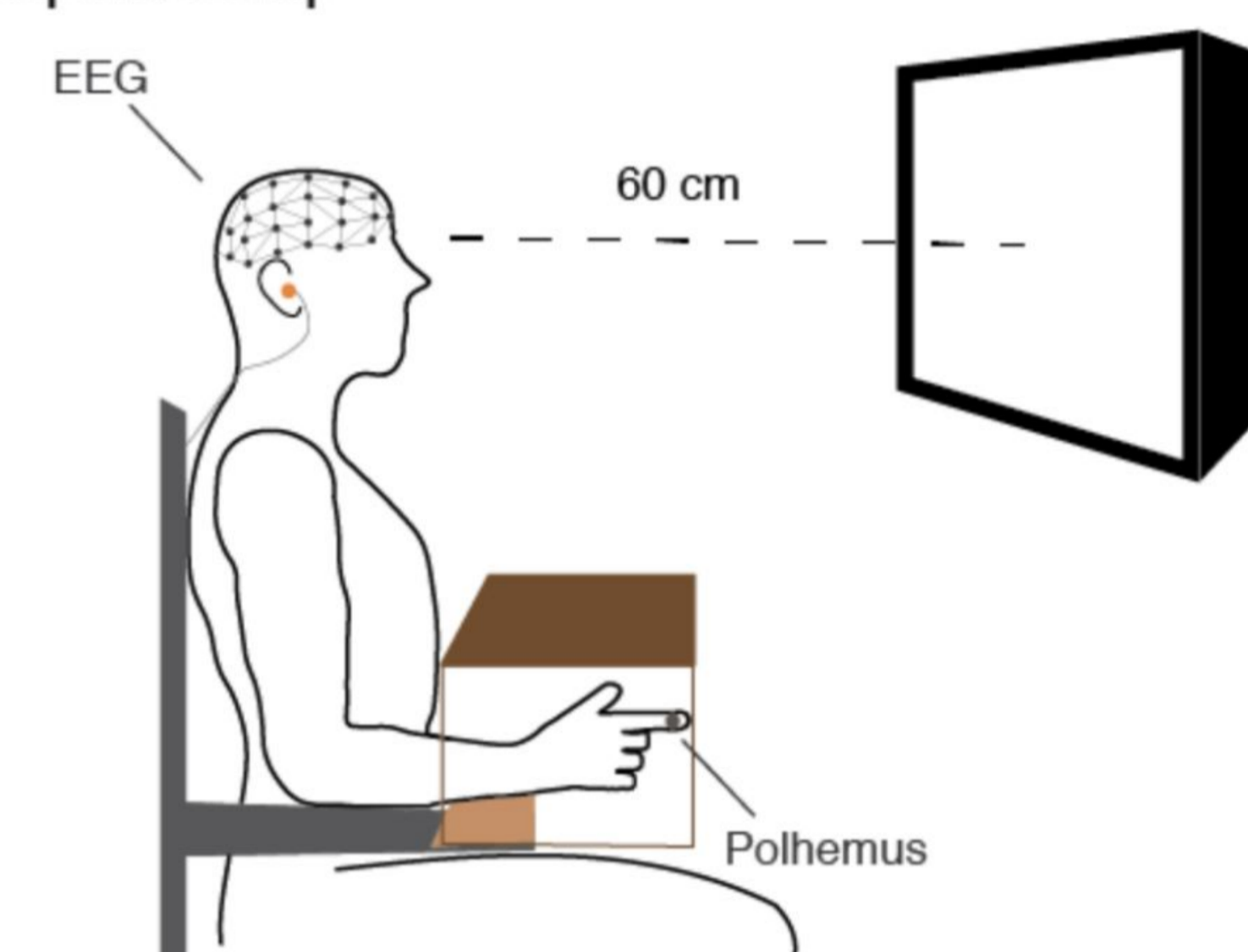
A. Experimental trials

Experiment 1 - Spatial Manipulation

Experiment 2 - Temporal Manipulation

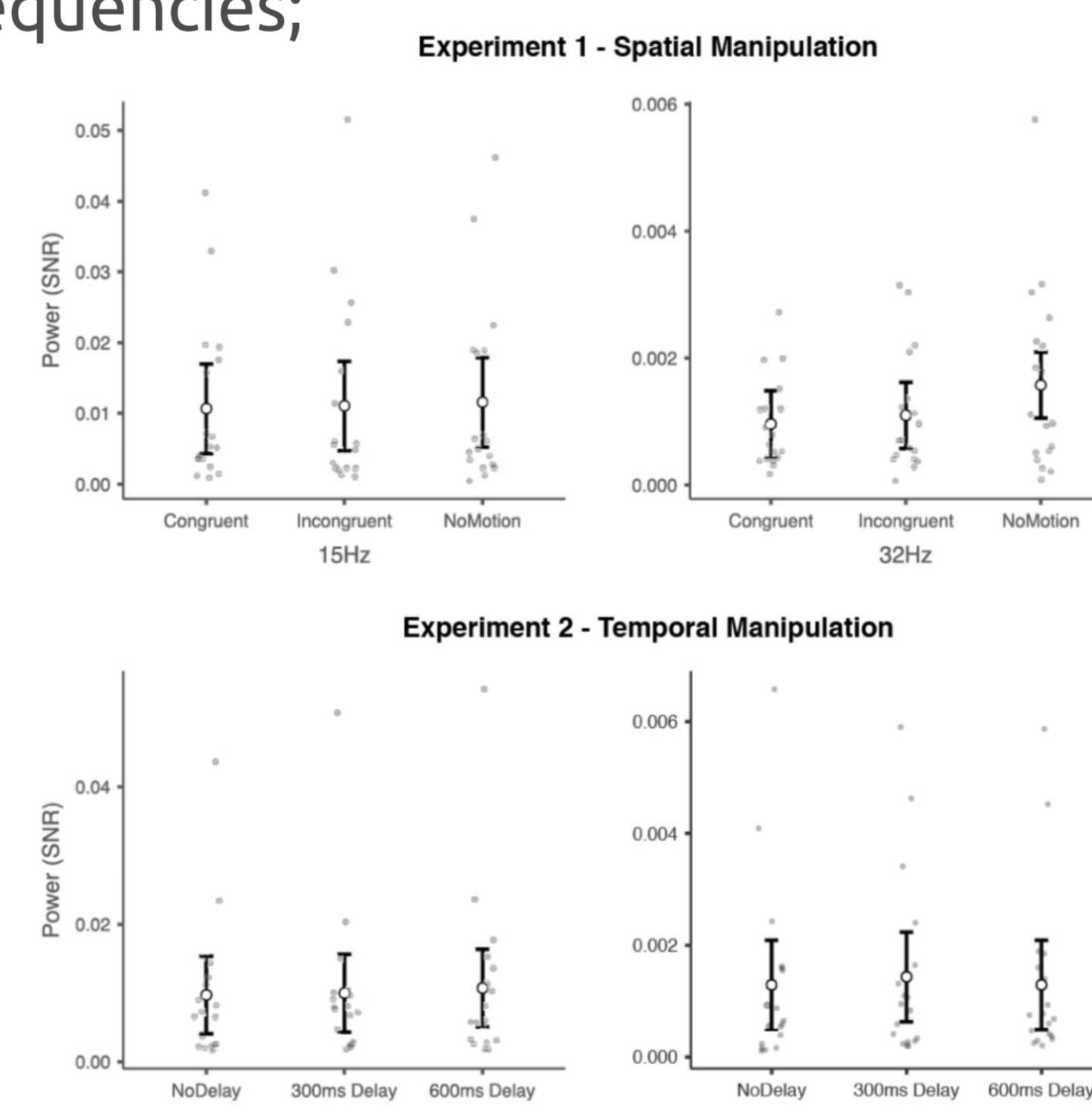
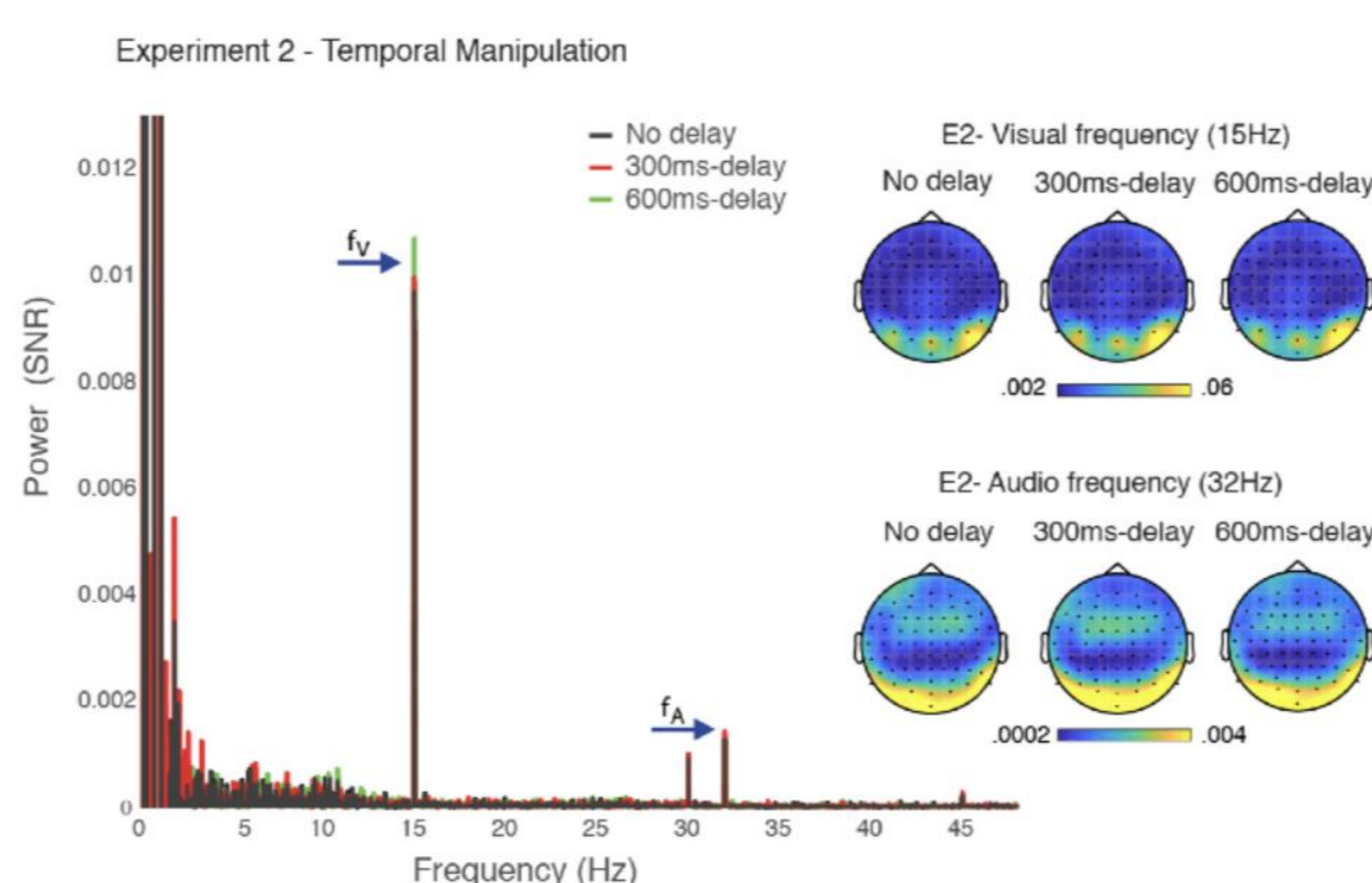
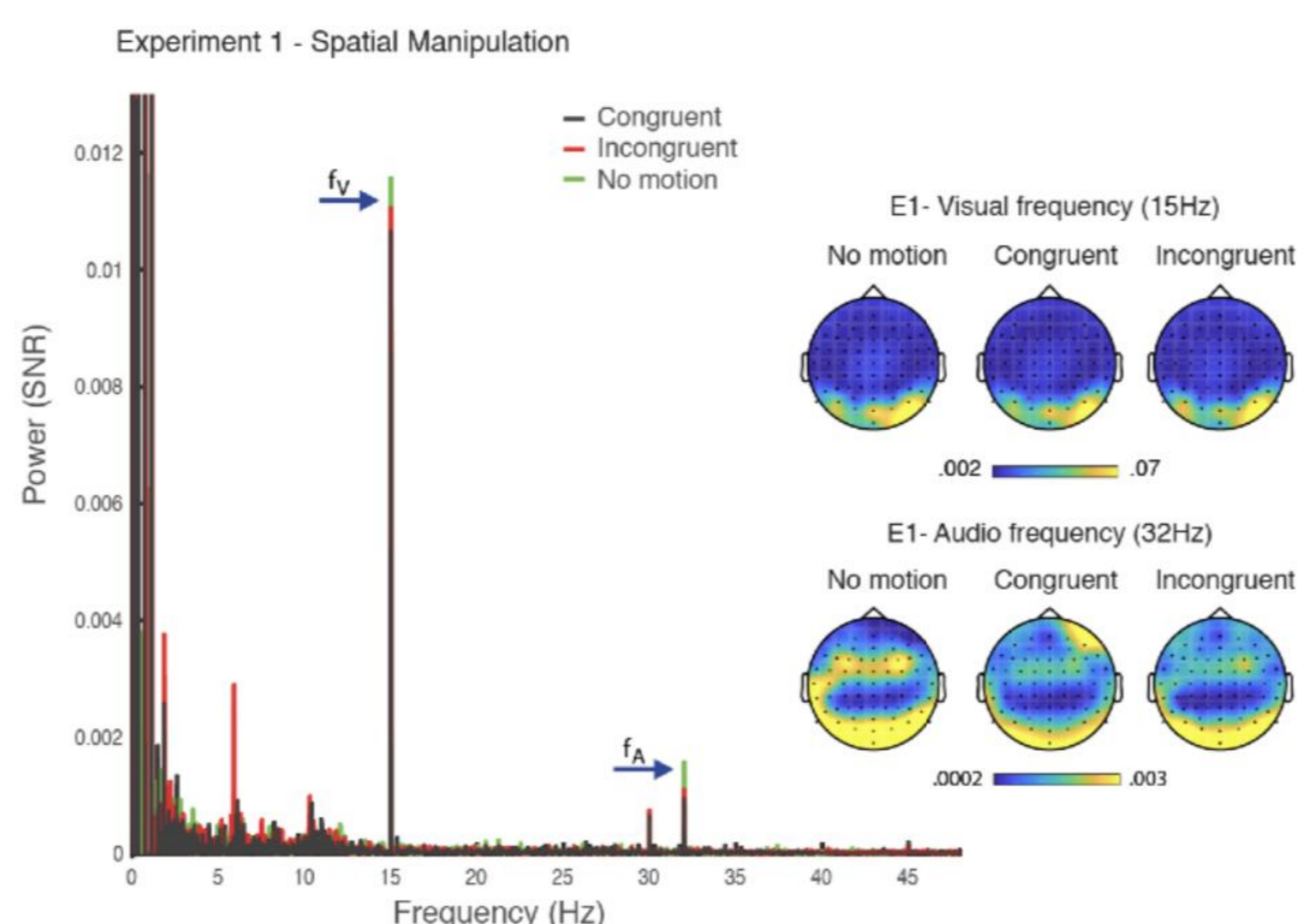


B. Participant setup

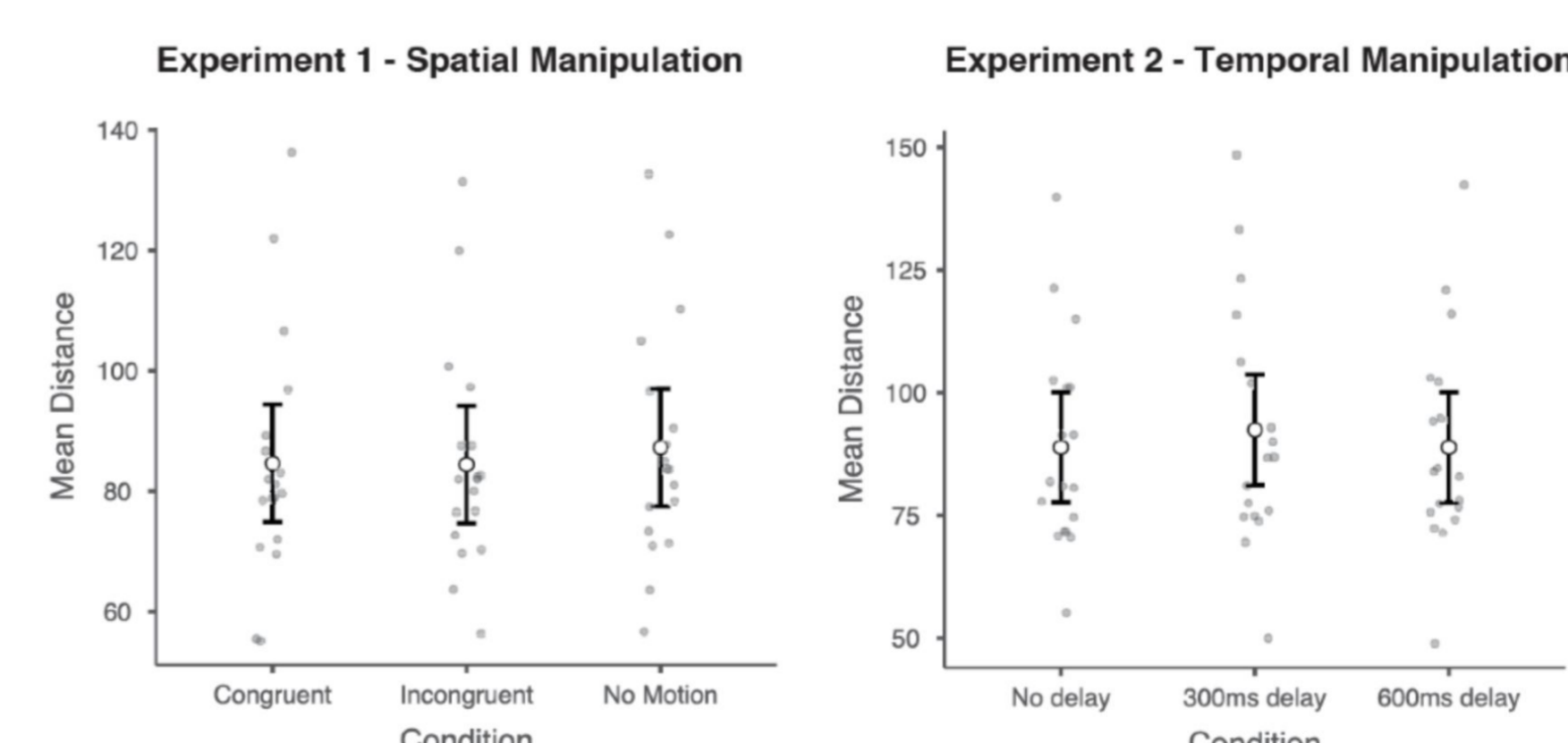


RESULTS

- E1 and E2 - significant EEG responses at the visual (15 Hz) and auditory (32 Hz) tagging frequencies;



- E1 - poorer performance and larger amplitudes at the auditory frequency for no moving condition. E2 - no differences for SSEPs or performance;



- No correlation between EEG and behavioural responses.

CONCLUSION

The movement synchronization performance and the neural processing of visual and auditory information were not influenced by congruency manipulation. For spatial manipulation, the moving auditory stimuli led to better performance, irrespective of congruency, when compared to the non moving sound. Importantly, in both experiments there were no significant responses at 17 and 47 Hz corresponding to the intermodulation frequencies of 15 and 32 Hz, suggesting an absence of global integration of visual and auditory information. Further exploration of the conditions that may result in the selective processing of visual and auditory information and their integration during motor tracking is needed.