

BACKGROUND

- Suppression of alpha band oscillations activity (~8-14 Hz) in parieto-occipital regions during visual stimulus presentation is associated with attentional deployment¹.
- It has been recently proposed that theta power modulation (~4-7 Hz) in frontal regions represents a key mechanism of endogenous attention².
- However, no clear electrophysiological pattern of intermodal selective attention has yet been identified.
- Clarifying the role of alpha and theta oscillations in neurotypical mechanisms could bolster our understanding of altered attentional patterns present in many neurodevelopmental conditions³.

OBJECTIVE

Investigate theta and alpha bands oscillatory activity patterns during an intermodal selective attention task.

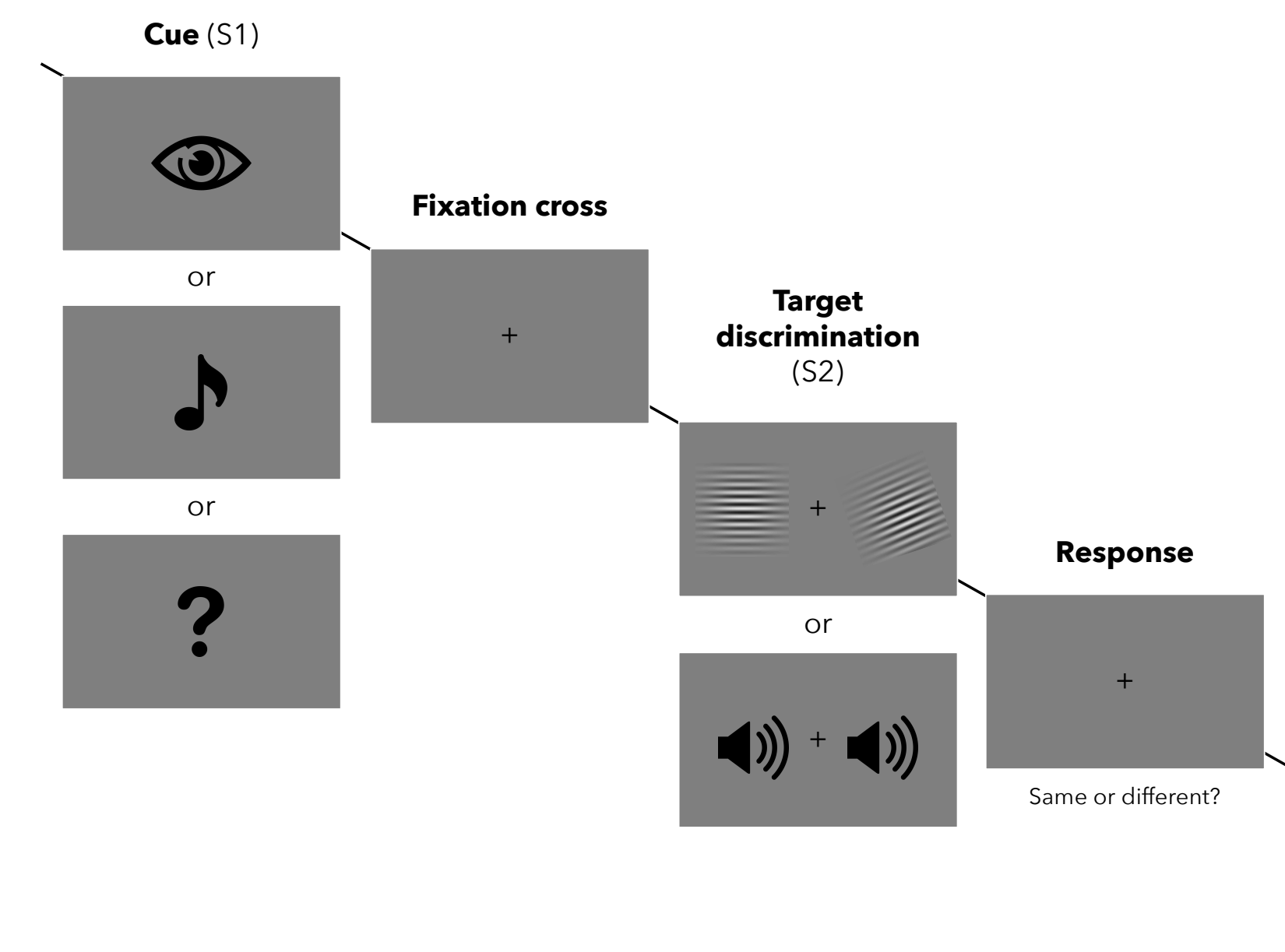
METHOD

Participants

	Age (years)		Auditory threshold (Hertz)		Visual threshold (polar angle)	
	M	SD	M	SD	M	SD
n = 20 (10 W)	26.60	3.22	10.02	5.39	3.05	1.53

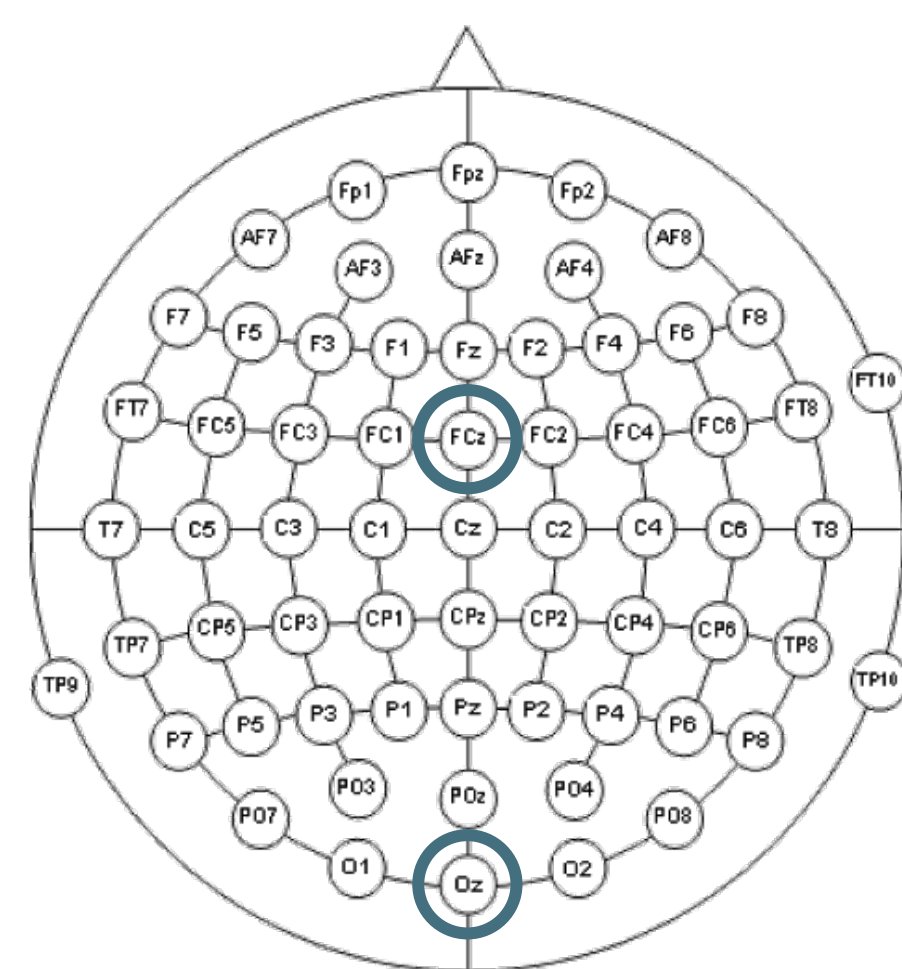
Experimental task

- 520 trials: **cue condition** (congruent or incongruent with targets, or no cue) X **targets' sensory modality** (auditory or visual).
- Auditory targets: 2 frequency tones, 2 000 Hz tone reference.
- Visual targets: 2 Gabor patches, horizontal lines orientation reference.
- Targets were psychophysically titrated for each participant using a 2AFC staircase procedure.



EEG - Complex Morlet wavelets

- -500 ms - 1500 ms after cue stimulus onset
- Wavelets ranging from 4 to 15 Hz in 1 Hz logarithmic steps, c = 4, dB normalized
- Induced activity: non-phase-locked to cue stimulus



Before each trial, a cue indicated the sensory modality of the following target discrimination.

BEHAVIORAL RESULTS

Accuracy

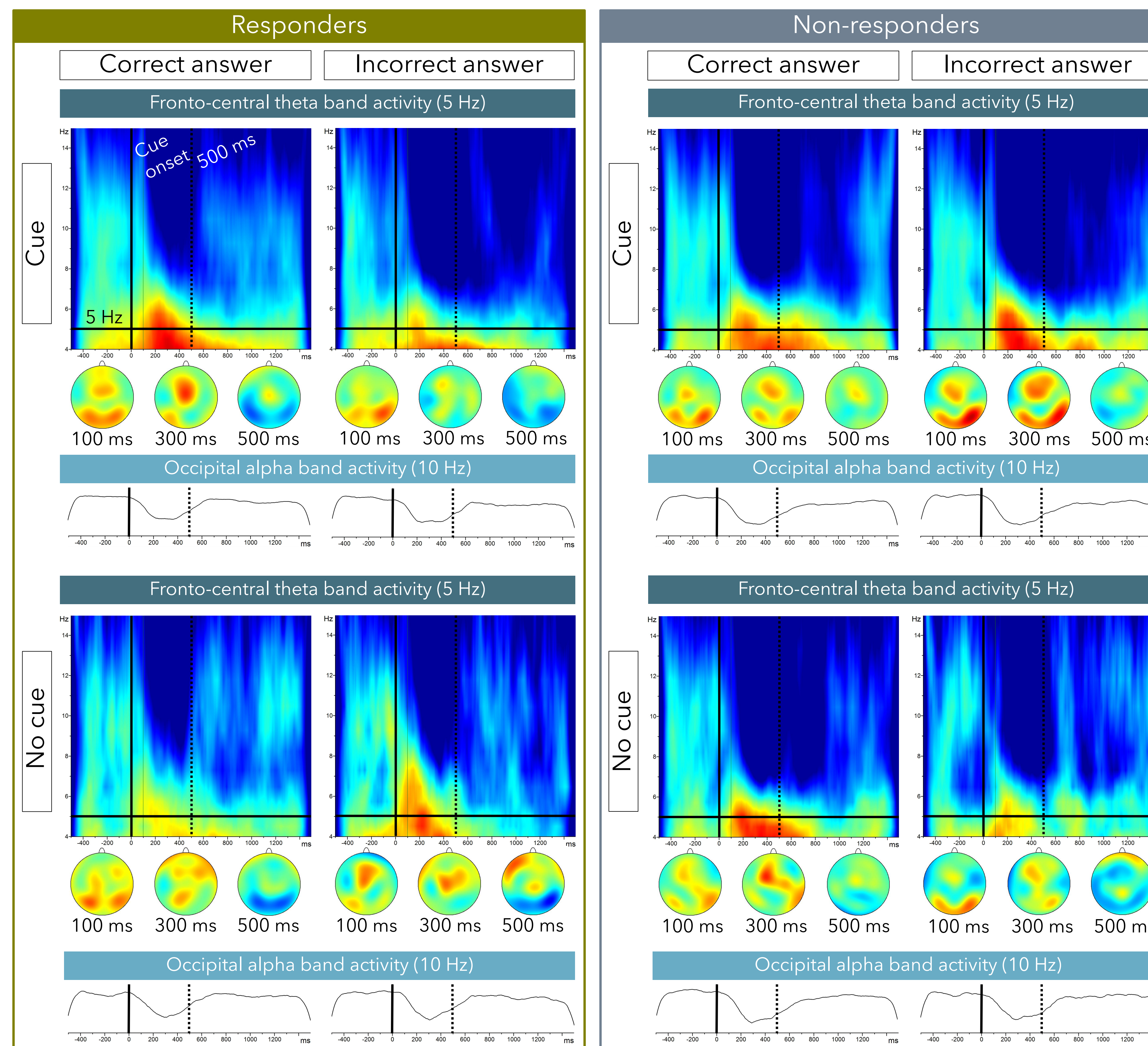
	Responders		Non-responders	
	M	SD	M	SD
Cue	0.62	0.07	0.60	0.09
No cue	0.57	0.07	0.63	0.08
Sig.	.000		.005	

Linear integrated speed-accuracy score⁴

	Responders		Non-responders	
	M	SD	M	SD
Cue	1679.49	1138.96	1885.59	752.87
No cue	1689.95	1116.81	1875.43	758.65
Sig.	.364		.378	

Attentional profiles (responders and non-responders) were created based on participants' behavioral performance. Responders seemed to efficiently use cues stimuli for the subsequent discrimination task, while non-performers seemed to have used a different attentional strategy.

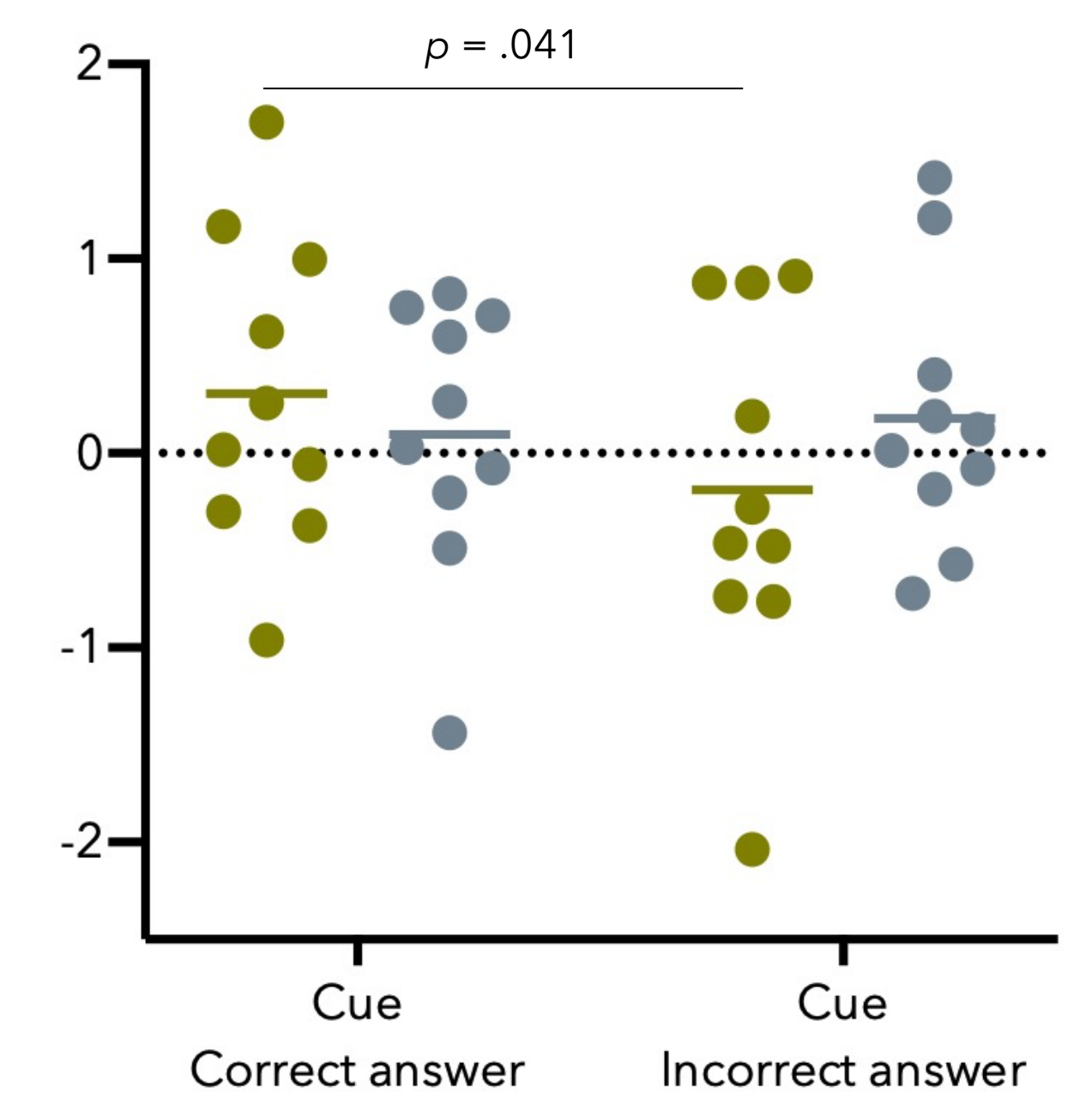
EEG RESULTS



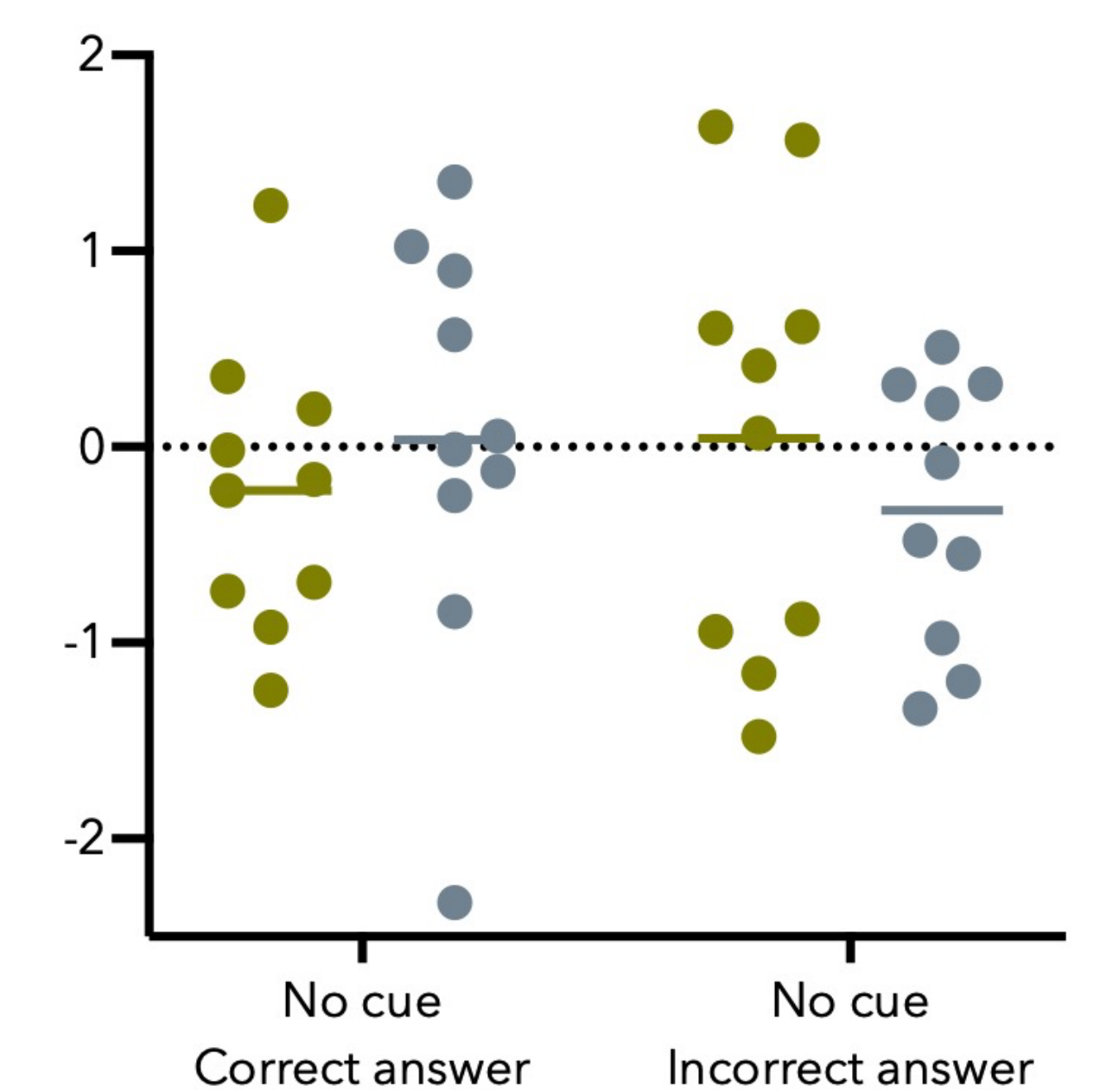
Fronto-central theta band activity (5 Hz)

Cue condition X Accuracy X Attentional patterns

$F(1, 18) = 6.162, p = .023, \eta_p^2 = .255$



● Responders ● Non-responders



DISCUSSION

- Behavioral results revealed two distinct profiles of attentional deployment related to cue stimuli. Responders performed better when discriminating cued versus un-cued target stimuli, while non-responders presented the opposite behavioral pattern.
- As expected, EEG results showed a decreased alpha band magnitude in parieto-occipital regions for all participants during the cue stimulus presentation.
- Compared to non-responders, responders had a greater theta band oscillatory activity for correct versus incorrect responses in the cued condition. There was no difference for the un-cued condition.

1. Williamson, S. J., Kaufman, L., Lu, Z. L., Wang, J. Z., & Karron, D. (1997). Study of human occipital alpha rhythm: the alphon hypothesis and alpha suppression. *International journal of psychophysiology*, 26(1-3), 63-76.
 2. Keller, A. S., Payne, L., & Sekuler, R. (2017). Characterizing the roles of alpha and theta oscillations in multisensory attention. *Neuropsychologia*, 99, 48-63.
 3. Simon, D. M., & Wallace, M. T. (2016). Dysfunction of sensory oscillations in autism spectrum disorder. *Neuroscience & Biobehavioral Reviews*, 68, 848-861.
 4. Vandierendonck, A. (2017). A comparison of methods to combine speed and accuracy measures of performance: A rejoinder on the binning procedure. *Behavior research methods*, 49(2), 653-673.