

Heart-rate modulations reveal attention and consciousness interactions

Maria I. Cobos¹, Pedro M. Guerra², Jaime Vila², Ana B. Chica¹

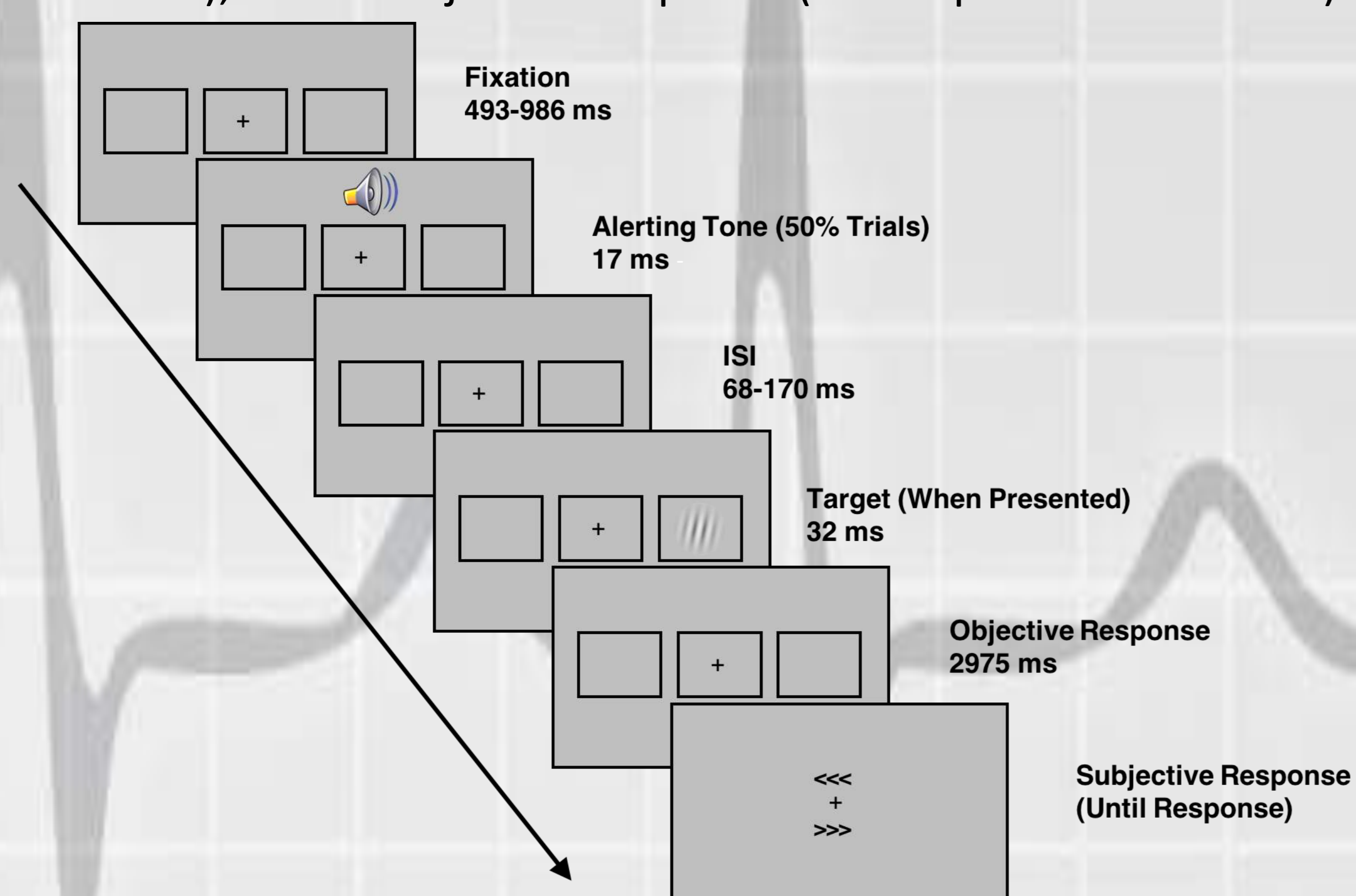
¹Department of Experimental Psychology, Brain and Behavior Research Center (University of Granada), Spain; ²Department of Clinical Psychology, Brain and Behavior Research Center (University of Granada, Spain)
Corresponding author: mariacobosmartin@correo.ugr.es

Introduction and aims

- Current theoretical models about conscious perception have mainly focused in cognitive and neural processing¹. However, cognitive processes do not happen in an isolated brain, being important to understand the interaction between the brain and the environment, and between the brain and the organism^{2,3}.
- The objective of the present study is to explore for the first-time cardiac modulations associated to attention and consciousness interactions. We explored if the previously demonstrated interaction between phasic alerting and conscious perception⁴.

Methods

- We manipulated phasic alertness and measured its impact on the conscious perception of a near-threshold Gabor stimulus (titrated to be consciously perceived on ~50% of the trials).
- Participants performed an objective response (Gabor's line tilt orientation), and a subjective response (Gabor present or absent).



Results

Behavioral results

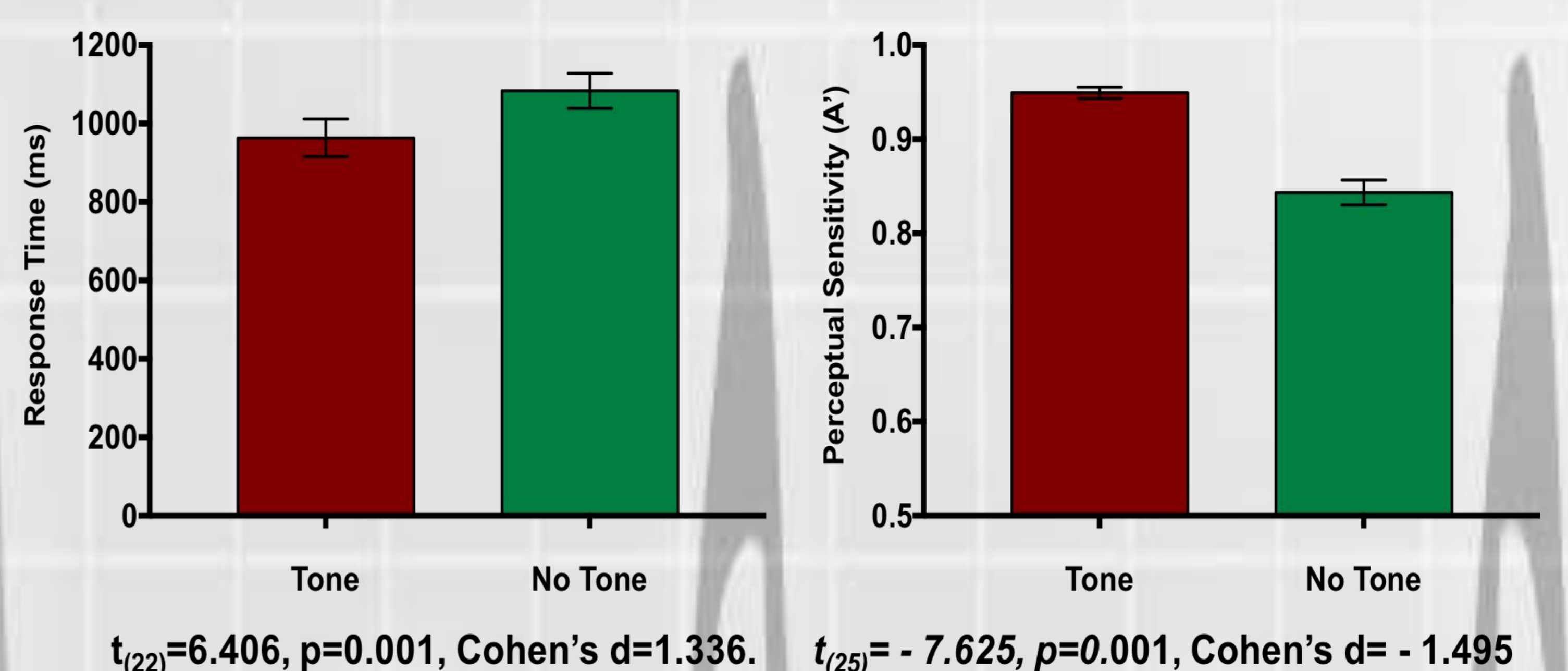


Fig 1: (left) Response Time and (right) Perceptual Sensitivity (A') to detect the Gabor when the alerting tone was present vs. absent.

Heart-rate results

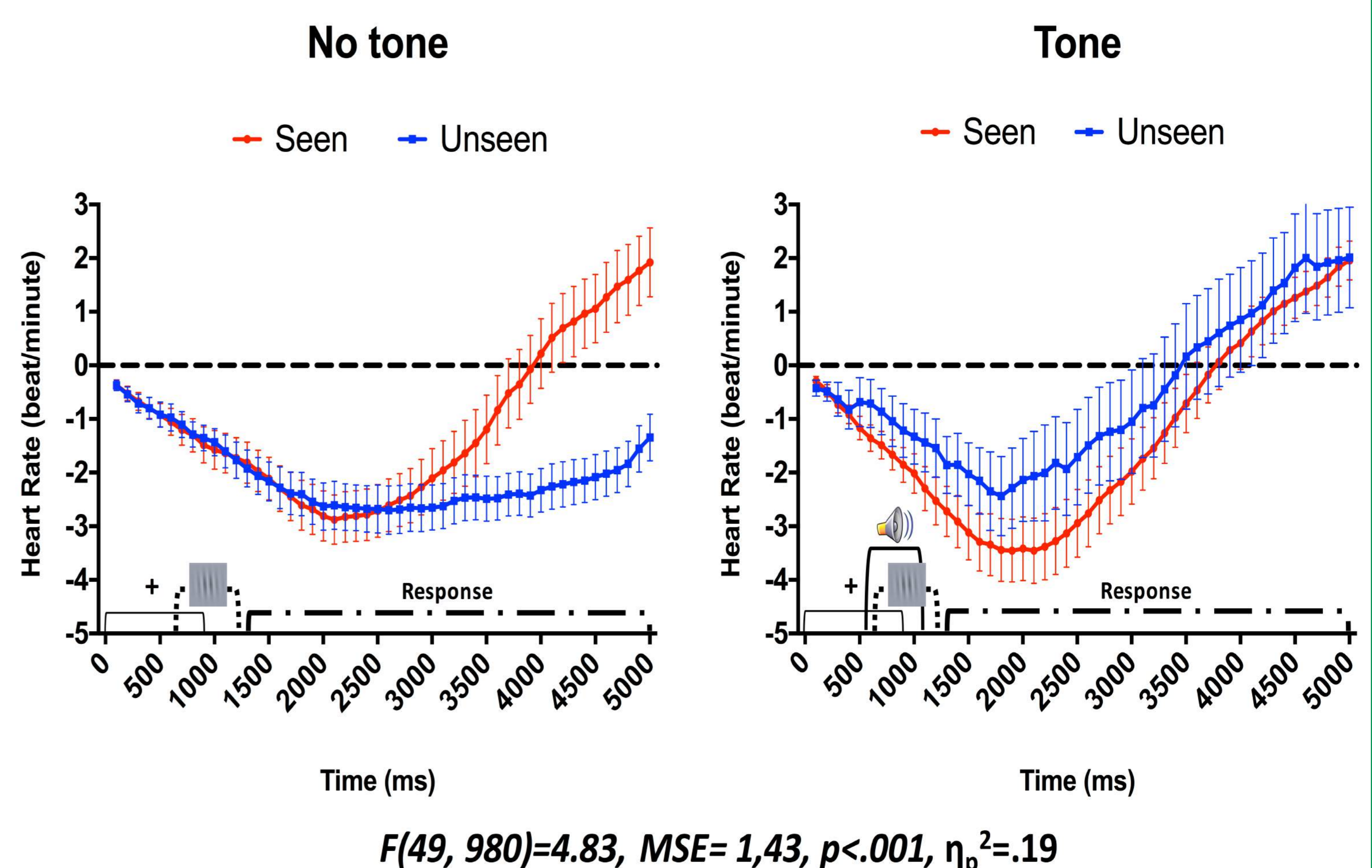


Fig 2: Changes in HR (relative to baseline) for seen and unseen Gabors when the alerting tone was absent (left panel) and present (right panel). The 0 value on the x axis represents the moment of fixation onset. The moment of presentation of the alerting tone and the Gabor was variable. In both tone and no tone conditions the deceleration-acceleration HR pattern is observed. The deceleration was more pronounced for seen as compared to unseen trials when the alerting tone was presented.

Skin Conductance results

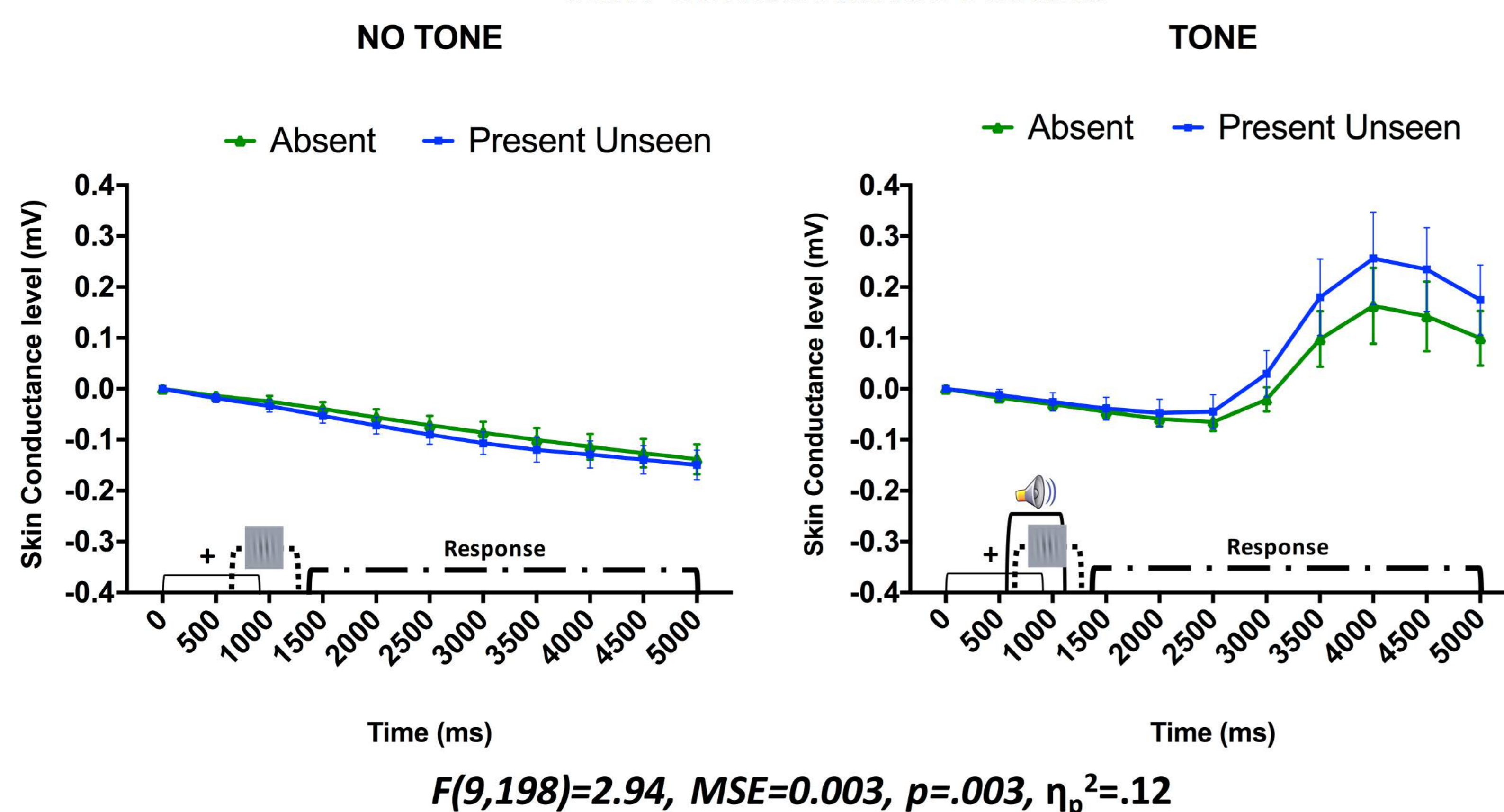


Fig 3: Changes in SC (relative to baseline) for absent vs. present but unseen Gabors when the alerting tone was absent (left panel) and present (right panel). The 0 value on the x axis represents the moment of fixation onset. The moment of presentation of the alerting tone and the Gabor were variable. Results demonstrated an increased SC response for unseen Gabors that were actually presented, as compared to absent Gabors. This indicates a subliminal processing of the stimuli.

Discussion and Conclusions

- The HR deceleration-acceleration pattern demonstrated an interaction between phasic alerting, time, and consciousness. Previous neuroimaging data have demonstrated interactions between phasic alerting and consciousness in a fronto-striatal network⁴. We hypothesize that the insula² might be an important node for integrating information from the organism and the brain.
- Skin conductance results revealed some kind of subliminal processing of stimuli reported as unseen, which has never been observed in our previous studies using behavioral methods and different neuroimaging techniques
- Attention-consciousness interactions are reflected in the organism (HR and SC), generating the need to add a biological component to theoretical models of consciousness³.