

## Introduction

- What is the difference in neural processing when we are aware versus unaware of a visual stimulus?
- Inattentional blindness<sup>1</sup> offers an excellent way to test this, as salient stimuli (e.g., a gorilla<sup>2</sup>) can be presented while participants are completely unaware of it.
- Previous studies<sup>3</sup> adapted the gorilla experiment into one that allows for concurrent brain recordings (with dozens of unseen and seen trials).
- The 3-phase paradigm used previously<sup>4-6</sup> found one EEG signal (VAN<sup>7-8</sup>) as a marker of awareness, while the P3b was linked with performing the report task.
- Direct comparisons between seen and unseen trials, however, were precluded by a condition-order confound (unseen blocks always preceded seen blocks).
- Here, as part of the Cogitate consortium, we developed a novel paradigm<sup>9</sup> that fixes this issue while still separating awareness-related from report-related signals.

## Methods

Distracted Attention (dAT) condition:

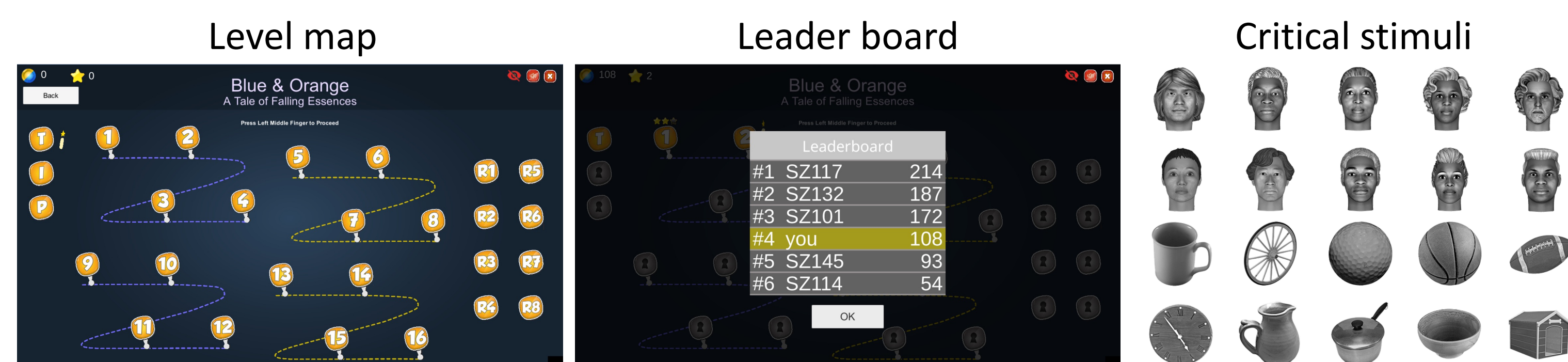
- Participants played an engaging video game as their primary task.
- Face and object stimuli were presented in the background every ~3-6s.
- Occasionally (every ~9-18s) the game paused immediately after stimulus offset, probing participants to report whether they just saw a stimulus or not.

Attended (AT) condition:

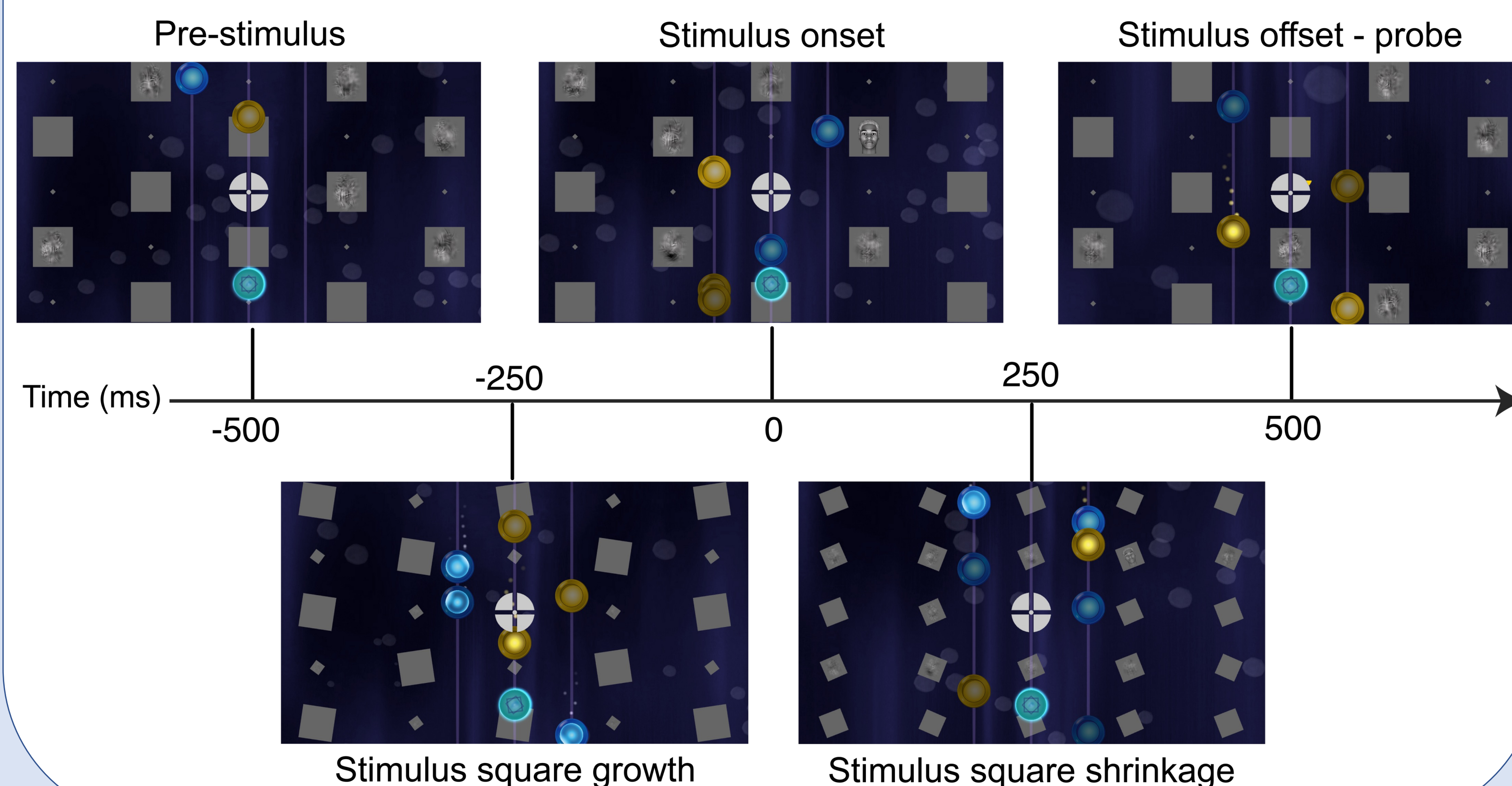
- An exact replay of the video game (from the dAT condition) was presented.
- Participants ignored the game to detect face or object stimuli in the background.

Participants & brain recordings:

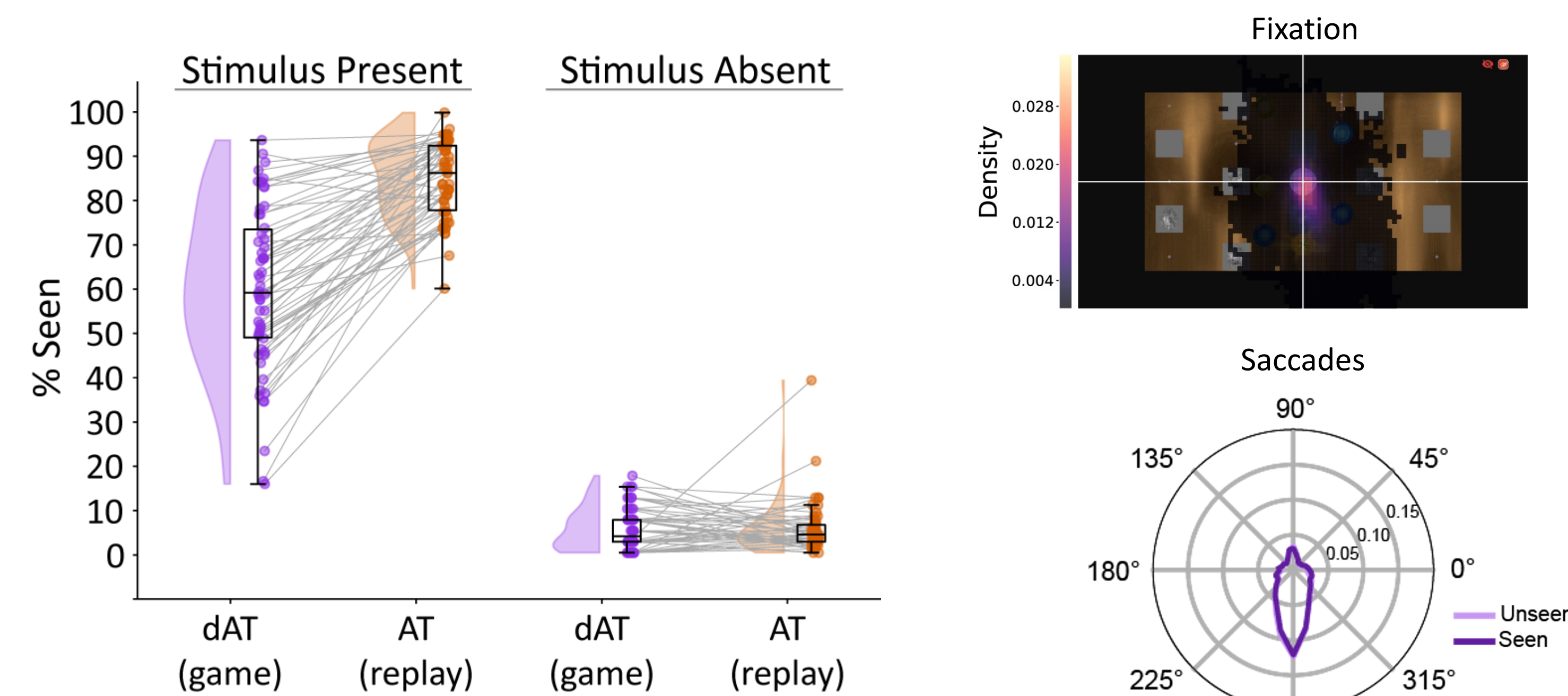
- N=83 (total) with simultaneous MEG-EEG.
- For analyses reported here, N=55 (main EEG results); N=47 (for classification results)



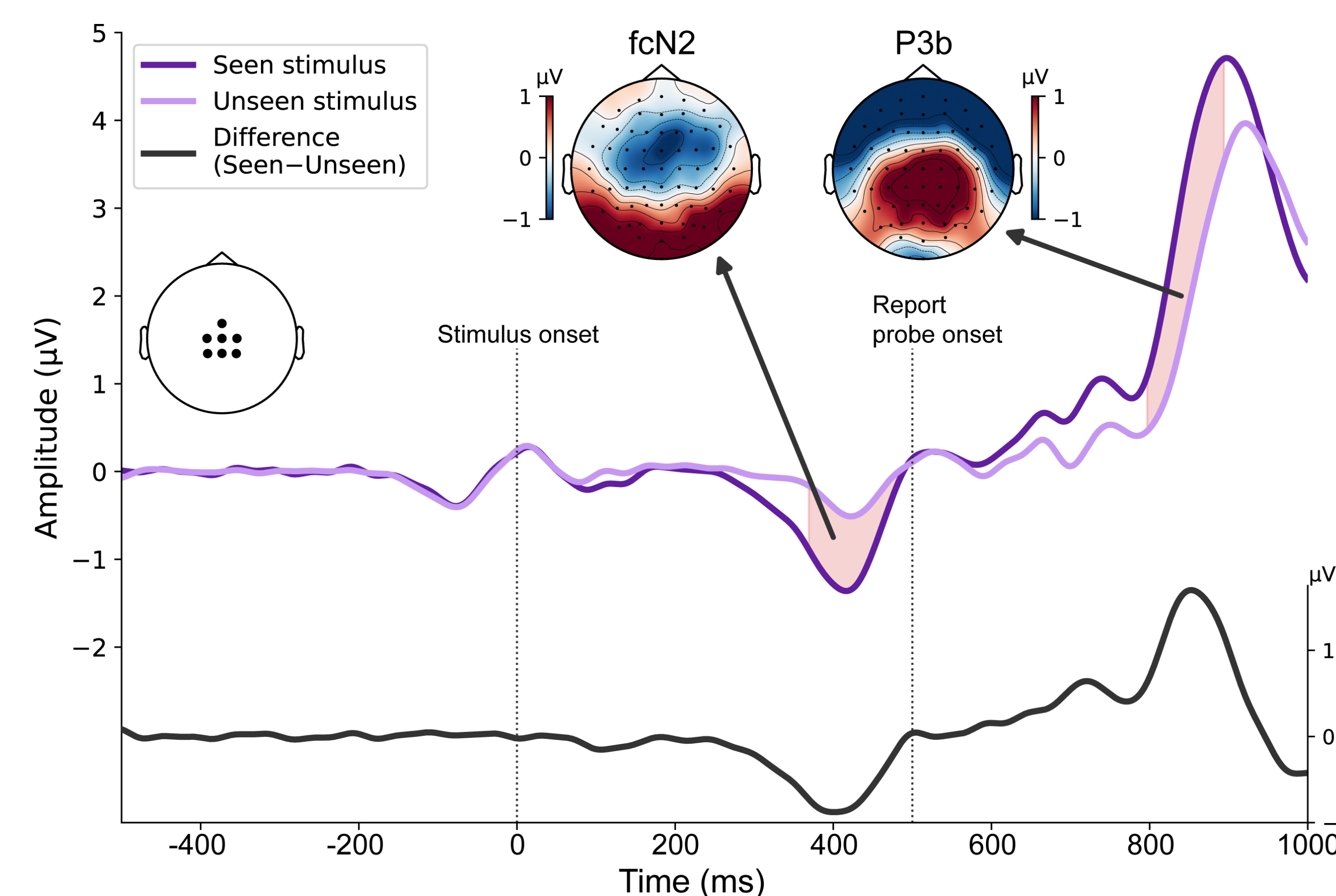
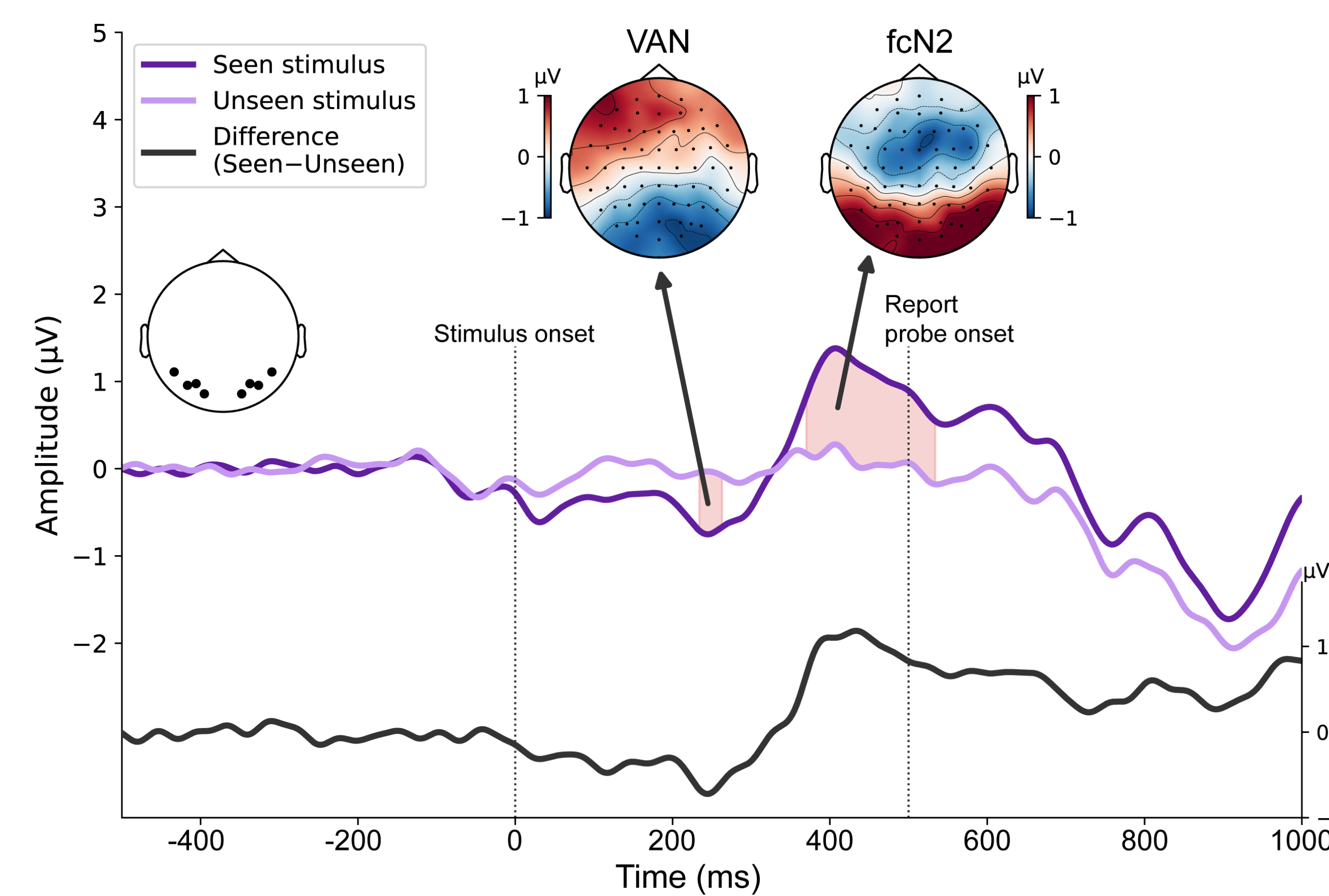
### dAT "report" trial



## Results: behavior & eye tracking

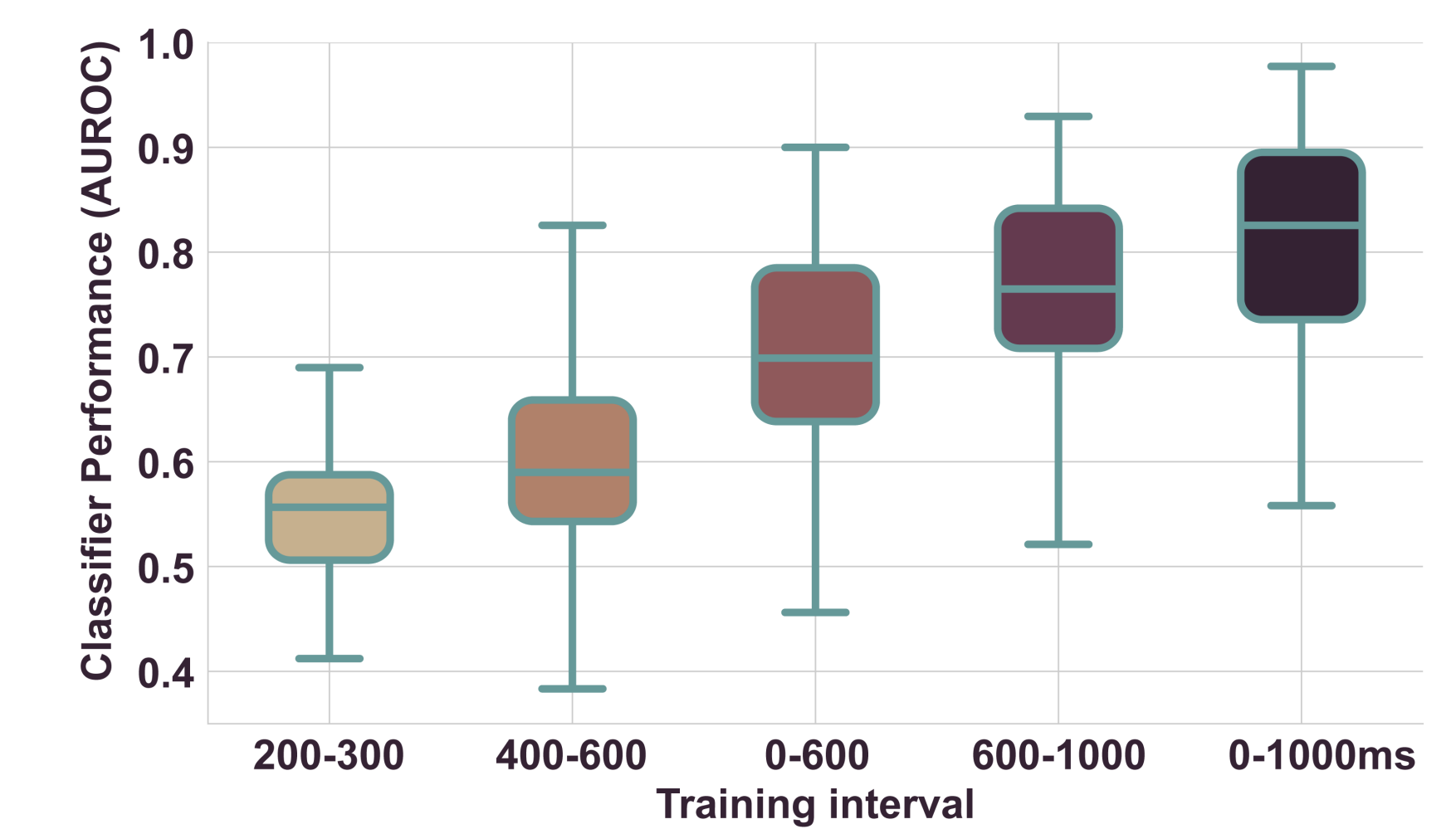


## Results: EEG from report trials

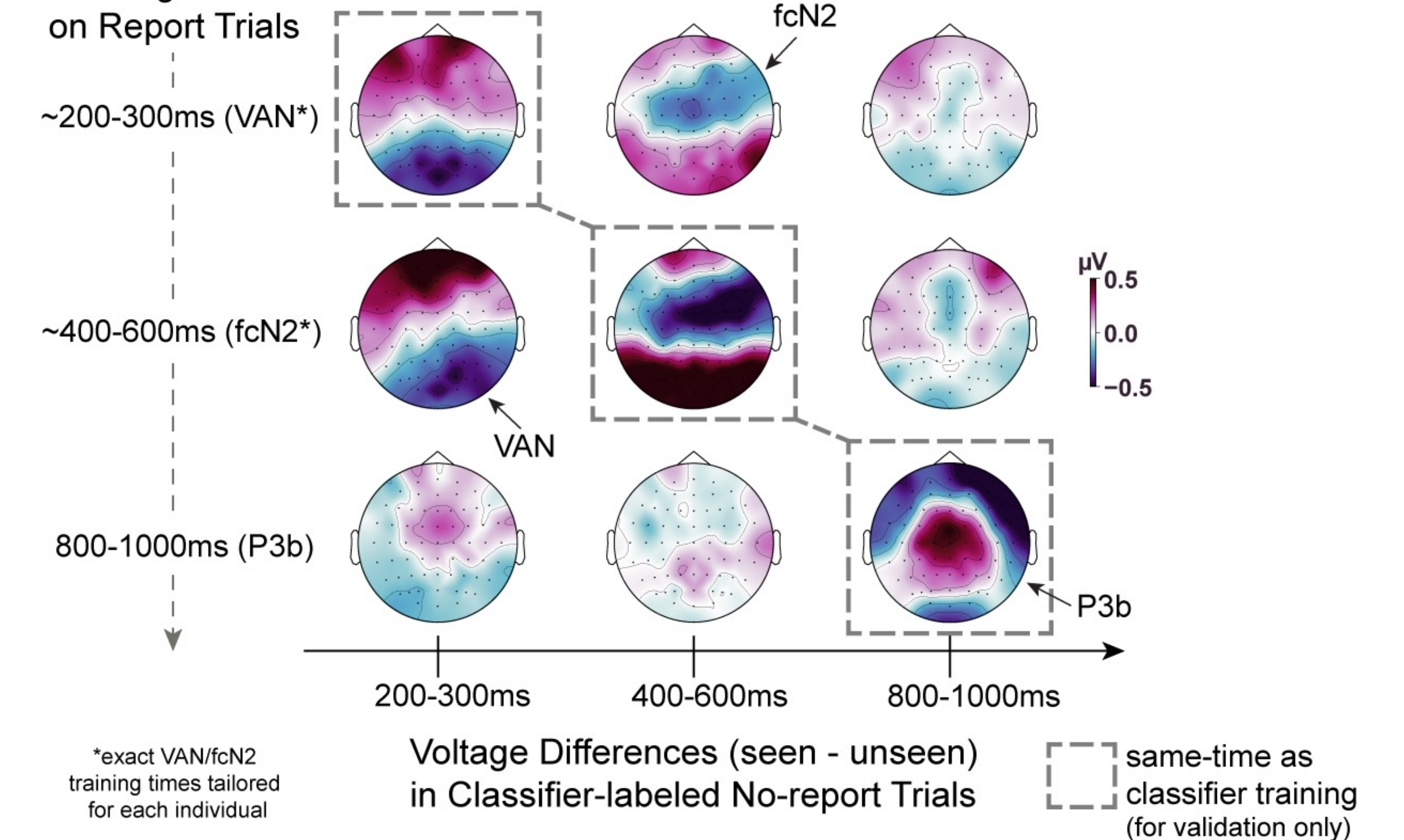


## Results: No-report classification

- First, we trained & tested pattern classifiers to decode seen-vs-unseen report trials, using different time-windows for training.
- Then, we used the trained classifiers to label no-report trials as seen-vs-unseen across these time windows.



Time Window for Training Classifier on Report Trials



## Conclusions

- In report trials, seen versus unseen contrasts led to three successive EEG effects:
  1. visual awareness negativity, VAN (~200-300ms)
  2. fronto-central N2, fcN2 (~400-600ms)
  3. P3b (~800-1000ms)
- VAN and fcN2 were elicited prior to report probes while P3b was elicited ~300ms after report probes, suggesting a temporal separation of awareness-related and report-related signals.
- Decoders trained on the VAN time window in report yielded trial classification in no-report in which fcN2 was still evident, and vice versa, while the P3b was absent; conversely, training on the P3b time window only preserved the P3b.
- These results suggest two successive stages of processing linked with visual awareness, both isolated from report.
- These stages may reflect mechanisms involved in establishing integrated perceptual content, and minimal cognitive access to that content, respectively<sup>10</sup>.

## References & Acknowledgments

<sup>1</sup>Mack & Rock (1998). *Inattentional Blindness*. MIT Press.  
<sup>2</sup>Simons & Chabris (1999). Gorillas in our midst: sustained inattention blindness for dynamic events. *Perception*, 28, 1059-1074.  
<sup>3</sup>Hutchinson (2019). Toward a theory of consciousness: A review of the neural correlates of inattentional blindness. *Neurosci & Biobeh Rev*, 104, 87-99.  
<sup>4</sup>Pitts, Martinez, & Hillyard (2012). Visual processing of contour patterns under conditions of inattentional blindness. *J CogNeuro*, 24, 287-303.  
<sup>5</sup>Pitts et al. (2014). Gamma band activity and the P3 reflect post-perceptual processes, not visual awareness. *NeuroImage*, 337-350.  
<sup>6</sup>Shafo & Pitts (2015). Neural signatures of conscious face perception in an inattentional blindness paradigm. *J Neurosci*, 35, 10940-10948.  
<sup>7</sup>Koivisto & Revonsuo (2003). An ERP study of change detection, change blindness, and visual awareness. *Psychophysiology*, 40, 423-429.  
<sup>8</sup>Dembski, Koch, & Pitts (2021). Perceptual awareness negativity: a physiological correlate of sensory consciousness. *Trends in CogSci*, 25, 660-670.  
<sup>9</sup>Melloni et al. (2023). An adversarial collaboration protocol for testing contrasting predictions of GNW and IIT. *PLOS ONE*, 18, e0268577.  
<sup>10</sup>Mudrik, Faivre, Pitts, & Schurger (2025). On a confusion about there being two types of consciousness. *Trends in CogSci*, Epub ahead of print.