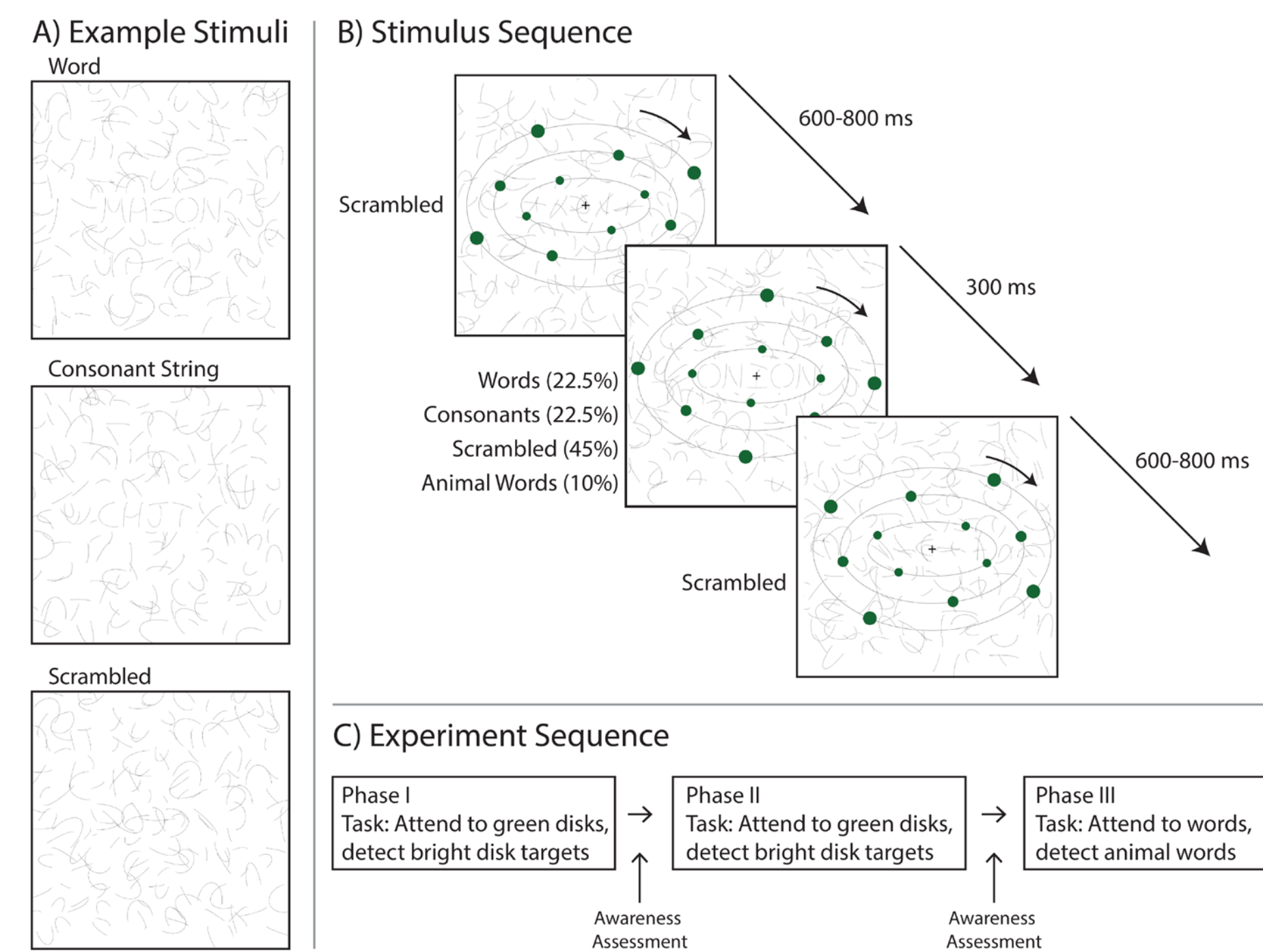


## Introduction

- To investigate the neural correlates of conscious perception, one strategy is to contrast ERPs elicited by identical visual stimuli of which subjects are aware versus unaware<sup>1</sup>.
- Inattention blindness refers to the failure to detect unexpected, but otherwise salient stimuli because one's attention is engaged elsewhere<sup>2</sup>.
  - The inattention blindness paradigm<sup>2</sup> was recently adapted for ERPs<sup>1</sup>.
- Previous studies suggest that access to meaning of "unseen" words occurs during the attentional blink, indexed by the N400 component<sup>3</sup>.
  - However, the prime words were seen and the unseen probe words were task-relevant targets<sup>3</sup>, thus it is unclear whether the N400 would remain during the complete absence of attention (inattention blindness).
  - Earlier components reflecting orthographic and lexical processing (N1, mid-late latency posterior components) may also be modulated by attention and awareness<sup>4</sup>.
- Key questions:** How much processing occurs automatically, in the complete absence of attention/awareness? What are the neural correlates of visual awareness of words and consonant strings?

## Methods



### ERP acquisition

- 96 equidistant electrodes
- Average mastoid reference
- 500Hz sampling rate
- 30Hz low-pass filtered

### Awareness assessment

- 1) Did you see any patterns or unexpected changes in the background?
- 2) If you did see something, please describe (or draw) what you saw in as much detail as possible.

(Verbal) Some participants were randomly assigned to conditions where additional distracting patterns were presented. Please indicate if you noticed any of these patterns.

3) Rate how confident you are that you saw each of the following patterns during the experiment.

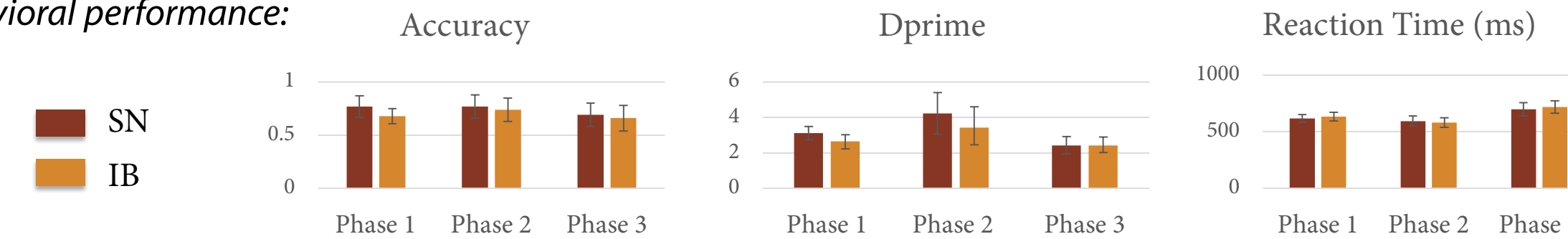
Shape	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nonword	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Animal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Behavioral Results

**Awareness assessment:** subjects divided into two groups based on the first awareness assessment.

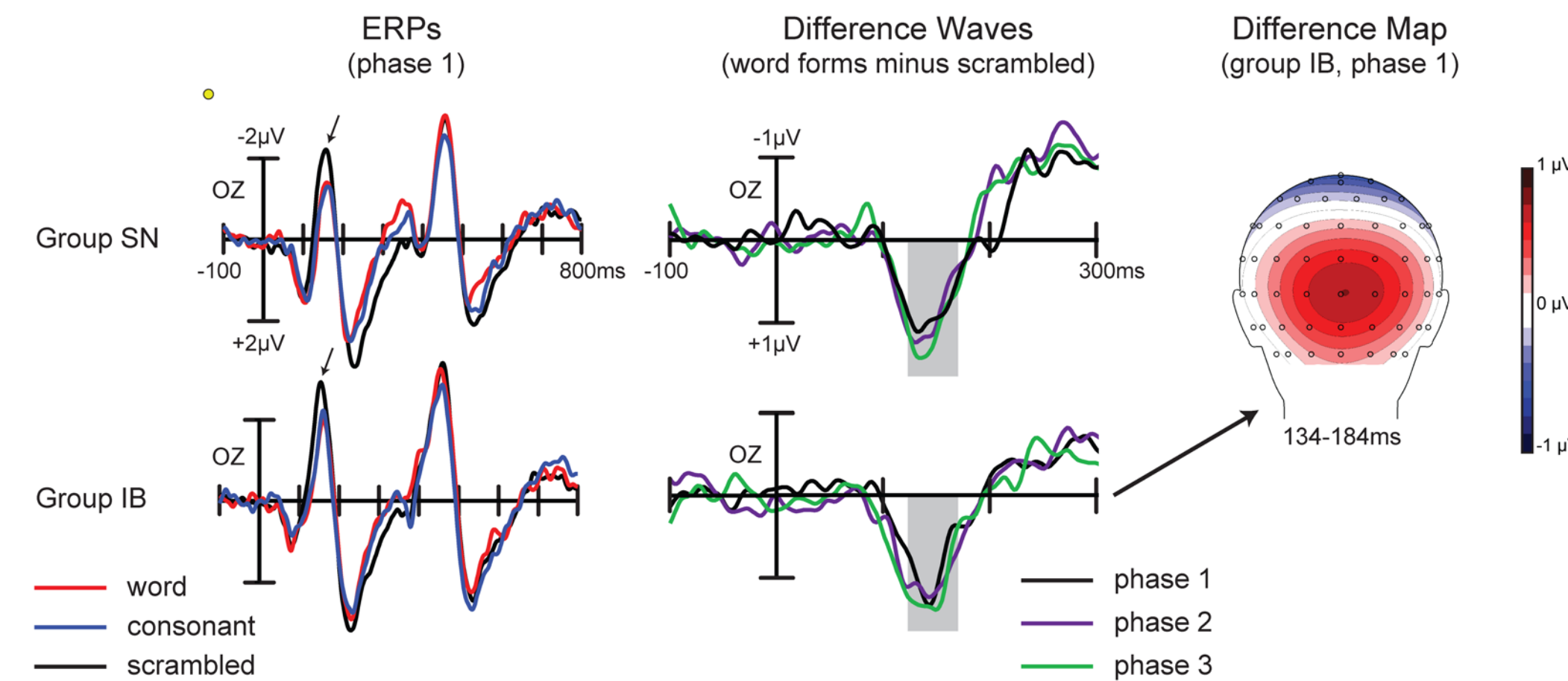
- "Inattentionally Blind" (IB)** = subjects unaware of the words/letters during the first phase (n = 10).
- "Spontaneous Noticers" (SN)** = subjects who spontaneously noticed the words/letters during the first phase (n = 12).

**Behavioral performance:**

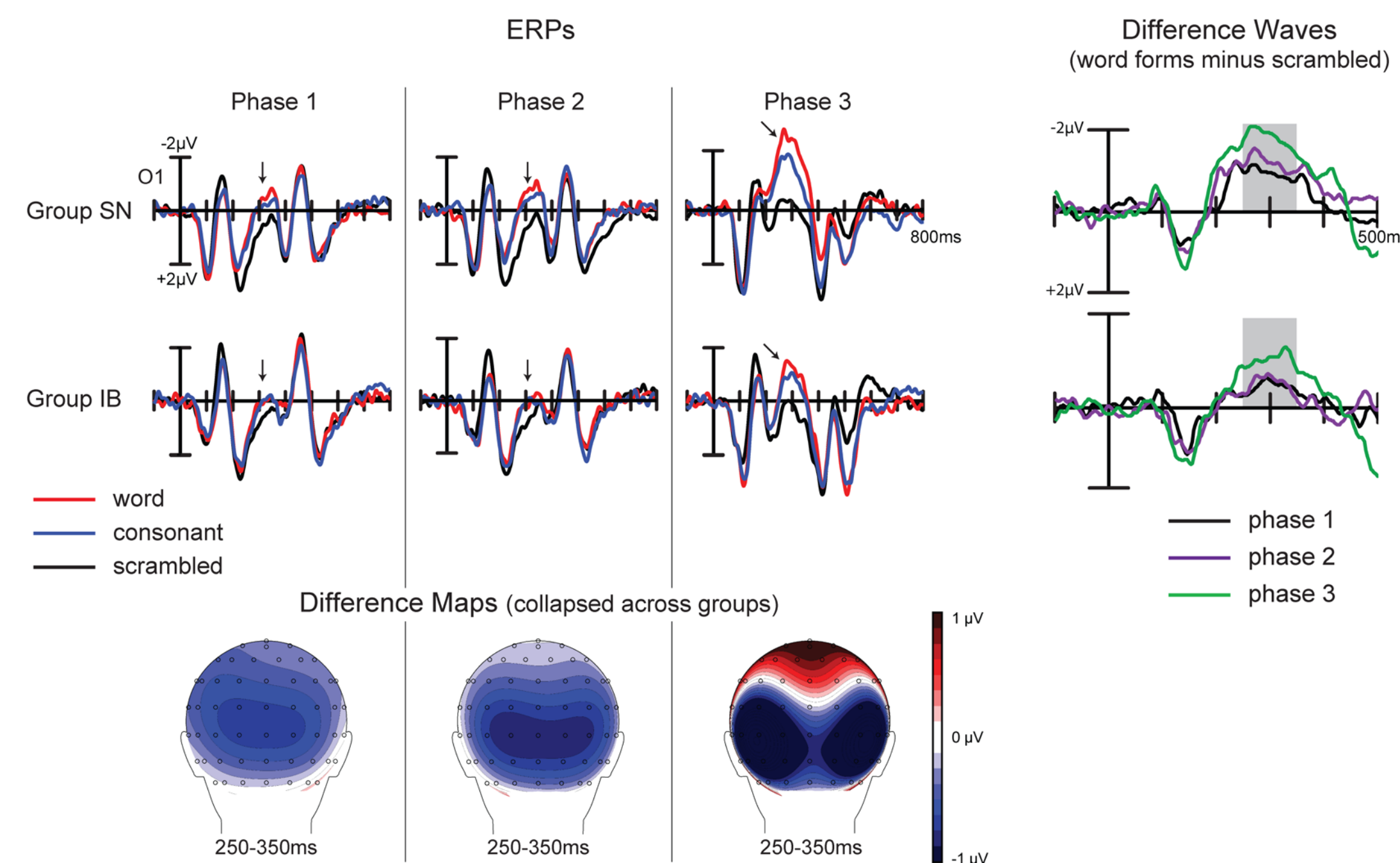


## ERP Results

1) N1 amplitudes were reduced (more positive) for words and consonants compared to scrambled lines in all phases, regardless of attention/awareness.

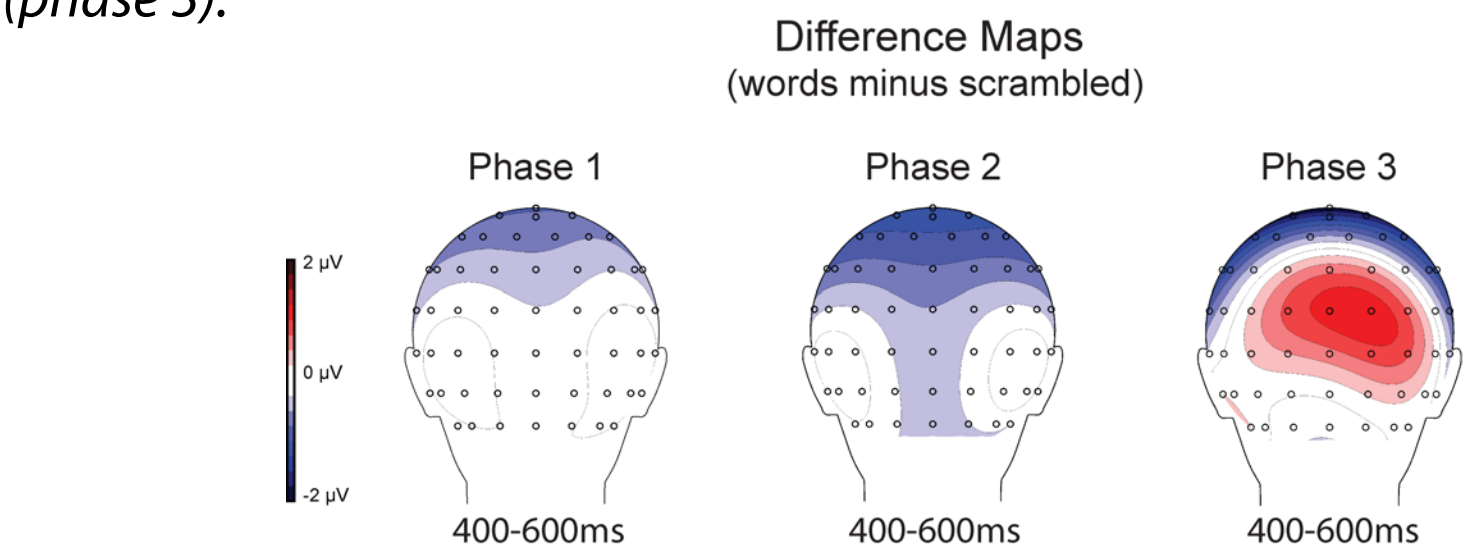


2) Words and consonants elicited a mid-late negativity from 250-350ms (Nd300) in all phases. This difference was enhanced when the words were task-relevant in phase 3.

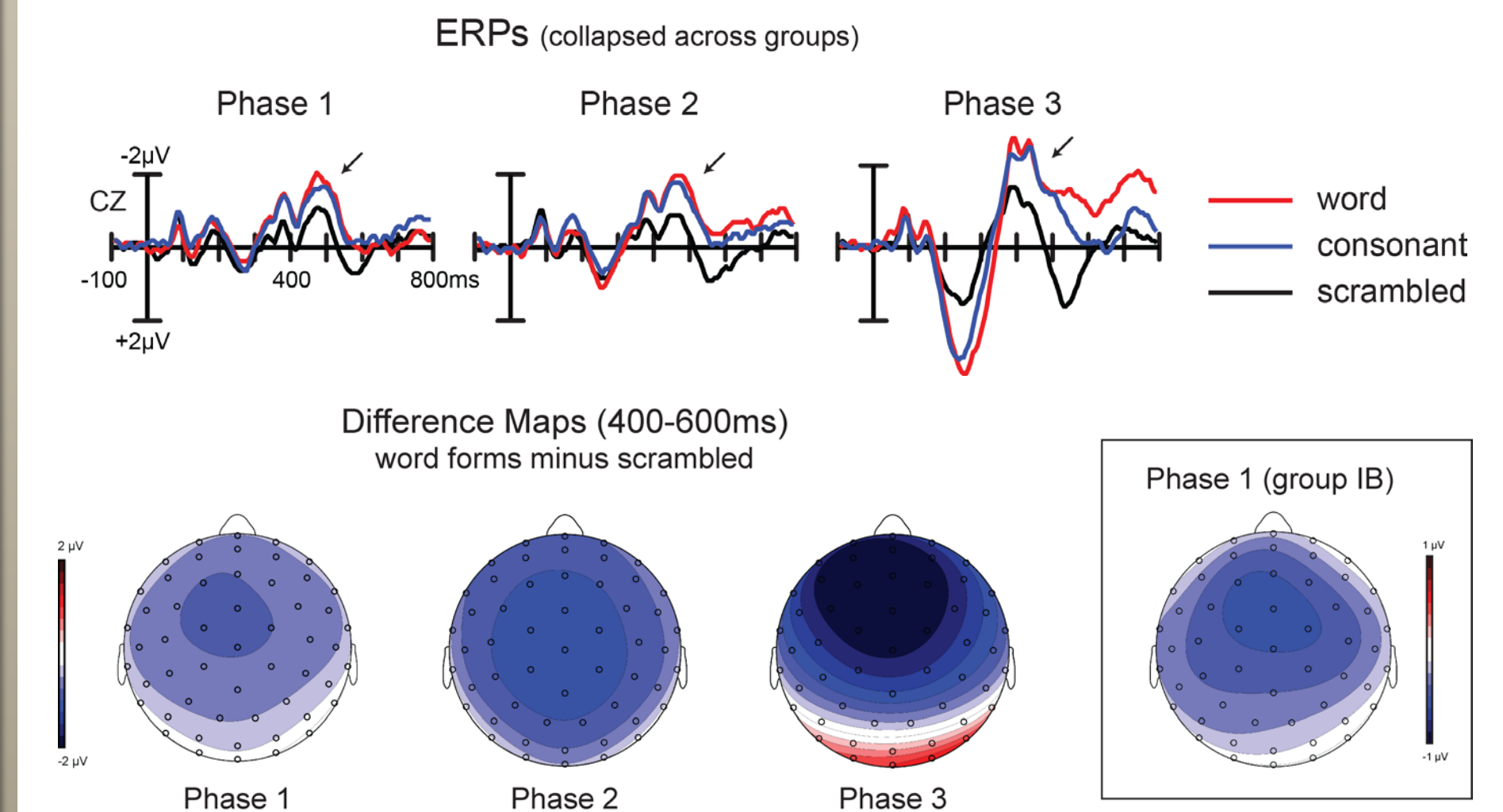


## ERP Results (continued)

3) Words elicited a P3b only when they were attended and task-relevant (phase 3).



4) Words and consonants elicited an N400 in all phases, with increased amplitude for attended and task-relevant conditions.



## Discussion

- The N1 difference and the Nd300 were present in all phases, and are thus potential markers of automatic orthographic processing. The Nd300 was enhanced by task-based attention, possibly reflecting an overlapping selection negativity.
- The P3b was evident only when the word forms were task relevant. This finding suggests that the P3b is associated with post-perceptual processing and is not a reliable correlate of visual awareness<sup>1</sup>.
- An N400 was observed for word forms in all phases, even during inattention blindness. This word-form N400 grew larger with attention/awareness and was largest when the words became task-relevant.
- ERPs elicited by words and consonants did not differ from each other during inattention blindness (not shown).
- Overall, these results suggest extensive processing of word forms in the absence of attention and awareness. Conscious perception of the words/letters led to only modest increases in Nd300 and N400 amplitudes.

## References

- Pitts, M., Martinez, A., & Hillyard, S. (2012). Visual processing of contour patterns under conditions of inattention blindness. *Journal of Cognitive Neuroscience*, 24:2, 287-303.
- Mack, A. & Rock, I. (1998). *Inattention blindness*. Cambridge, MA: MIT Press.
- Luck, S., Vogel, E., & Shapiro, K. (1996). Word meanings can be accessed but not reported during the attentional blink. *Nature* 383(6601): 616-618.
- Appelbaum, L., Liotti, M., Perez, R., Fox, S. & Woldorff, M. (2009). The temporal dynamics of implicit processing of non-letter, letter, and word-forms in the human visual cortex. *Front Hum Neurosci* 3, 56.