# Visual processing of faces during inattentional blindness

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SCALPLAB
Sensation Cognition Attention Language Perception

## Background

- To investigate the **neural correlates of conciousness** (NCCs) previous studies have compared event-related potentials (ERPs) elicited by identical visual stimuli of which subjects are aware versus unaware.
  - Some studies have implicated a mid-latency posterior ERP component (**Nd2/VAN**) as a potential ERP correlate of conscious visual processing[1].
  - Other studies suggest that later fronto-parietal interactions are necessary for conscious perception and are indexed by a late positive wave (**P3b**)[2].
- **Inattentional Blindness** – the failure to detect an unexpected, but otherwise salient stimulus because one's attention is engaged elsewhere.
  - Paradigm recently adapted for ERPs by ensuring that some subjects fail to notice stimuli across many trials[3].
- **Face perception** differs from perception of other object categories in behavioral and neuroimaging paradigms.
  - In ERP paradigms, this manifests as an enhanced negativity over lateral occipital electrode sites known as the **N170**.

## Research Questions

What are the neural correlates of visual awareness of faces?

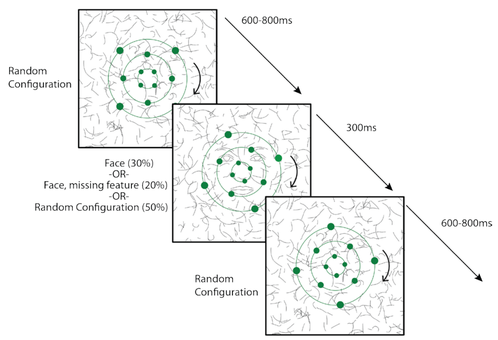
- Does the N170 occur even when faces are not consciously perceived?
- How do other proposed correlates of awareness (e.g. Nd2, P3) contribute to face perception?

## Methods

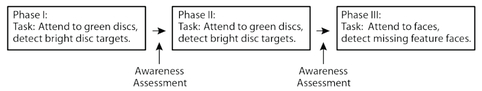
*Stimuli and Procedure*

a) Example Stimuli:


b) Stimulus Sequence:




c) Experiment Sequence:




*EEG/ERP specs*

- 96 equidistant electrodes.
- 500Hz sampling rate.
- Average referenced.
- 30Hz low-pass filtered.

*Awareness assessment*

1. Describe (or draw) any patterns you observed in the background lines during the target detection task.
2. Some participants were randomly assigned to conditions in which the line segments in the background occasionally formed coherent patterns. Did you see any coherent patterns?
3. Rate how confident you are that you saw each pattern during the experiment.

Please use the following scale:
1 = very confident I did not see it
2 = confident I did not see it
3 = uncersin
4 = confident I saw it
5 = very confident I saw it

| | | | | | |
|---|---|---|---|---|---|
| Violin | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| Face | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| Lightbulb | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| Flower | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |
| Car | ☐1 | ☐2 | ☐3 | ☐4 | ☐5 |

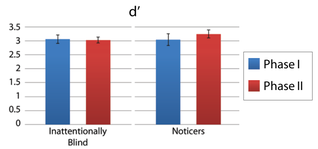
## Behavioral Results

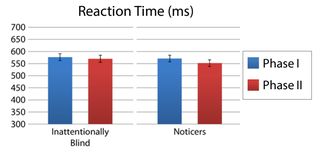
*Awareness assessment results*

- Subjects divided into two groups based on first awareness assessment:
  - those who were unaware of the faces during the first phase: "**Inattentionally Blind**" (n=15).
  - those who spontaneously noticed faces during the first phase: "**Noticers**" (n= 15).

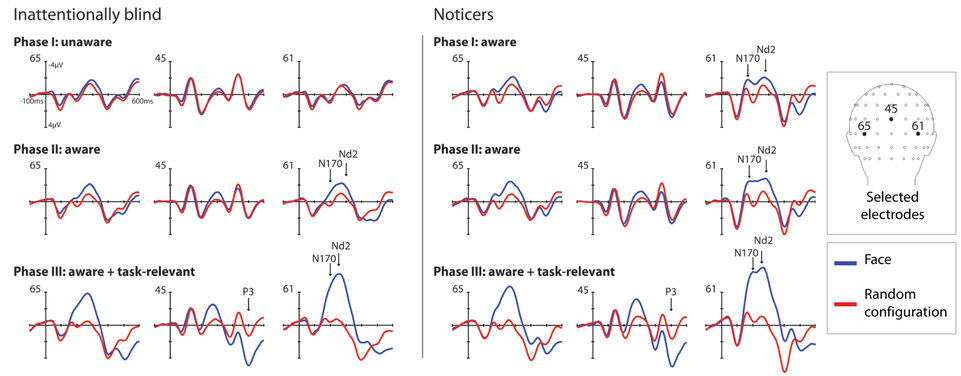
*Behavioral Performance*

- Performance on distractor task did not differ within each group across the first two phases or between groups within each phase.

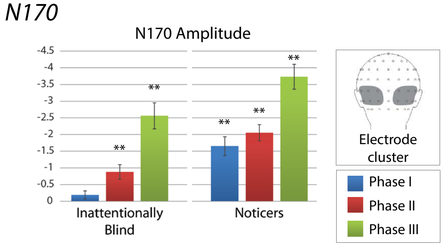


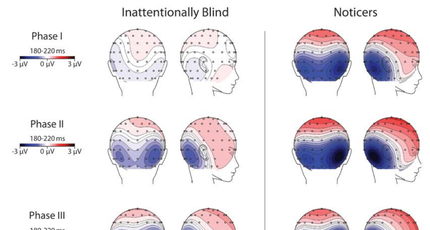




## ERP Results

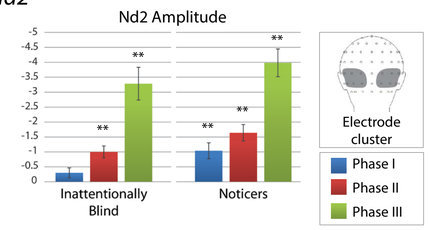


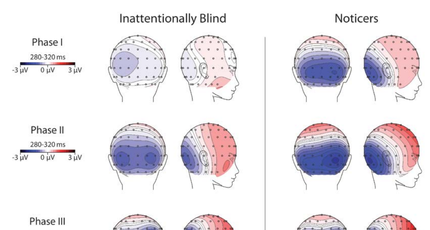

*N170*



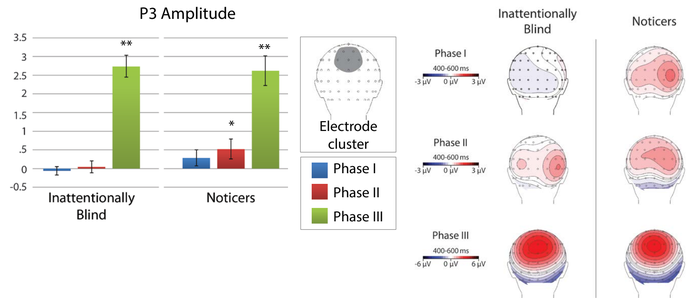

*Nd2*



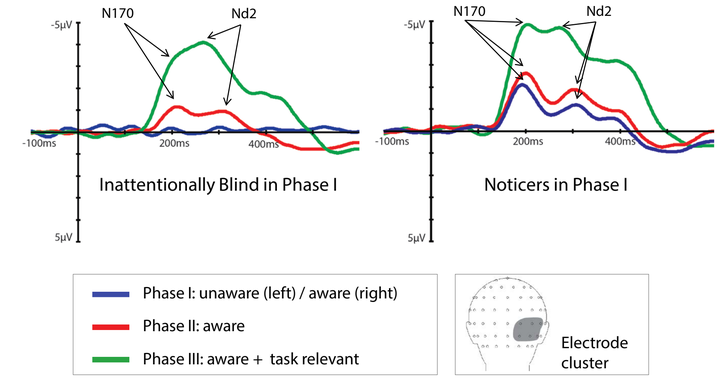




## ERP Results *(continued)*

*P3*




*Difference Waves*




## Discussion

- The face-specific N170 was absent during inattentional blindness.
- The N170 and a subsequent negativity (Nd2) were present for all subjects during awareness – those who spontaneously noticed faces during the first phase, as well as those who had previously been inattentionally blind.
- During the third phase, when faces were task-relevant, N170 and Nd2 were enhanced.
- A late positivity (P3b) was evident when faces were task relevant, but was absent during the previous phases despite subjects' awareness of the faces.
- These findings suggest a fundamental relationship between early to mid-latency ventral stream processing (N170/Nd2) and visual awareness, and suggest that late fronto-parietal interactions (P3b) reflect post-perceptual processes that are not necessary for awareness per se.

### Selected References

1. Railo, H., Koivisto, M., Revonsuo, A. (2011). Tracking the processes behind conscious perception: A review of event-related potential correlates of visual consciousness. *Consciousness and Cognition, 20,* 972-983.
2. Dehaene, S., Changeux, J. P., (2011). Experimental and theoretical approaches to conscious processsing. *Neuron, 70,* 200-227.
3. Pitts, M. A., Martínez, A., Hillyard, S. A. (2012). Visual processing of contour patterns under conditions of inattentional blindness. *Journal of Cognitive Neuroscience, 24:2,* 287-303.