

# Neural activity linked with visual awareness and task-relevance in a novel 2x2 design

CO

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# Background and Rationale

- Current experiment expands upon Dehaene et al.'s (2001) study [1], which used visual masking to render physically identical stimuli "seen" vs. "unseen".
- Dehaene et al. (2001) found that the P3b event-related potential (ERP) was uniquely elicited by "seen" stimuli, and is thus a neural marker of visual awareness.
  - BUT, the critical stimuli were always task-relevant

So, we asked...

Does the neural contrast between seen and unseen stimuli that suggests the P3b as a marker of visual awareness also extend to task-irrelevant stimuli?

# Mask-Stimulus-Mask Streams: 200ms Unseen OR 33ms OR 33ms OR 33ms (shown on 20% of trials)

### Procedure for (n=14) naive subjects:

- 1. 4x task-irrelevant blocks (232 trials each) *Task*: respond with button press if red oval is seen
- 2. Incidental Memory Test (IMT) \*94% accuracy\*
  - Did you see this exact image during the previous condition? [8 lightly masked, 8 heavily masked, 8 foils]
- 3. 4x task-relevant blocks (232 trials each) *Task*: respond with animal/object/nothing button press

### Trials

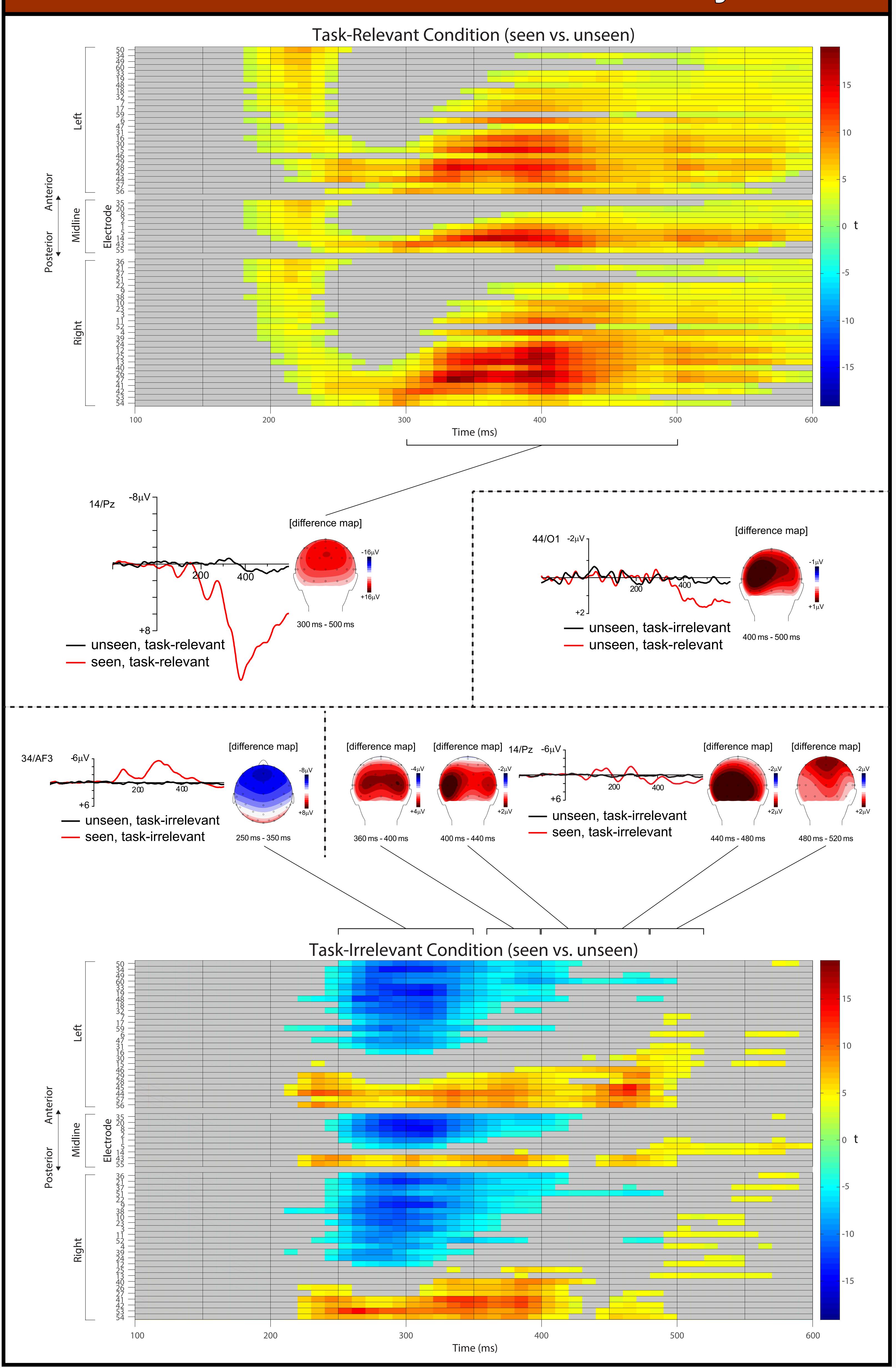
[1856 trials per subject]

- 25% lightly masked critical stimuli
- 25% lightly masked blanks
- 25% heavily masked critical stimuli
- 25% heavily masked blanks

### EEG Methods

- 64 equidistant channels
- 500Hz sampling rate
- 0.1-150Hz hardware filter
- 30Hz low-pass offline filter
- average mastoid reference
- baseline correction: -200-0ms

# ERP Results & Mass Univariate Analysis



# Theoretical Implications

The (well-supported) empirical theory of consciousness, **Global Neuronal Workspace Theory (GNWT)** [2-3], describes a *functional* view of conscious processing...

### Theoretically,

- Sophistocated nonconscious processing
- Widespread information sharing = conscious perception
   Empirically,
- P3b ERP = neural marker of Global Neuronal
   Workspace activity

### In prediction,

 The *P3b* should be evident whenever stimuli are seen and *NOT* when stimuli are unseen, regardless of task-relevance

# Summary and Conclusions

- P3b results from task-relevant condition replicate
   Dehaene et al.'s (2001) findings
- MUCH (8x) larger P3b for task-relevant compared to task-irrelevant stimuli
- P3b-like component also observed for task-relevant unseen stimuli
- Thus, *P3b* is mostly related to task relevance
- Frontal "no-go" N2 (inhibition) when seeing but not responding to irrelevant animal and object stimuli
  - Future studies need to eliminate these "no-go" decisions to more clearly investigate the P3b
- GNWT may be correct; however, the current study demonstrates the importance of isolating perceptual differences from task-based differences

## References

- Dehaene, S., Naccache, L., Cohen, L., Bihan, D. L., Mangin, J., Poline, J., & Rivière, D. (2001). Cerebral mechanisms of word masking and unconscious repetition priming. Nature Neuroscience, 4(7), 752-758.
- 2. Dehaene, S., & Changeux, J. (2011). Experimental and Theoretical Approaches to Conscious Processing. Neuron, 70(2), 200-227.
- 3. Dehaene, S. (2014). Consciousness and the brain: Deciphering how the brain codes our thoughts. New York: Penguin.