Distinct EEG bifurcation dynamics in report and no-report conditions of a visual masking paradigm

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1

SCALPLAB
Sensation Cognition Attention Language Perception
www.reed.edu/psychology/scalp

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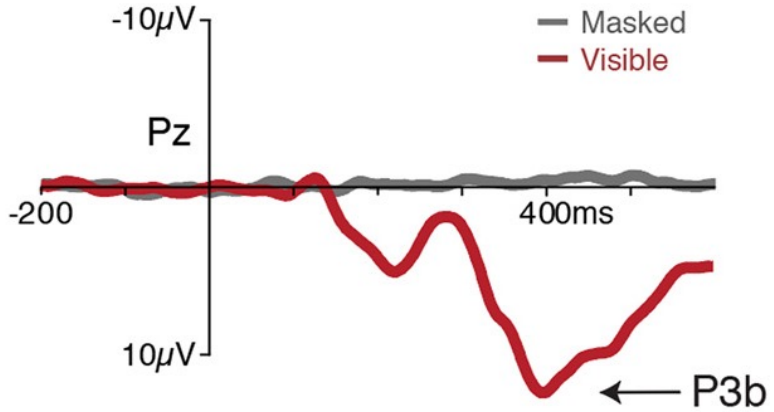
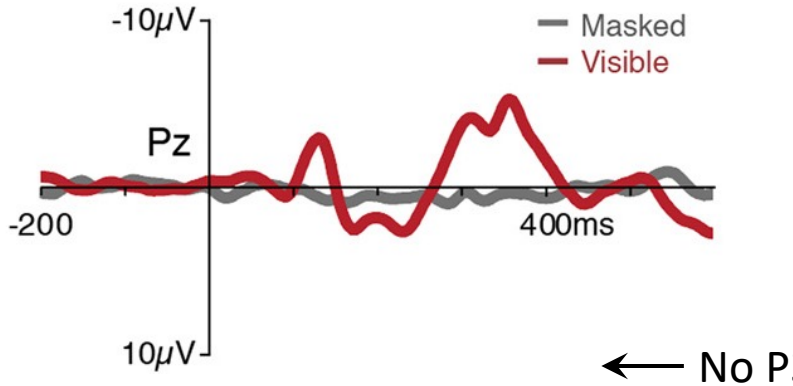
EEG masking: report vs. no-report

stim-mask SOAs:
visible = 200ms
masked = 33ms

Report:

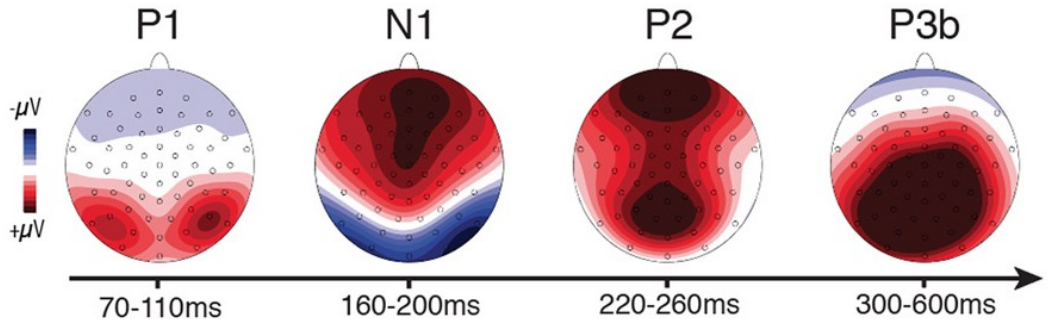


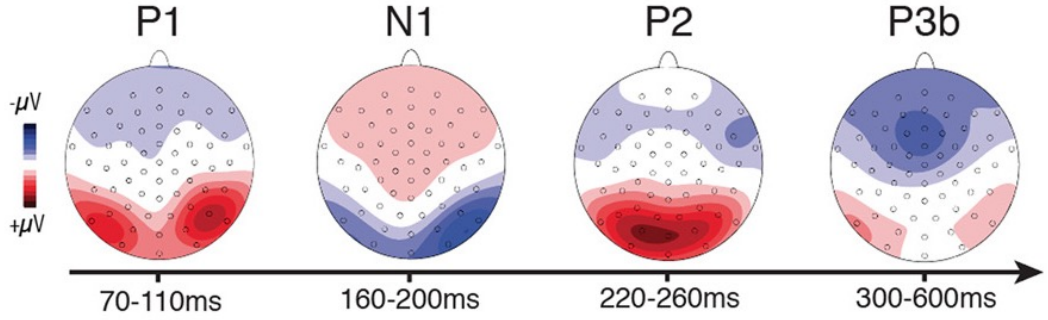
No-report:



No P3b

Difference maps (visible minus masked)



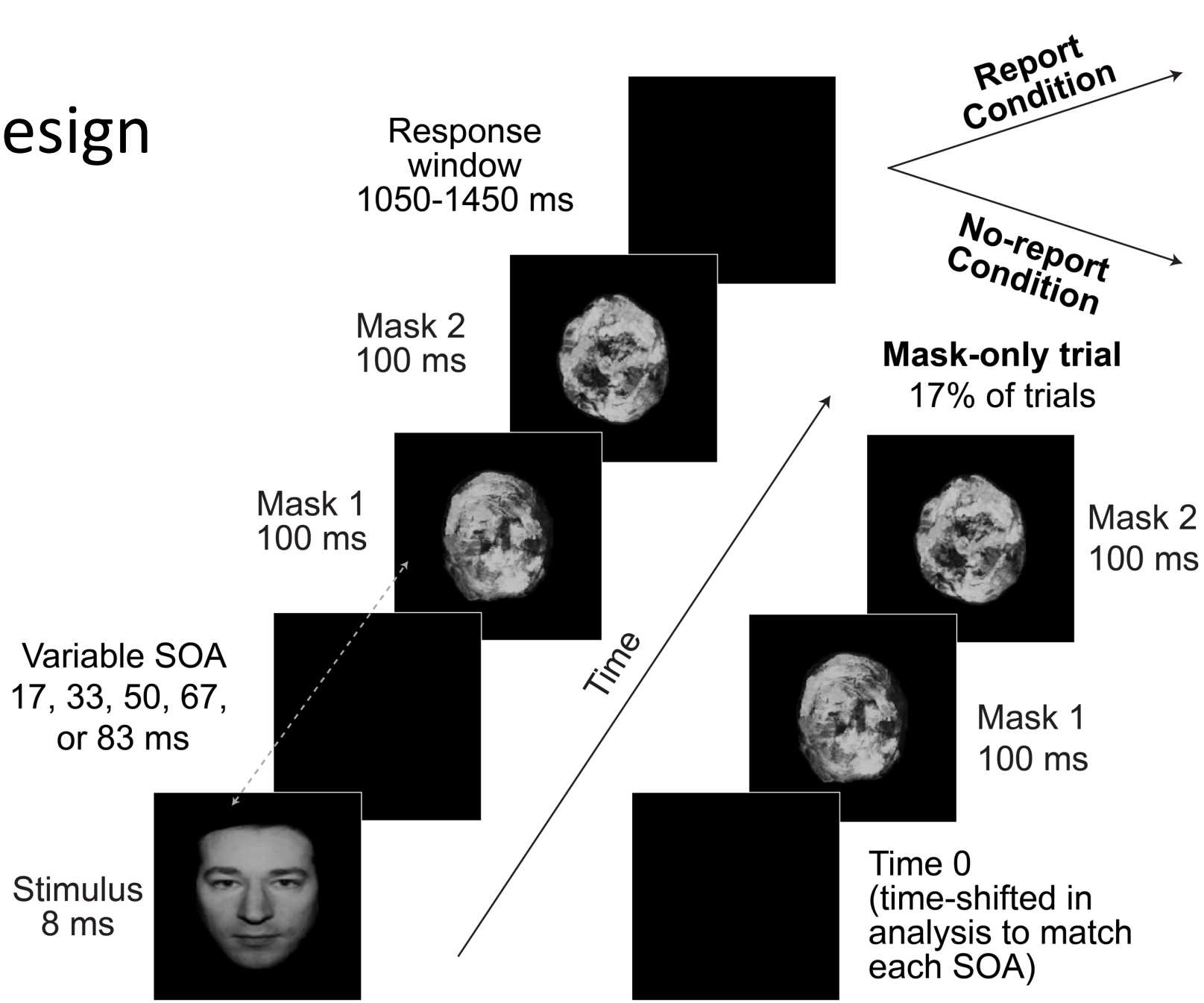


Cohen et al. (2020) *J Neurosci*

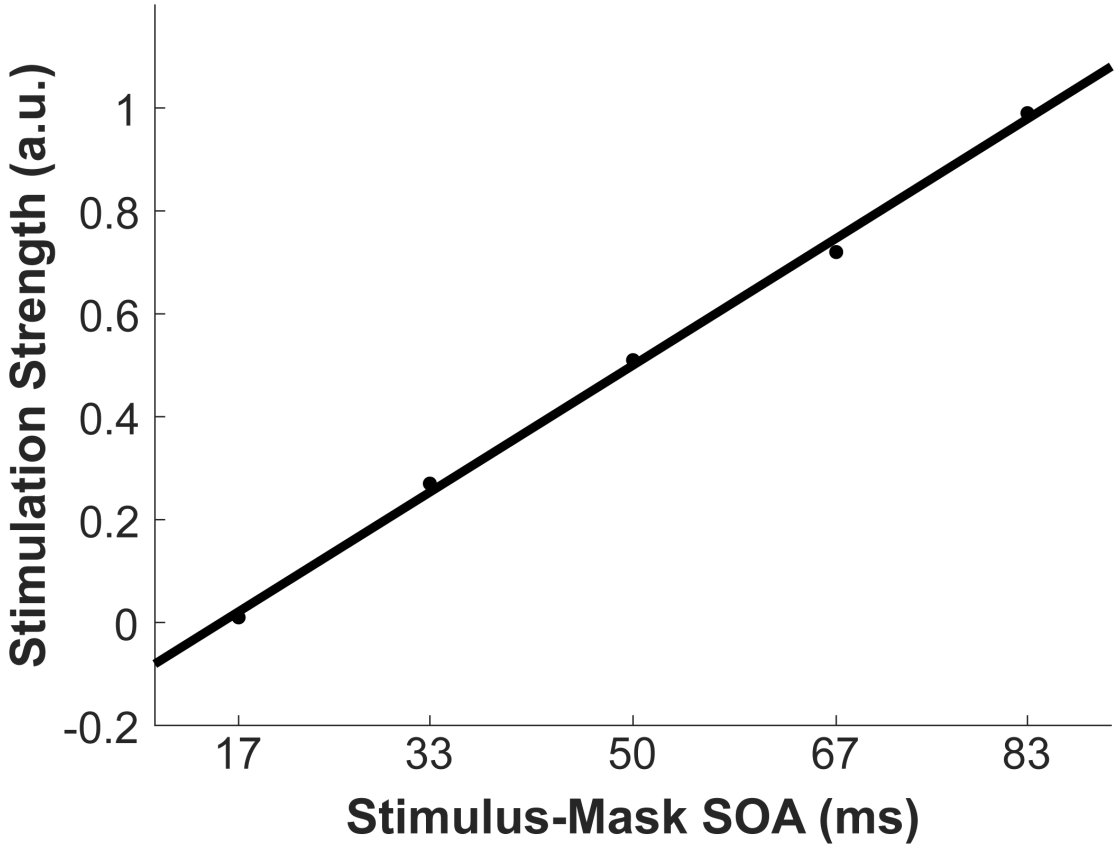
New Masking Experiment

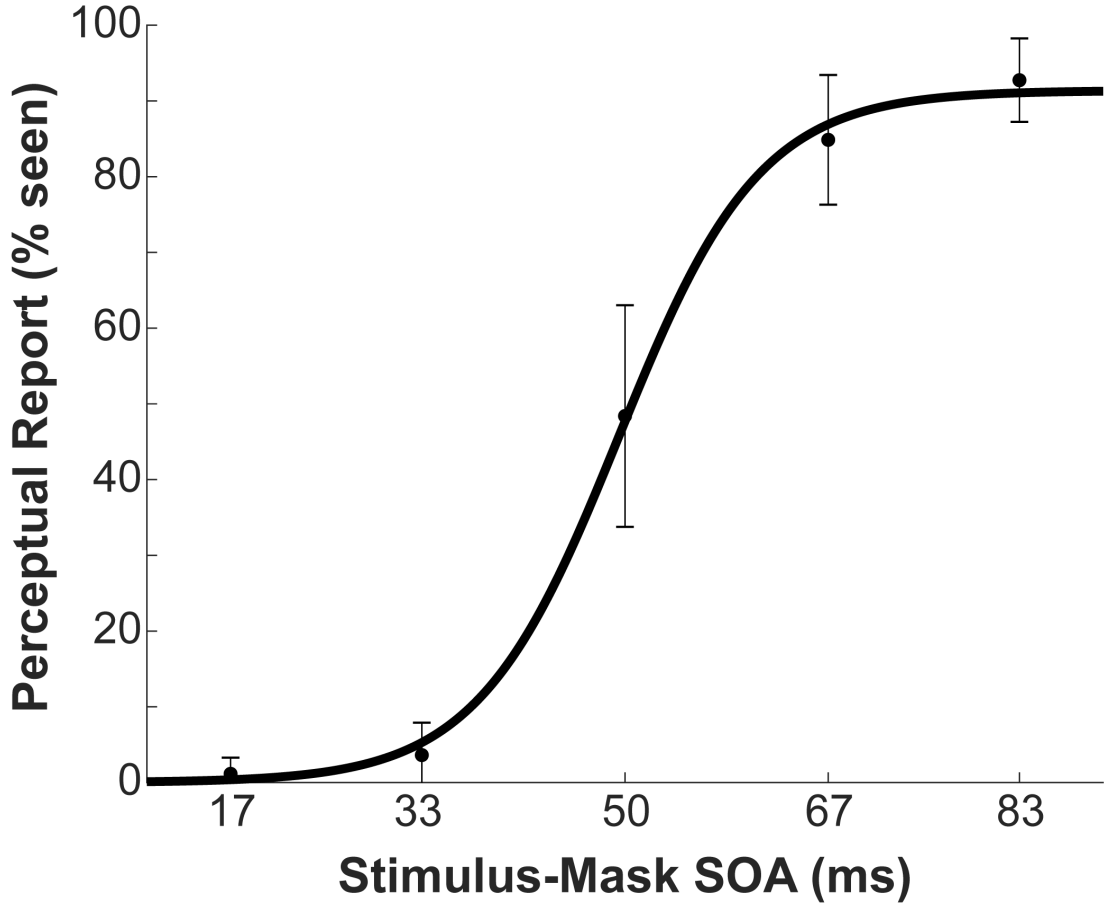
- Design: Del Cul et al. (2007) *PLoS Bio*
- Stimuli: Kouider et al. (2013) *Science*
- 5 evenly spaced SOAs:
  - Shortest 2 SOAs = never seen
  - Middle SOA = threshold (seen on 50% of trials)
  - Longest 2 SOAs = always seen
- Report condition: replicate Del Cul et al. (2007)
- No-report condition: isolate NCCs from task-related activity

Design

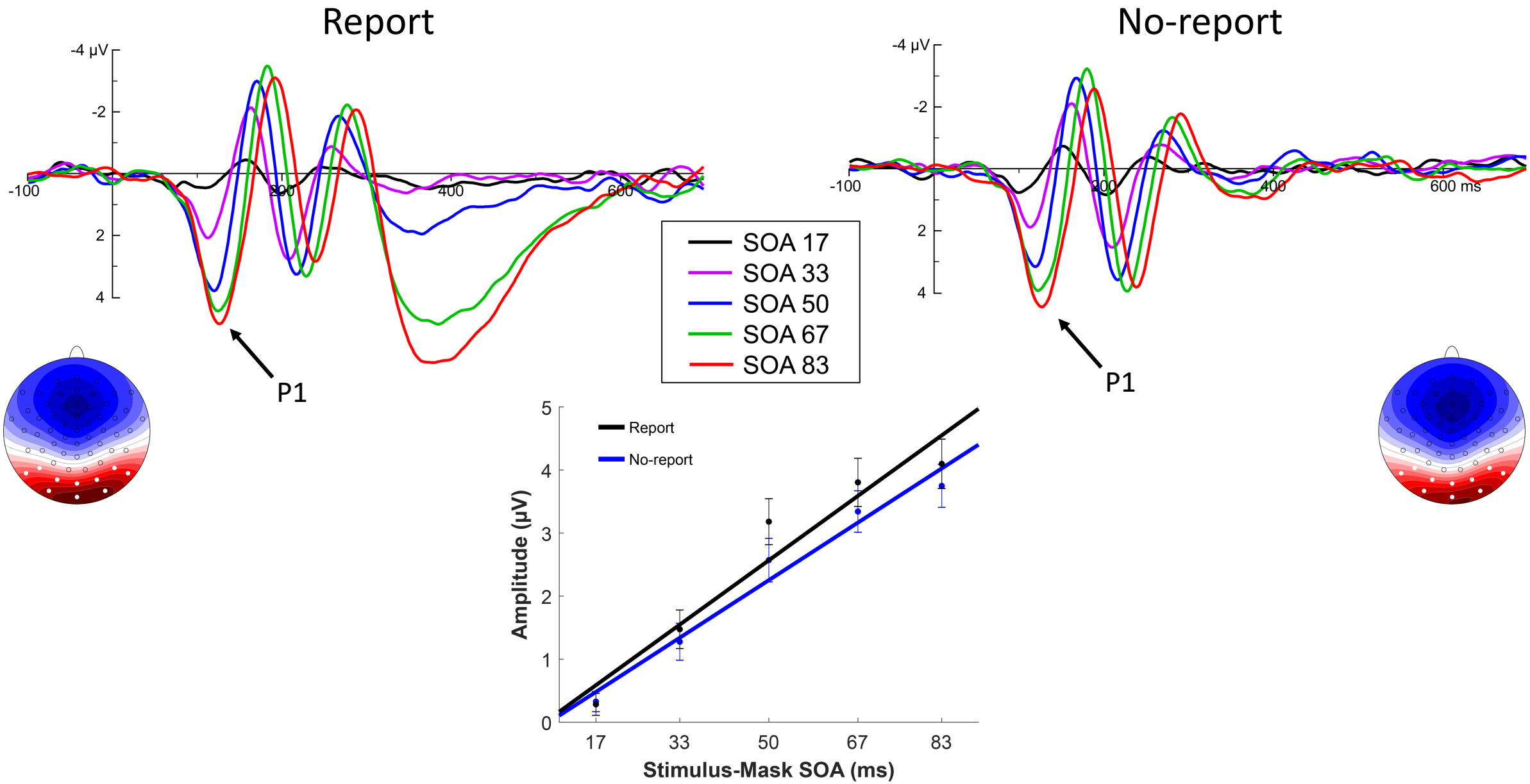

Response window 1050-1450 ms
Mask 2 100 ms
Mask 1 100 ms
Variable SOA 17, 33, 50, 67, or 83 ms
Stimulus 8 ms
Time
Time 0 (time-shifted in analysis to match each SOA)
Mask 1 100 ms
Mask 2 100 ms
Mask-only trial 17% of trials
Report Condition
No-report Condition
Report stimulus perception seen/not seen 100% of trials
Respond to infrequent green rings 15% of trials
Green ring trial

Behavioral Results

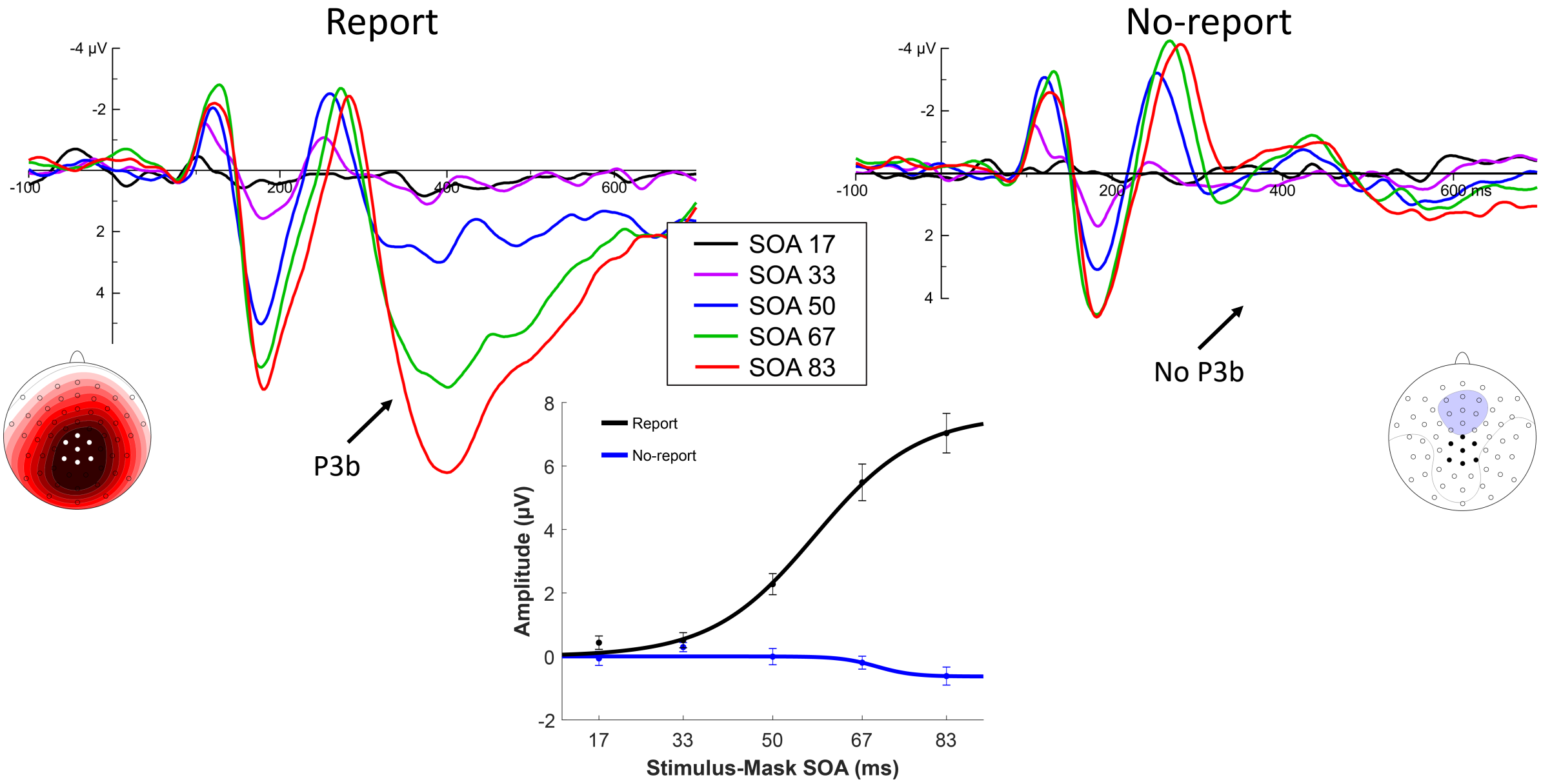




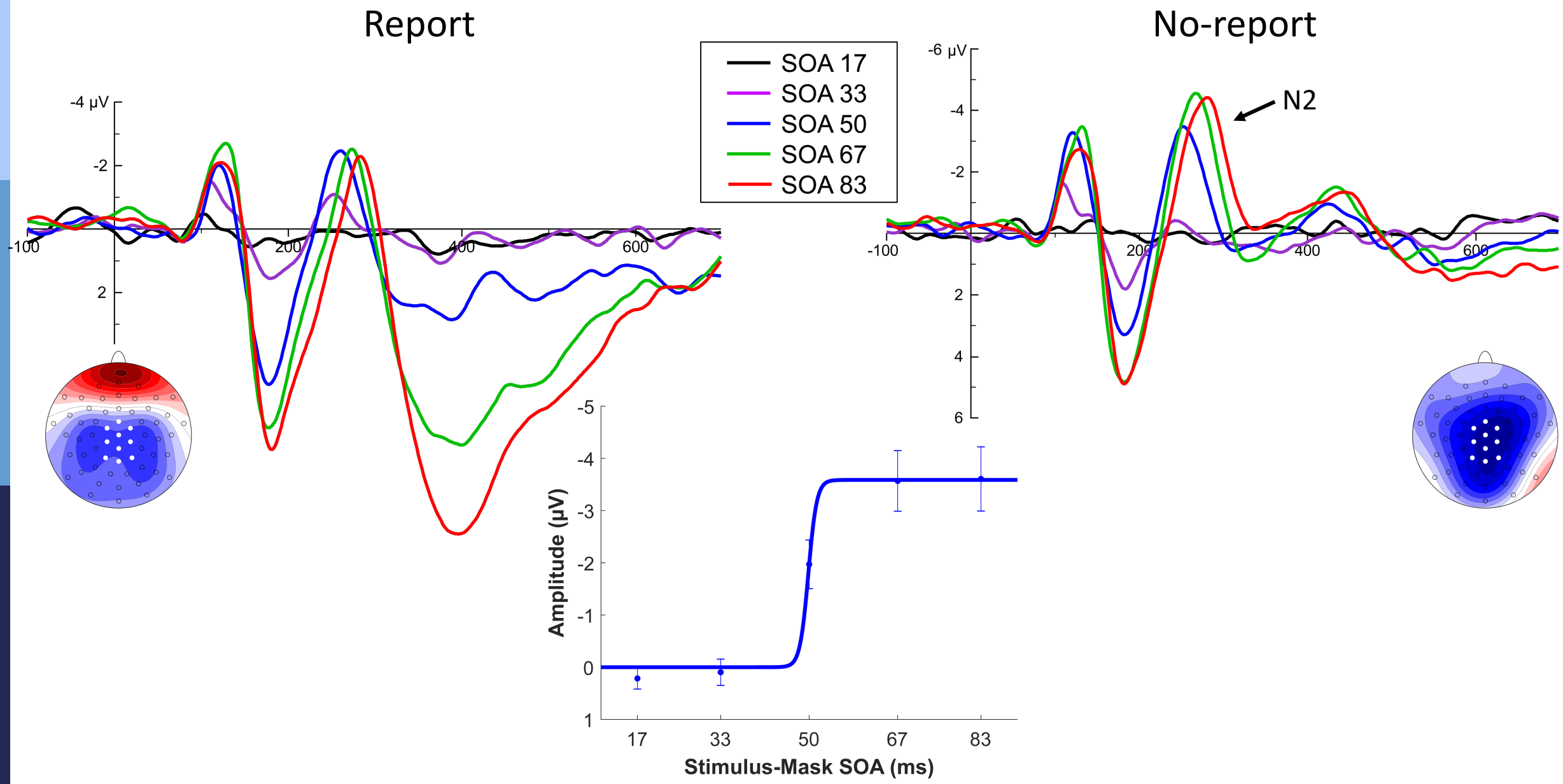
EEG Results: P1 (100-140ms)



EEG Results: P3b (300-600ms)

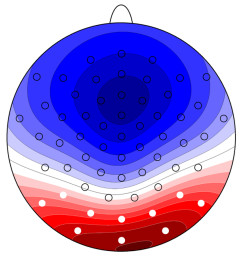


EEG Results: N2 (250-300ms)

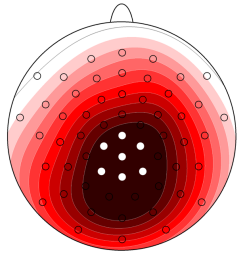


Results Summary

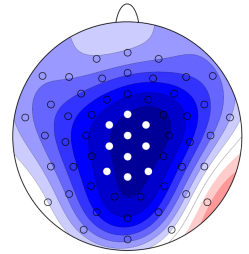
- P1 (100-140ms) = early sensory stage (pre-conscious)
  - matches linear increase in stimulus strength ✗



- P3b (300-600ms) = late decision stage (post-conscious)
  - matches sigmoid shape of behavioral reports ✓
  - present in report, absent in no-report ✗



- N2 (250-300ms) = intermediate perceptual stage (NCC?)
  - matches sigmoid shape of behavioral reports ✓
  - present in no-report, obscured by P3b in report ✓



Conclusions & Interpretations

- No-report EEG (masking & IB):
  - **NCCs consistently found between ~200-300ms**
- What does this mean for some of the theories?
  - late recurrent processing? early global ignitions? attention schema?
  - “AIRs?” “entry point to C?” “global playground”?
- Future plans with data & paradigm:
  - decoding (TG), intertrial variability, extend to fMRI & ECoG

Thanks for your attention (and awareness)!

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Kevin Ortego

Clay Steinhilber

Michael Cohen

Copy of slides

Post-doc position

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- NSF
- TWCF
- Reed College

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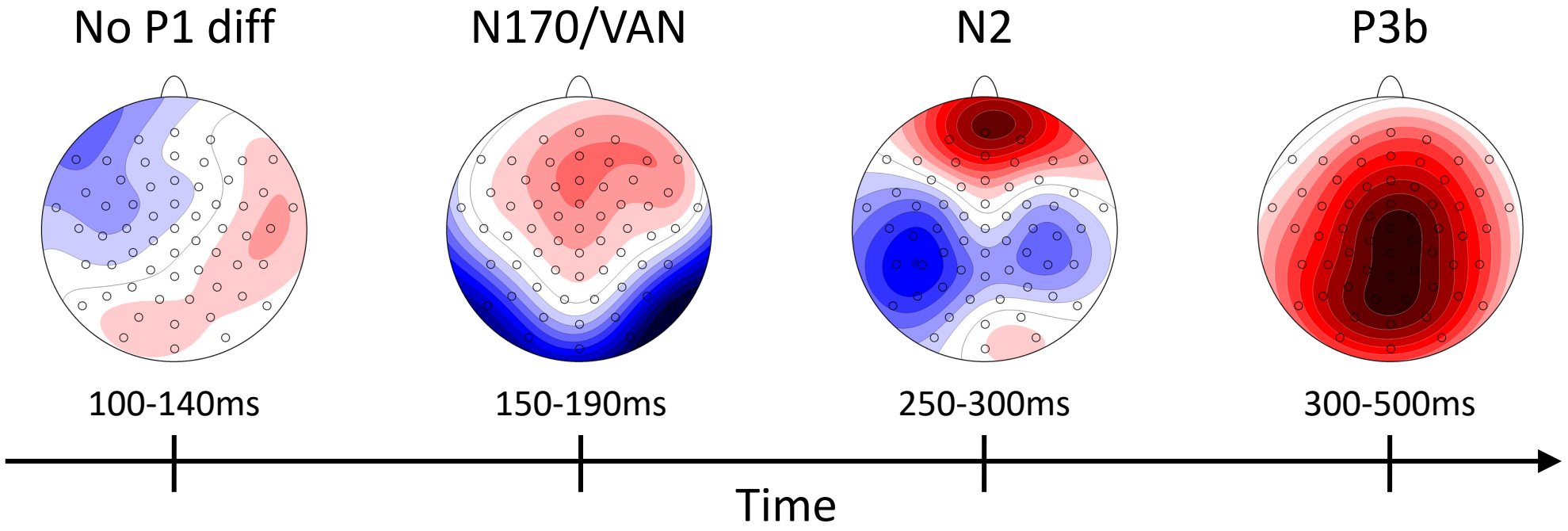
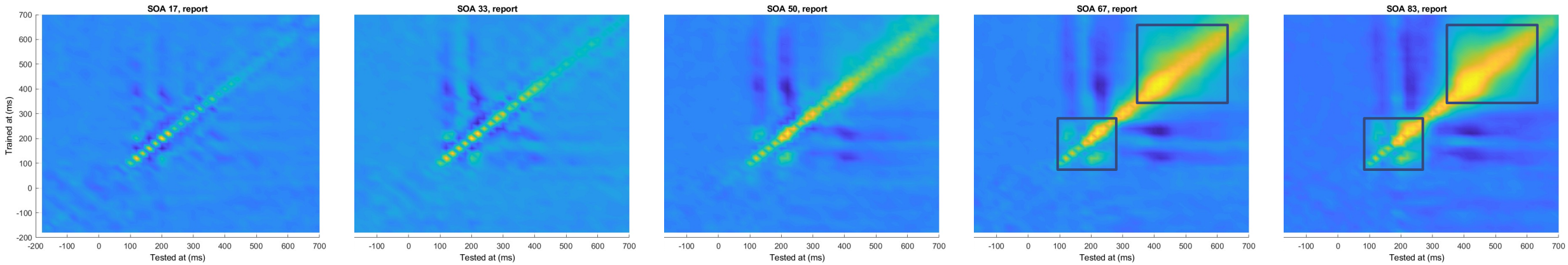
Report condition, SOA 50ms, seen vs. unseen difference maps

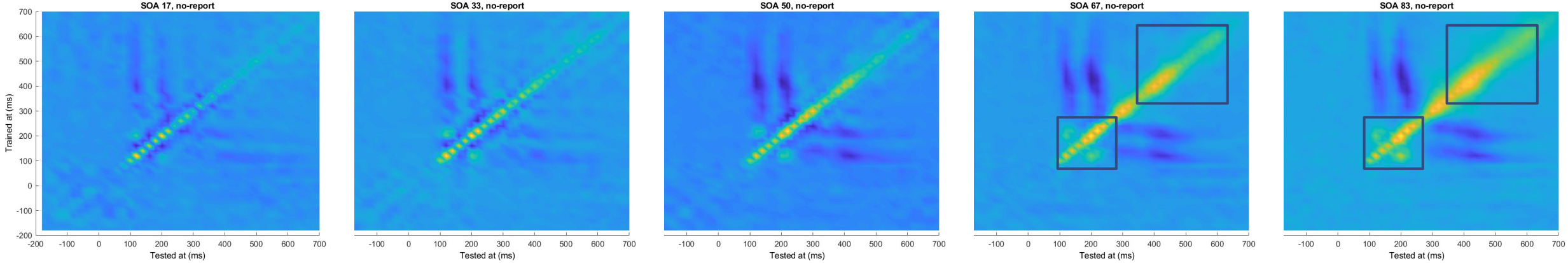


Temporal Generalization of Decoding (stim+mask vs. blank+mask) ***preliminary***

Report



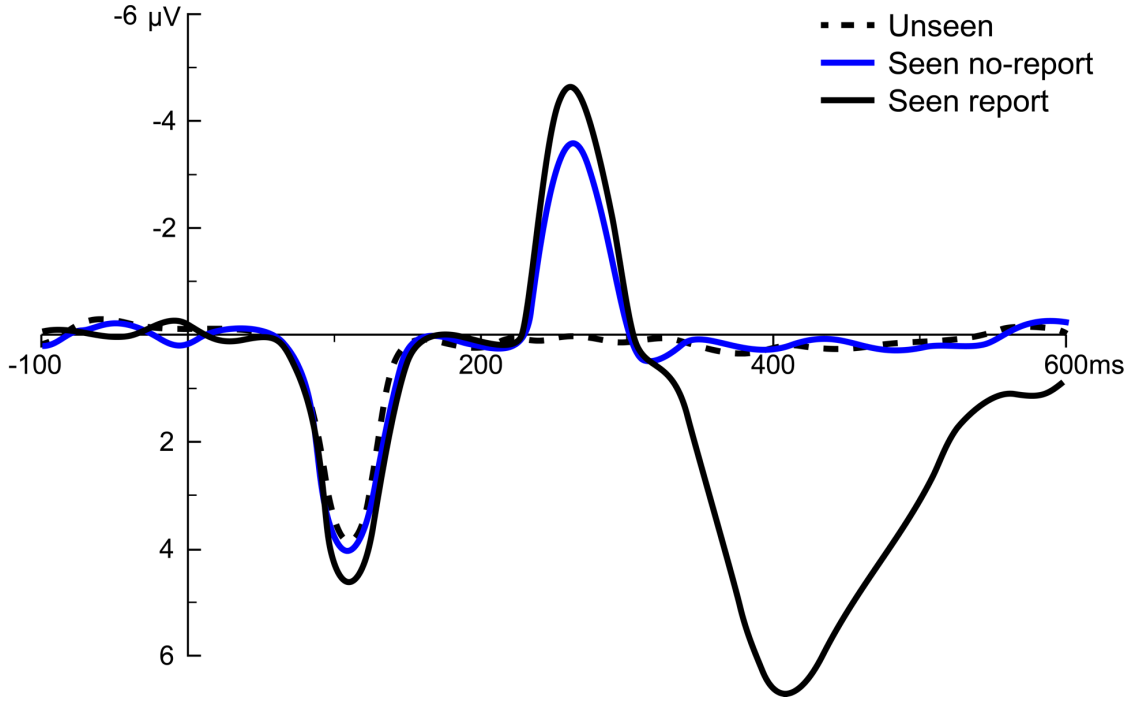
No-report



SOA: 17ms 33ms 50ms 67ms 83ms

Previous work

- Inattentional blindness (3-phase no-report paradigm)
  - Pitts et al. (2012) *J CogNeuro*
  - Pitts et al. (2014) *NeuroImage*
  - Shafto & Pitts (2015) *J Neurosci*
  - Schelonka et al. (2017) *Consc Cogn*
  - Harris et al. (2018) *Eur J Neurosci*
  - Schlossmacher et al. (2020) *J Neurosci*
  - Schlossmacher et al. (2021) *NeuroImage*
  - Dellert et al. (2021) *J Neurosci*
  - Hutchinson et al. (2021) *Consc Cogn*
  - Hutchinson (2019) *NeuroBioRev*
  - Förster et al. (2020) *Consc Cogn*
  - Dembski et al. (2021) *TICS*



summary (*not real data)

Relationship with other key data (Sergent et al., 2005)