

EEG bifurcation dynamics in a no-report visual awareness paradigm

Background & Objectives

Which patterns of neural activity reflect unconscious sensory processing vs. visual awareness vs. perceptual reporting?

Del Cul et al. [1] manipulated stimulus strength linearly, measured perceptual reports, which were nonlinearly "bifurcated," and then searched for neural signals that matched the stimuli vs. the reports.

Early ERPs (P1) matched the linear manipulations of stimuli while late ERPs (P3b) matched the bifurcated perceptual reports. P3b was thus considered a neural marker of perceptual awareness.

Subsequent studies [2-3] using no-report paradigms, however, found the P3b to be linked with reporting one's perception rather than visual awareness per se.

Here, we closely replicated Del Cul et al. [1] while adding a novel no-report condition to identify bifurcated neural signals linked with perceptual awareness independently from perceptual reports.

Subjects (N = 31) were presented with face stimuli followed by two masks.

Stimulus visibility was manipulated by varying stimulus onset asynchrony (SOA) between the stimulus and the first mask across 5 evenly spaced intervals:

- 17 & 33 ms: stimulus almost never seen
- 50 ms: stimulus seen ~50% of the time
- 67 & 83 ms: stimulus almost always seen

Report condition: after each trial, did you see the face (Y/N)?

No-report condition: respond when you see a green ring (15% of trials).

(17%)Mask-only trials were subtracted from stimulus-mask trials to isolate stimulus-related brain activity.



Methods

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Behavioral Results Visibility (report condition)



Report stimulus perception seen/not seen 100% of trials

Respond to infrequent



Report

Mask-only trial 17% of trials

Time 0

(time-shifted in

analysis to match

each SOA)

Mask 2





EEG Methods

- 64 channel, equidistant 500Hz sampling rate Hardware filter: 0.1-150Hz • Offline filter: 25Hz low-pass Average mastoid referenced Artifacts detected and rejected
- Baseline correction: -200-0ms

L O Linear P1 0 N N N Linear P1 100 - 140 ms -4 μV 0 μV

We plan to replicate these results in a new set of subjects & conduct additional EEG analyses.

1. Del Cul, A., Baillet, S., & Dehaene, S. (2007). Brain dynamics underlying the nonlinear threshold for access to consciousness. PLoS Biology, 5(10), e260. 2. Pitts, M. A., Padwal, J., Fennelly, D., Martínez, A., & Hillyard, S. A. (2014). Gamma band activity and the P3 reflect post-perceptual processes, not visual awareness. NeuroImage, 101, 337–350. . Cohen, M. A., Ortego, K., Kyroudis, A., & Pitts, M. (2020). Distinguishing the Neural Correlates of Perceptual Awareness and Postperceptual Processing. Journal of Neuroscience, 40(25), 4925–4935.

P1 linear (both conditions) P3b bifurcated (report only)



Summary and Continuing Work

In the report condition, we closely replicated Del Cul et al. [1].

In the no-report condition, early ERP patterns (P1) remained linear, while P3b disappeared.

Several ERPs (N2, LPN, LFN) displayed bifurcation dynamics in the no-report condition. These neural signals were likely obscured by the task-related P3b in the report condition.

References





No-report bifurcation signals

