Neural dynamics of visual processes in challenging visibility conditions

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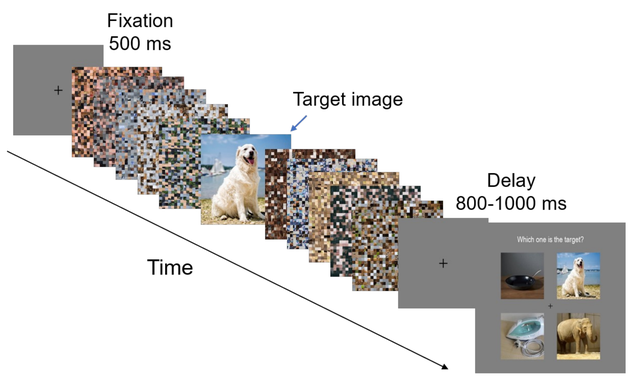
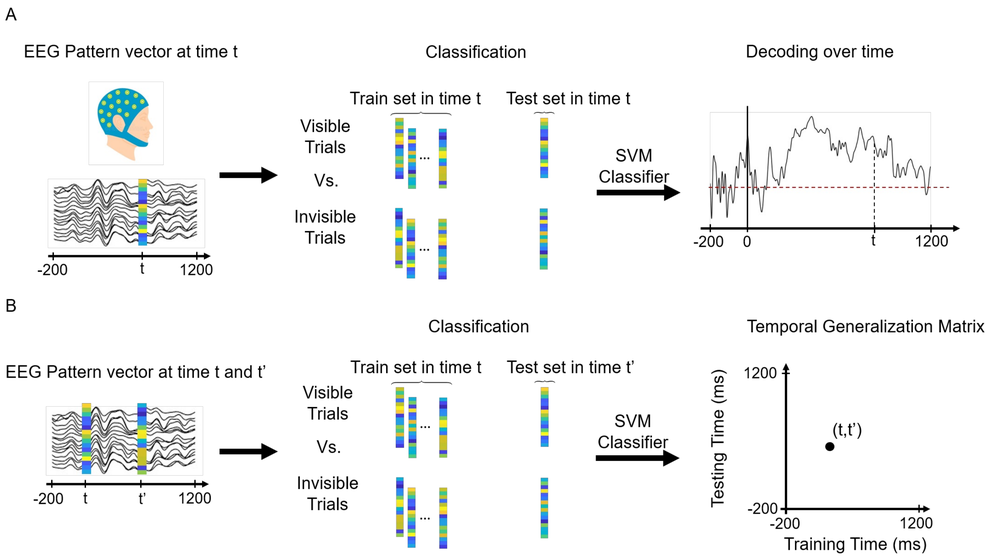
I. Introduction

- The human brain has the fantastic ability to recognize objects in less than a blink of an eye [1]. Several studies have investigated core object recognition [2]; however, object recognition under challenging visibility conditions is less understood [3, 4, 5].
- Previous studies questioned whether object recognition within IT (infratemporal) cortex along the ventral stream is strictly feed-forward, or requires feedback or recurrence especially in challenging viewing conditions [4, 6].
- In this work, we examine rapid object recognition under challenging visibility conditions, to compare the decodability of brain responses to visible and invisible cases.

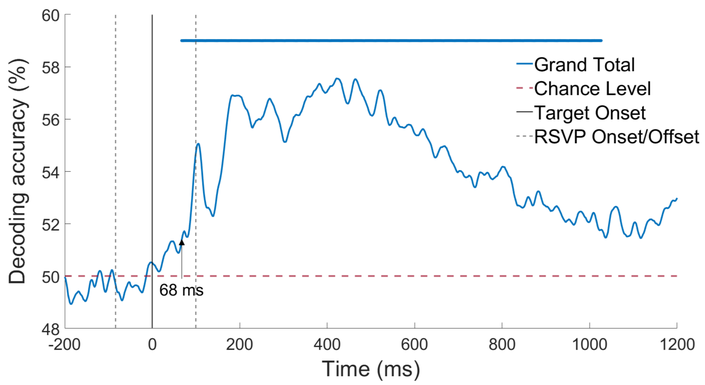
II. Experimental Procedure & Methods

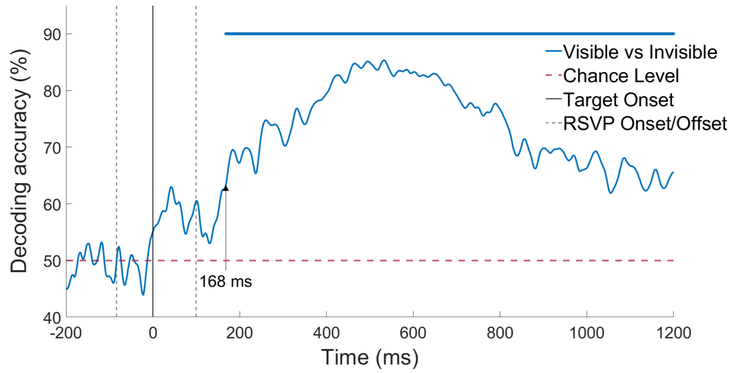


- We collected EEG data while participants (N=13) viewed a rapid series of 11 images, each presented for 17 ms.
- At the end of each trial, participants were asked to report the target by choosing from among four options.

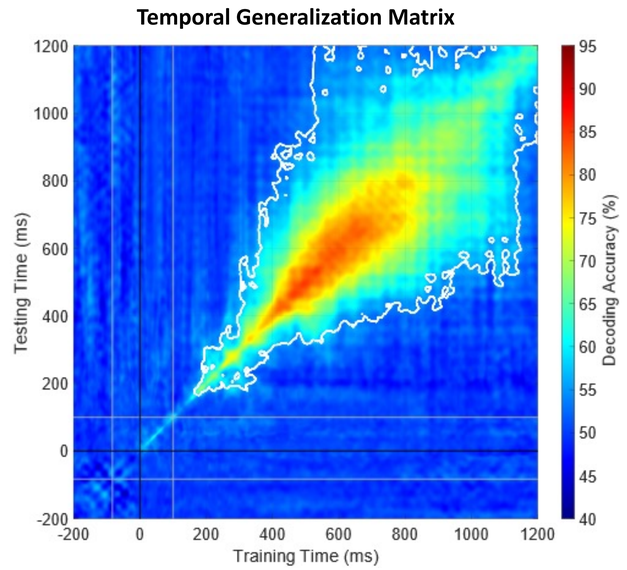


III. Results





- Above-chance neural decoding accuracy in discriminating visible from invisible conditions emerges ~170 ms after the target onset, which is later than the time usually associated with feed-forward processing.



- The temporal generalization matrix shows maps with off-diagonal significant decoding starting ~170 ms after the target onset, which is an indication of sustained neural representations for these timepoints. This demonstrates that the neural representations discriminating visible from invisible conditions remain intact for future time points.

IV. Discussion

The late decoding of visible vs. invisible conditions in our results shows that the visibility of targets under challenging conditions cannot be explained only in a feed-forward path of processing, which would happen before 100 ms after target onset [1, 4], and later feedback processes are critical for the visibility of targets under challenging conditions.

References & Acknowledgement

[1] Mohsenzadeh et al. 2018 eLife
[2] DiCarlo et al. 2012 Neuron
[3] Rajaei et al. 2019 PLoS computational biology
[4] Wyatte et al. 2014 Frontiers in psychology
[5] Tang et al. 2018 Proceedings of the National Academy of Sciences of the United States of America
[6] Kafaligonul et al. 2015 Frontiers in psychology

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