

Does volitional attention operate the same across domains?

An investigation of willed attention to color

John Nadra, MA¹, Mingzhou Ding, PhD² & George R. Mangun, PhD¹

¹Center for Mind and Brain, University of California, Davis ²J. Crayton Pruitt Family Department of Biomedical Engineering, University of Florida

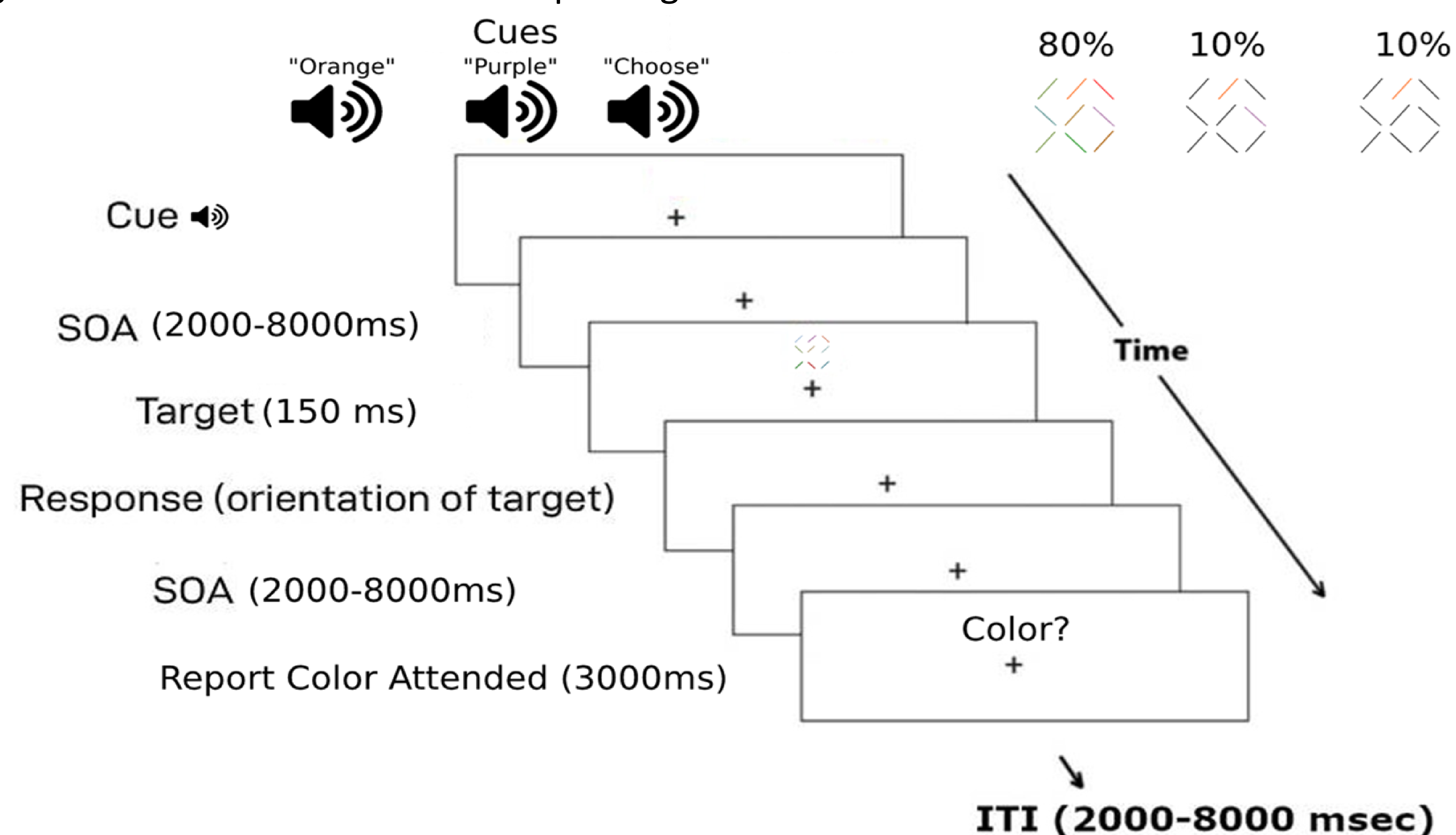


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Introduction

Attention without external constraints ('willed attention') has been studied in covert spatial attention, with novel brain networks recruited specifically for willed attention in comparison to instructed attention. Here, we have conducted an EEG analysis on how willed attention operates when color is the domain of interest. The EEG dynamics provide novel insights into attentional control in the visual system and allow a greater understanding of how visual attention is guided with minimal external influence.

Figure 1. The color willed attention paradigm.



Methods

Participants were presented with one of three cues, either the verbal words "Orange", "Purple" or "Choose" with the former two cues acting as instructions to shift attention to the cued color, and the third option acting as a prompt to willfully choose between the two colors. The SVM analysis presented here focuses exclusively on the "choose" cue. The reaction time data shows a condition (10% of trials) where only one color appeared on the screen, contrasting when that color was cued (or chosen) to when it was not.

Figure 2. Reaction times showing attention validity effect ('only one color' condition)

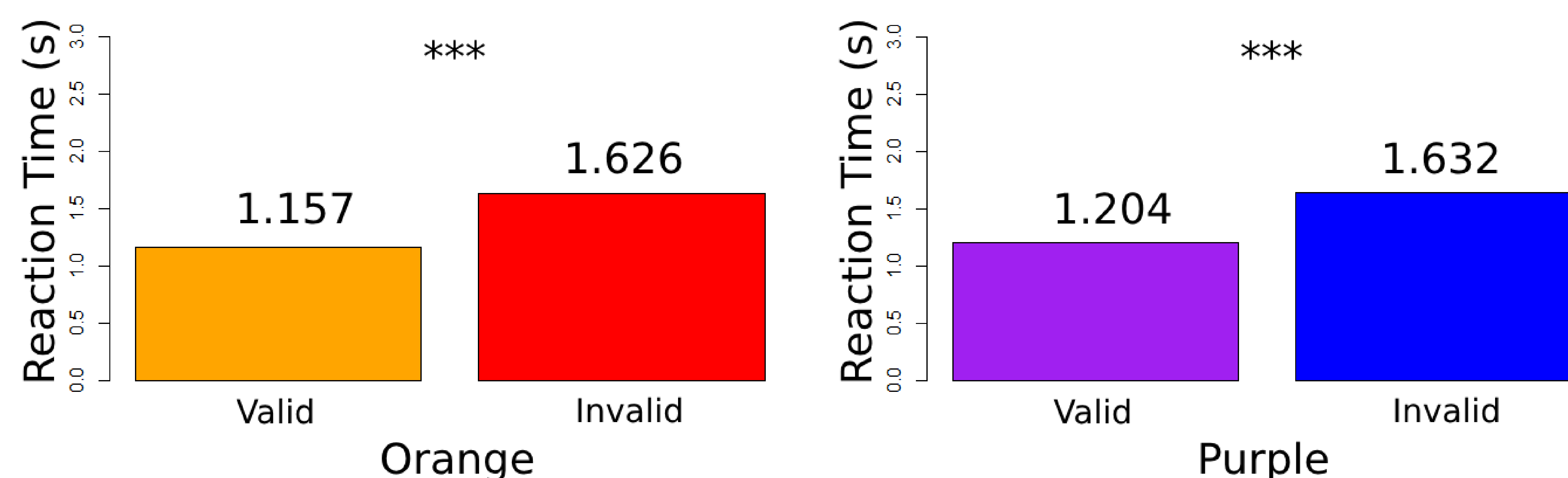
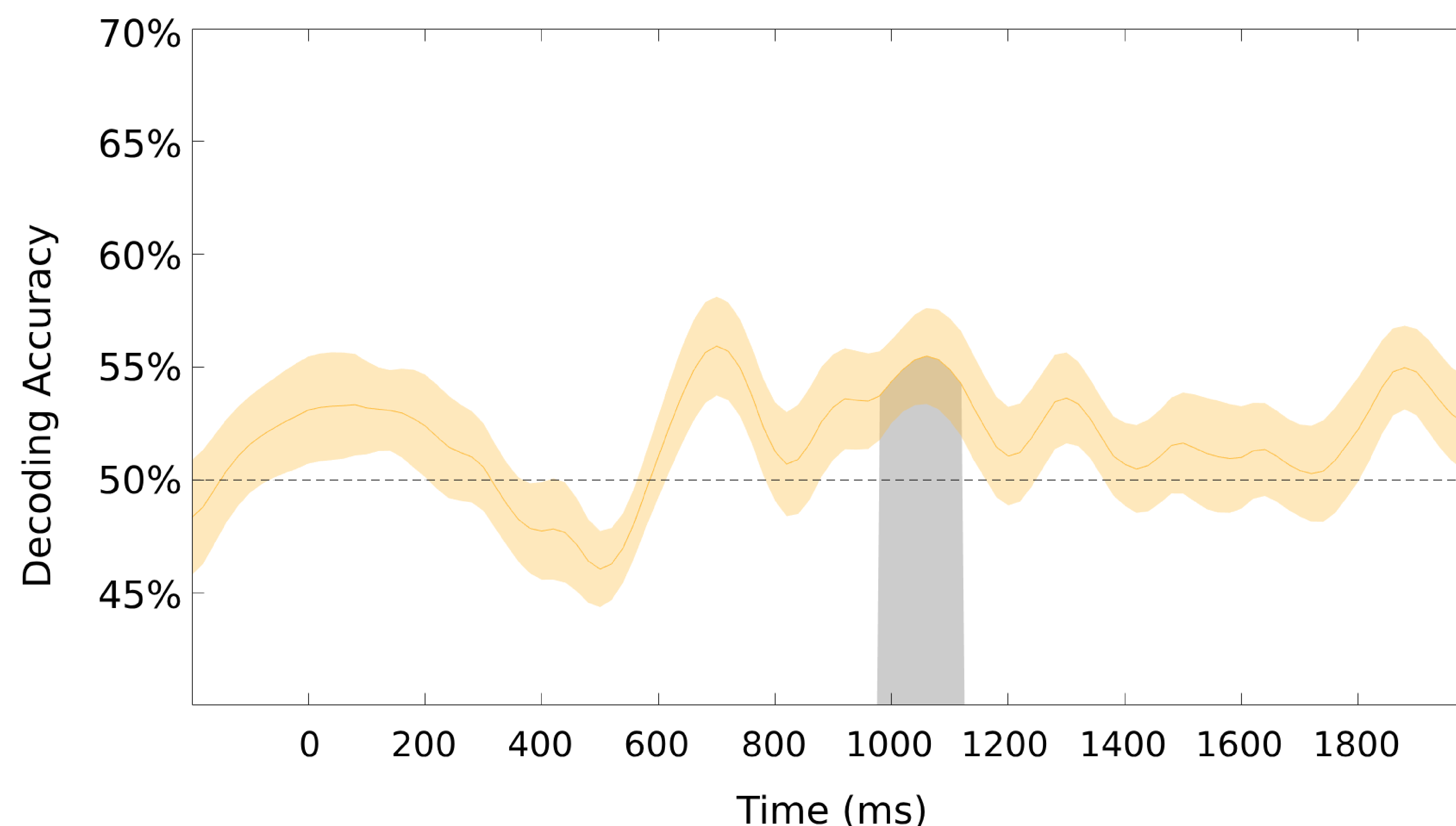


Figure 3. Support Vector Machine decoding after the auditory 'choose' cue.



Results

We have validated our paradigm by showing an attention decrement for the unattended color in reaction time data (Figure 2). Using a support vector machine decoding pipeline that compares two classes over each timepoint, we found that in the alpha band (8-12 Hz) we can decode a willed shift of attention to a color (orange or purple) after a prompt signaling a willed choice (Figure 3). These results indicate that we can decode a choice between two colors using EEG signals in the alpha-band (8-12Hz) in the cue to target period.

Conclusion

In this project, we assessed whether decisions to shift attention to individual colors (either orange or purple) are decodable in alpha-band EEG (8-12 Hz). This work follows up on research conducted on willed attention in covert spatial attention across various paradigms with the goal of isolating the neural mechanisms of a decision to attend in the absence of external cues. Expanding the study of willed attention past the realm of covert spatial attention, this project found that similar electrophysiological correlates underlie the decision process for space and color. Isolating the neural signature underlying a decision to attend across domains provides insight into what controls willed attention and could have a great impact on the development of online brain computer interfaces.