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Blinded by magic: electrophysiological correlates of change blindness

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Abstract

Magicians can often hide their method for a trick in plain sight by effecting a phenomenon known as change blindness. The purpose of this study was to find the reason for why an individual is induced with change blindness. Alpha oscillations are known to impair detection of visual stimuli, but it is unclear if this is due to increased guess rate or decreased fidelity of the mental representation. Here we estimated fidelity and guess rate as a function of pre-stimulus alpha oscillations using a change blindness task. In this study, each trial began with an array of 6 Gabor patches with a fixated dot that subjects were instructed to keep their eyes on. As the array traveled to the center of the screen, it either changed direction vertically at 90 degrees or continued horizontally. When the array switched direction, one of the Gabor patches rotated 30 degrees simultaneously. Subjects were then asked to identify which patch rotated. EEG (electroencephalography) data was simultaneously recorded with eye-tracking as subjects performed the task. Twenty-eight participants performed this task, which included six blocks of forty-eight trials. There were two different types of trials: flexion, in which the array changed direction, and control, in which the array did not change direction. Reaction time tended to be slower in flexion trials, and we found that the change in direction affected the subject's ability to see the Gabor patch rotation. Based on the event-related potential results, which are an average of EEG signals aligned to the start of a trial, we could see that the P300 differed between correct flexion, incorrect flexion, and control trials. The P300 can be interpreted as a marker of consciousness. This difference demonstrates that the subject's attention is automatically drawn to a larger change in stimuli.

Key words:
Change blindness, EEG, Gabor patch, magi

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Blinded by Magic: Electrophysiological Correlates of Change Blindness

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Introduction

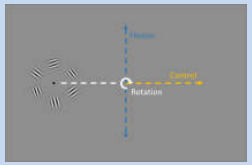
- Magic tricks prove that our vision is not as accurate as we think
- Using misdirection, magicians can hide their method for a trick in plain sight by effecting change blindness
- Individuals experience change blindness when there is a sudden change in the direction of movement
- The purpose of this study is to find the reason for why an individual is induced with change blindness

Methods

- Number of subjects = 28 (age range = 17-36)
- Number of trials = 6 blocks of 48 trials

Task Stimuli

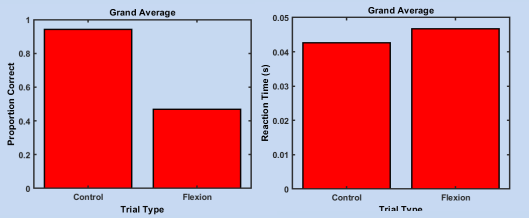
- Each trial began with an array of 6 Gabor patches with a fixated dot that subjects were instructed to keep their eyes on
- As the array traveled to the center of the screen, it changed direction vertically at 90 degrees or continued horizontally
- When the array switched direction, one of the Gabor patches rotated 30 degrees simultaneously
- Subjects were asked to identify which patch rotated and EEG (electroencephalography) data was recorded as they performed the task



Eye-tracking

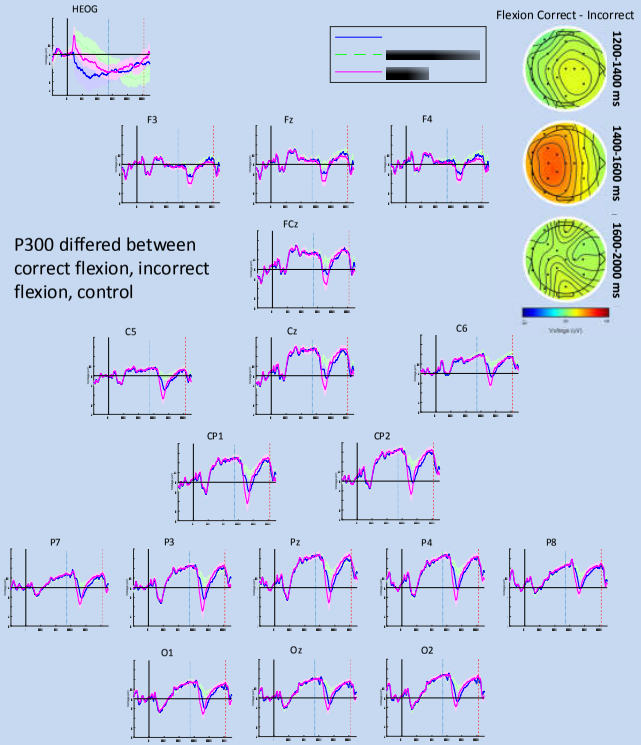
- Eye-tracking was simultaneously recorded with EEG data

Behavioral Results



- Reaction time slower in flexion trials
- More accuracy on control trials

ERP Results



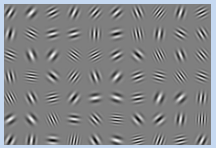
P300 differed between correct flexion, incorrect flexion, control

Discussion

- Change in direction affected ability to see Gabor change
- Reaction time is slower in flexion trials
- P300 differed between correct flexion, incorrect flexion, and control trials
- P300 difference demonstrates that attention is automatically drawn to a larger change in stimuli
- P300 can be interpreted as a marker of consciousness

Future Directions

- Time-frequency analysis (power and phase)
- Follow-up experiments:
  - Small vs. large Gabor
  - Asynchronous timing between direction change and Gabor rotation
  - Higher vs. lower Gabor frequency
  - Degree of Gabor rotation



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