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Difficulty of discrimination modulates attentional capture by regulating attentional focus

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Introduction

P3a reflects the neural response regarding attentional capture for deviant events.

Attentional capture for distractor is enhanced by difficulty of discrimination between standard and target in the three-stimulus oddball paradigm. Katabayama & Polich (1998); Sawaki & Katayama (2006, 2007)

Purpose: to elucidate the cognitive mechanism of attentional capture modulation.

Hypothesis: attentional capture is modulated by top-down controlled attentional focus.

Attentional focus and cost-benefit

Spatial attention is tightly focused on a selective location to improve stimulus processing.

**BENEFIT:** processing facilitation inside attentional focus

**COST:** processing impairment outside attentional focus

In the difficult task, attention is sharply focused on the central location, and the distractor falls in this attentional focus (A).

If so, when distractors are presented in the surrounding location, distractors would fall outside the attentional focus in the difficult task (B).

Methods

Participants: 12 students (7m, 5f; 21-26 (M = 23, SD = 1.9) yrs.)

Task: Visual three-stimulus oddball task

Stimuli:

To make a quick button press by the right thumb to the target stimuli

<table>
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<tr>
<th>Standard (p = .70)</th>
<th>Target (p = .15)</th>
<th>Distractor (p = .15)</th>
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<tr>
<td>Easy Difficult</td>
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Surrounding stimuli (triangle & square) were placed with their corner 2.2° to this krf and right of the vertical meridian, and 2.2° above and below the horizontal meridian.

ERP recording:

EEG: 30 electrode sites, referred to the nose tip

Bandpass: 0.05 - 100 Hz; A/D: 500 Hz (30 Hz off-line low-pass filter)

P300 peak: max. pos. pts. 300 - 700 ms at Pz (target), Cz (distractor)

Results & Discussion

Figure 3. Reaction time.

Figure 4. Grand averaged ERPs (N = 12).

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Behavior

Figure 1. Reaction time.

Figure 2. Hit rate.

Figure 3. False positive rate.

Figure 5. Topographic maps for P3a and P3b.

Figure 6. Mean P3 peak amplitude.

Target P3b Amplitude & Latency:

Amplitude: Easy > Difficult (both conditions)

Latency: Easy < Difficult (both conditions)

>>> Task difficulty was successfully manipulated.

Distractor P3a Amplitude:

Central condition: Easy < Difficult

Surrounding condition: Easy > Difficult

>>> Task difficulty had a contrasting effect on the P3a amplitude between central and surrounding conditions.

Conclusion

Attentional capture for distractor is modulated by top-down controlled attentional focus.

Acknowledgments: Risa Sawaki is now at the Center for Mind and Brain, UC Davis, 267 Cousteau Place, Davis, CA, 95618.