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Stimulus Context Effect on Deviant Target and Non-target: P3 ERP Study

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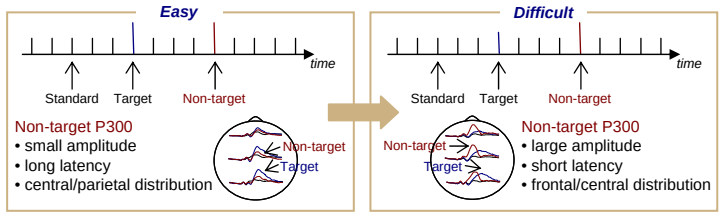
Introduction

Stimulus Context Effect on Non-target P300:

Difficulty of standard/target discrimination in three-stimulus oddball task



Katayama & Polich (1998); Sawaki & Katayama (2006)

>> Difficult discrimination induces an **anterior enhancement of non-target P300**.
Does it reflect the enhancement of **attentional capture process** or **inhibition process**??

Purpose:

To elucidate whether the discrimination difficulty modulates an attentional capture process or inhibition process.

Attentional capture can occur for target as well as non-target
>> Discrimination difficulty would influence both target and non-target P300s
Inhibition can occur only for non-target
>> Discrimination difficulty would influence only non-target P300

Methods

Participants:

12 students (6m, 6f; 20-28 (*M* = 24.3, *SD* = 2.9) yrs.)

Task:

Three-stimulus oddball task
To make a quick button press by the right thumb to the target stimuli

Stimuli:

Table 1. *Stimulus characteristics for each task condition*

	Three-category		Two-category	
Discrimination difficulty	*Easy*	*Difficult*	*Easy*	*Difficult*
Frequent circle (*p* = .70)	Standard		Standard	
Rare circle (*p* = .15)	Target		Target	
Rare square (*p* = .15)	Non-target			

SOA: 1.2 s; Duration: 120 ms; Viewing distance: 1 m
Visual angle: frequent circle 1.15° x 1.15°, large rare circle 2.3° x 2.3°, small rare circle 1.3° x 1.3°, rare square 2° x 2°

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 (nontarget)

Results & Discussion

Behavior

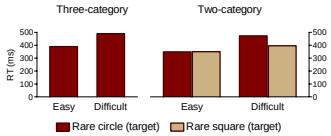


Figure 1. Reaction time for target stimuli.

Rare circle: Easy < Difficult (both tasks)
Rare square: Easy < Difficult (two-category)

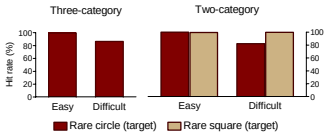


Figure 2. Hit rate for target stimuli.

Rare circle: Easy > Difficult (both tasks)
Rare square: *N.S.* (two-category)

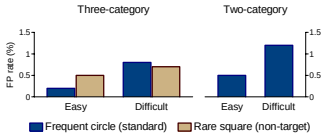


Figure 3. FP rate for standard and non-target stimuli.

N.S.

ERP

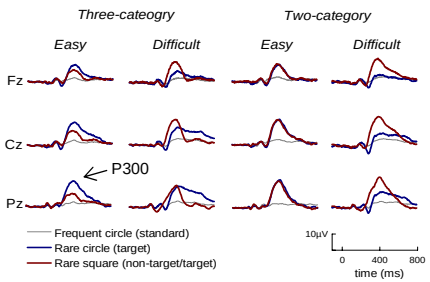


Figure 4. Grand averaged ERPs (*N* = 12).

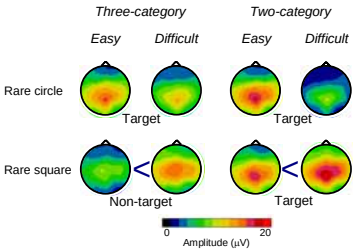


Figure 5. Topographic maps taken at P300 peak latency.

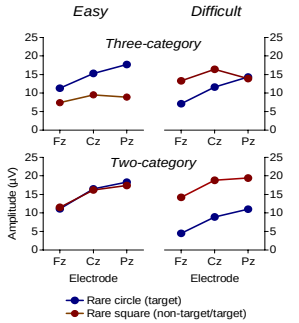


Figure 6. Mean P300 peak amplitude.

Three-category task (rare square: *non-target*)

>> P300 for target rare circle was smaller in amplitude and longer in latency in the difficult condition
>> P300 for *non-target rare square* was larger in the difficult condition

The effect of discrimination difficulty on non-target P300 was further supported.

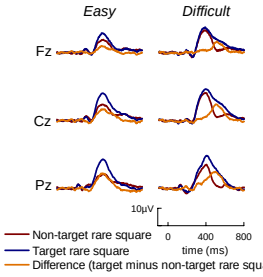


Figure 7. Grand averaged ERPs from target and non-target rare squares, and difference waveforms.

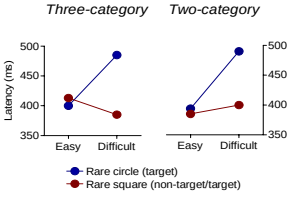


Figure 8. Mean P300 peak latency.

Two-category task (rare square: *target*)

>> P300 for target rare circle was smaller in amplitude and longer in latency in the difficult condition
>> P300 for *target rare square* was larger in the difficult condition at anterior electrode sites (Fz and Cz)

The discrimination difficulty affected P300 not only for non-target rare square but also for target rare square.

Conclusion

The discrimination difficulty modulates *attentional capture* for deviant information.