Task Difficulty Modifies the Visual Distraction Effect on P300 ERP

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INTRODUCTION

Background:

ERPs as a tool for evaluating cognitive ability of children with develop. disorder:

- seeking out the appropriate paradigm
- A kind of simulation for interpreting the result pattern
  just difficult for them or they show specific characteristics

Distraction effect:

- deteriorating performance caused by orienting attention to unexpected deviation in task-irrelevant stimulus property
  e.g., tonal frequency change in duration discrimination task
  size change in shape discrimination task
- Enhancement of the P300 amplitude

Purpose:

to examine the effect of task difficulty on the visual distraction

METHODS

Participants:

13 students (m/f = 6/7, 20 – 28 (mean = 24.2) yrs.)

Stimuli:

Table 1. *The stimuli used in this experiment*

	Easy		Difficult	
	Freq. (42%)	Dev. (8%)	Freq. (42%)	Dev. (8%)
Go (50%)				
No-go (50%)				

Go: r = 1.00 cm (3.14 cm^2) No-go Easy: r = 1.50 cm (7.07 cm^2)
No-go Diff.: r = 1.15 cm (4.15 cm^2)

viewing distance: 1 m
2 conds. X 3 blocks X 200 stimuli
SOA: 1200 ms, dur.: 120 ms
random order; on white background

Task:

to make a quick button press by the right thumb to the Go stimuli, regardless of the color

ERP recording:

EEG: 30 electrodes, referred to the nose tip
bandpass: 0.05 - 100 Hz, A/D: 500 Hz, 30 Hz offline low-pass filter
low-pass filtering (8 Hz, FIR zero-phase, -24 dB) after averaging
P300 peak: max. pos. pts. 300 - 700 ms at CPz (Go) or FCz (Nogo)

RESULTS & DISCUSSION

Behavioral Data:

Table 2. *Performance data for each condition (mean & SD)*

	Easy		Difficult	
	Freq.	Dev.	Freq.	Dev.
RT (ms)	317(77)	340(83)	383(94)	397(92)
Hit (%)	98.0(3.6)	97.6(4.2)	88.3(7.2)	90.7(7.2)
FP (%)	6.3(5.9)	5.6(7.0)	9.9(7.5)	10.5(12.4)

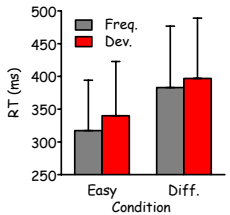

Fig.1. Mean RT.

2 diff. X 2 stim. ANOVAs
- RT: Easy < Diff, Freq. < Dev.
- Hit rate: Easy > Diff.
- FP rate: *n.s.*

- Difficulty manipulation was successful
- Distraction effect in RT
- No effect of task difficulty on RT distraction

ERPs:

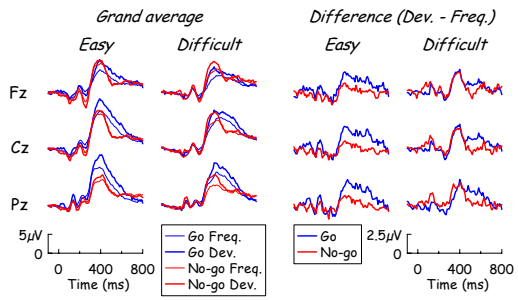

Fig.2. Grand averaged and difference ERPs (*N* = 13).

P300:

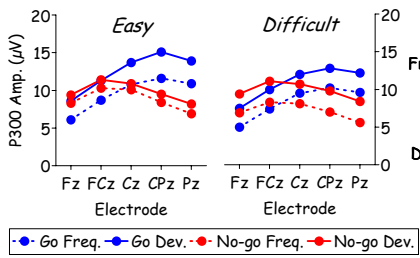

Fig.3. P300 amplitude for each condition.

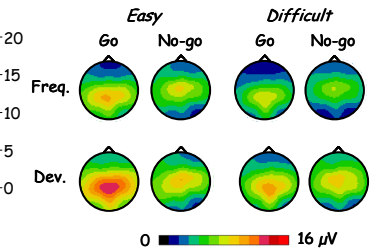

Fig.4. Scalp distribution of P300s.

- Go stimulus elicited centro-parietal P300, whereas No-go stimulus elicited fronto-central P300 in both conds.
- The amplitude of these P300s were smaller in the Difficult condition.
- These P300s were enlarged to the deviant stimulus.

2 Difficulty X 2 Go/No-go X 2 Stim. ANOVA
- Main effects of Diff, Go/No-go, and Stim
- 3-way interaction
  - Go: both Easy & Diff.: Dev. > Freq.
  - No-go: both Easy & Diff.: Dev. > Freq.
    but the effect was small in Easy condition

- P300 distraction effect was smaller in No-go of Easy condition.

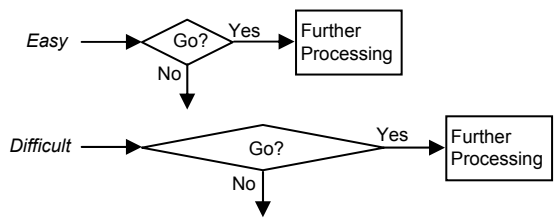

Fig.5. Schematic illustration for size discrimination task.

CONCLUSION

- No-go stimulus in the easy condition showed the small distraction effect on P300.
- This stimulus required shorter processing time for the task.

>> P300 distraction effect is related to the later part of the processing.

CONTACT INFO.

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