

EXAMINATION OF SIMULTANEOUS PRESENTATION OF AUDITORY AND VISUAL STIMULI DURING THE P300-BASED CONCEALED INFORMATION TEST: COMPARISON BETWEEN PICTURES AND WORDS AS VISUAL STIMULI

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Introduction

In the ERP-based CIT (concealed information test) studies, the most promising ERP index in terms of practical application to the criminal investigation is the P300 component because it is elicited by rare and meaningful events that are relevant to the subject's task. In the P300-based CIT protocol, visual stimuli such as photographs, words, or numbers are usually presented on a computer display, while question items are presented orally in the field CIT practice with autonomic indices. The merits and demerits of auditory and visual presentations are summarized in Table 1.

Table 1. The merits and demerits of auditory presentation and visual presentation in the CIT.

	Merit	Demerit
Auditory presentation	Ignoring questions could be relatively difficult.	Less information could be provided in one question.
Visual presentation	Much information could be provided in one question.	Ignoring questions could be relatively easy.

Purpose

We investigated the which type of visual stimulus (picture or word) works better in the P300 CIT using simultaneous presentation of auditory and visual stimuli.

Method

Participants

Participants included 10 undergraduate students who gave their consent. All participants experienced both the picture and the word conditions.

Apparatus and Measurement

Brainwaves were recorded from Fz, Cz, and Pz sites using the TEAC polygraph system. The participants wore Noise-cancelling headphones (SONY MDR-NC500D) to reduce environmental noise in both conditions.

Stimulus

Target stimulus : Coin; Probe stimulus: Neckless; Irrelevant stimulus: Ring, Earring, Broach and Watch (See Figure 1 and Table 2)

Procedure

All participants were instructed to steal one of five items from a room. After the mock crime, all participants underwent the P300-based CIT. There were two main conditions: a picture as visual stimulus with auditory stimulus, and a word as visual stimulus with auditory stimulus. Each auditory and visual stimulus was simultaneously presented using a computer display and headphones. Three types of stimuli were used: target, probe, and irrelevant. Each stimulus was randomly presented 40 times. During the CIT, participants were required to respond to all irrelevant and probe stimuli by pressing a left button and to the target stimulus by pressing a right button. The number of averaged epochs for the final P300 evaluation was 20 epochs. In this study, Target: Probe: Irrelevant ratio was 1:1:4 in both conditions. The presentation of visual stimuli, picture or word, was presented on a computer screen. Each stimulus duration was 400 ms with a 1500 ms ($\pm 20\%$) inter stimulus interval. The presentation of auditory stimuli in both conditions, the stimuli were presented through digitized human voice. Each stimulus duration was 450-900 ms with a 1500 ms ($\pm 20\%$) interstimulus interval.



Figure 1. The actually presented stimuli in picture condition.

Table 2. The actually presented stimuli in word condition.

Language	Target	Probe	Irrelevant	Irrelevant	Irrelevant	Irrelevant
Japanese	キンカ	ネックレス	ユビワ	イヤリング	ブローチ	トケイ
English	Coin	Neckless	Ring	Earring	Broach	Watch

Results

During the picture condition, mean P300 amplitudes for the probe and irrelevant stimuli were 14.7 and 9.0 μ V, respectively. For the word condition, mean P300 amplitudes for the probe and irrelevant stimuli were 10.6 and 8.6 μ V, respectively. A repeated measures ANOVA revealed significant differences for the main effect for the stimulus ($F(1,9)=5.398$, $p=.045$, partial $\eta^2=.375$) but no significant differences for the main effect for the condition ($F(1,9)=3.106$, $p=.112$, partial $\eta^2=.257$). Moreover, the interaction between stimulus and condition showed a clear tendency toward significance ($F(1,9)=5.053$, $p=.051$, partial $\eta^2=.360$). Simple main effects revealed that the probe elicited significantly larger P300 amplitudes than the irrelevant stimuli ($p<.01$) in the picture condition. Additionally, the probe-elicited P300 amplitude in the picture condition was significantly larger than that in the word condition ($p<.05$).

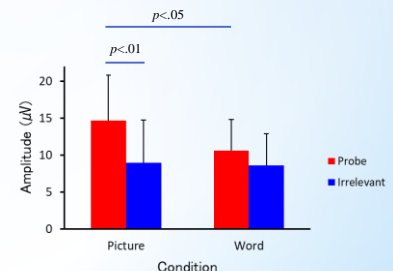


Figure 2. P300 amplitudes in the both conditions at Pz site.

Discussion

The probe elicited larger P300 amplitudes than the irrelevant stimuli in both conditions. However, the difference was significant only in the picture condition. Additionally, the probe-elicited P300 amplitude in the picture condition was significantly larger than that in the word condition.

We conclude that the picture was highly effective in the simultaneous presentation of auditory and visual stimuli during the P300-based CIT.

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