EFFECT OF DUAL TASK BY AUDITORY AND VISUAL RESPONSES ON ATTENTION.

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INTRODUCTION

With the advance in technological development, humans have innovated extremely useful equipment and devices for enhancing comfort and enriching lifestyle. The introduction of electronic gadgets such as portable and car phones has rendered communication between remote and inaccessible sites and cities possible. As humans have come to rely more on the use of portable phones in recent years, the incidence of traffic accidents increases exponentially. It has been reported that the reaction time required for a driver to brake immediately before an accident is delayed when he or she is preoccupied with a portable phone in one hand while driving. Employing a portable phone while driving, a dual-task performance, induces attention dispersion diverting concentration partially from the main focus of a certain task to attention channeled on the other task. Hitherto, studies on the effects of a dual task on attention during work performance have been limited, especially on the aspects of inputs of concomitant external stimuli on performing a visual/auditory dual task in humans. It is therefore of interest to examine the effects of performing the auditory response of talking on the phone while driving.

Previous investigations have demonstrated that information received via one ear is relayed first to the contralateral cerebral hemisphere for input processing and integration. There exist differences in qualitative/quantitative outputs in between information processed and integrated by both cerebral hemispheres.

In this study, we attempted to study effects of an integrated auditory/visual dual task on the performance of attention-dependent responses. The dual task involved an auditory task that required the subjects to answer randomly projected questions previously recorded on a mini-disk recorder while performing a visual task with an attention-load closely approximating that of driving.

METHOD

Subjects

Ten male adults of 21-22 years of age (mean 21.6 years) volunteered for the study. They were briefed on the experiments before giving consent to participate in the study.

Visual task

A personal Computer was used to impose visual task. A reference point was first imposed in the center of monitor for 3 sec. A cue was then displayed on the right or left above the reference point. The cue was allowed to appear for either 0.5 sec (short interval) or 3 sec (long interval) on the screen. In the next task, a reference point was imposed in the center on the monitor again, and a target appeared on either the left or right of the visual field

Table 1. An accounting of the visual task. The number of displaying a cue and a target The A cue and a target same and contrary direction on the screen

The direction of a cue and a target	The number of a visual task (a ratio)	The position of a cue	The position of a target	The number of a visual task
The same direction	30(75%)	right	right	15
		left	left	15
The contrary direction	10(25%)	right	left	5
		left	right	5

for 2 sec. The subject was instructed to press a key (as fast as possible) when a target was presented, and the target would be erased on pressing the key. A test-trial was allowed before the subject attempted 40 experimental trails. The cue was displayed at random, and the probability of a target appearing in the same display was 75%(30 times), and in the other indication was 25%(10 times)(Table. 1).

Auditory task

In the auditory task, subjects listened to questions previously recorded on a mini disk via the right or left ear, and had to provide the answer faithfully within the shortest time possible. The questions were recorded at a regular interval (Fig. 1) and chose at random.

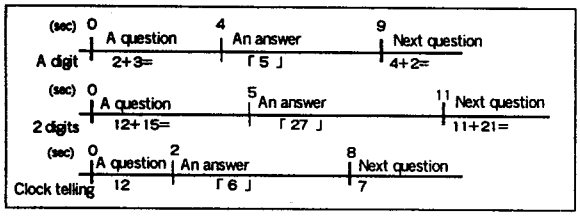

Fig 1 The interval of question in Visual task

The answers involved mental calculations based on arithmetic, encompassing single and double figures, or clock-based time-telling that involved a spatial cognitive task. In the time-telling questions, the subject was instructed to imagine the face of a clock and had to provide the number linearly opposite to that mentioned in the question.

For example, if the number in question was 12, the answer would be 6.

Experimental condition

This study designated 14 conditions [(2 time-intervals for displaying the cue/arrow in the visual task × 2 levels of listening in the auditory task via the right or left ear ×3 levels of auditory task) + 2 time-intervals for displaying the cue in the visual task without any auditory task](Table. 2). The order of conditions was chosen at random for each subject (Fig. 2).

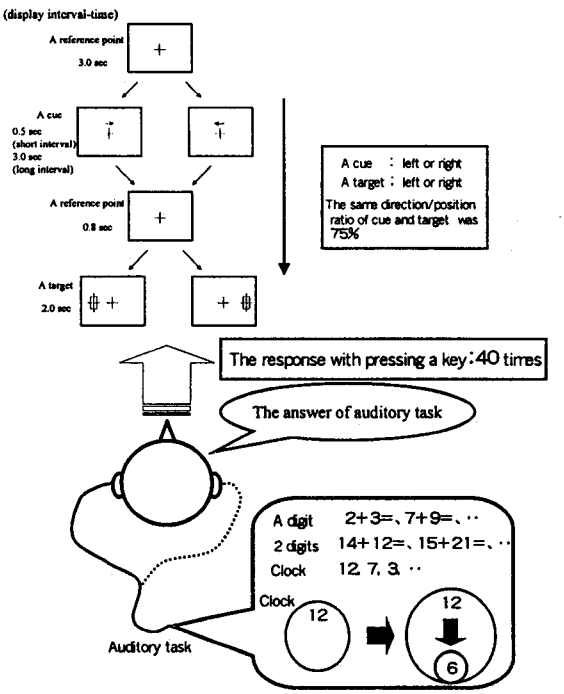

Fig 2 The dual task in visual/auditory task

Analysis

The Reaction time was calculated as the mean of each task for all subjects under each experimental condition.task for all subjects under each experimental condition.

RESULT AND CONDEITION

Reaction time of all experimental conditions

On comparisons of the reaction times with and without the auditory task (Fig. 3), the former was significantly delayed regardless of the display interval for the cue. This delay in reaction time occurred under all conditions, without differences

Table 2 The condition of a experiment.

condition	1	2	3	4	5	6	7
The interval of a cue	Long	long	long	long	long	long	long
The listening ear	left	left	left	right	right	right	
Auditory task	A digit	2 digits	Clock	A digit	2 digits	Clock	Non-task

8	9	10	11	12	13	14
short	short	short	short	short	short	
left	left	left	right	right	right	
A digit	2 digits	Clock	A digit	2 digits	Clock	Non-task

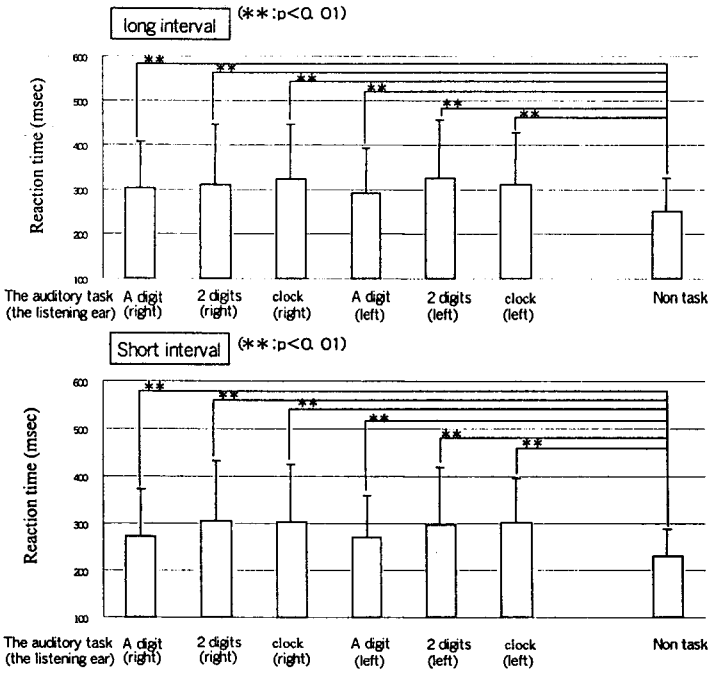

Fig3 The reaction time of all conditions.

through either ear and auditory tasks. This implicated that an auditory task executed with an on-going visual task delayed the reaction time of visual task.

Reaction time and indication of the cue

Fig4 shows the difference in reaction times between the short and long cue display time-intervals in the non-auditory task. The reaction time of imposing the cue for 3 sec was significantly delayed compared with that imposed for a 0.5-sec time interval in a case when the target was displayed in either direction/position with respect to the reference point. This

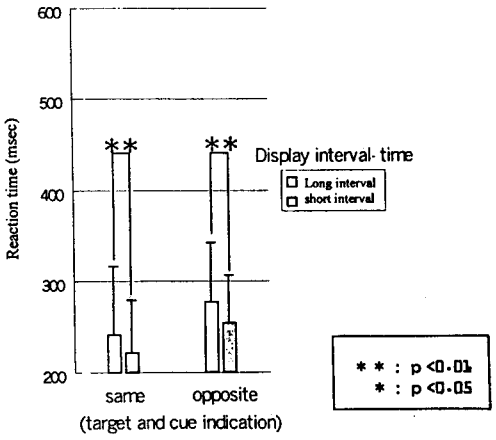

Fig 4 The reaction time in non auditory task

difference in reaction time was probably caused by time-related distraction.

Difference in the reaction time between short and long cue time-interval in the auditory task with arithmetic addition(Fig5) revealed the reaction time imposing the cue for a longer time interval was significantly delayed compared with that subjected to a shorter display time-interval. A similar significant tendency was observed without auditory tasks.

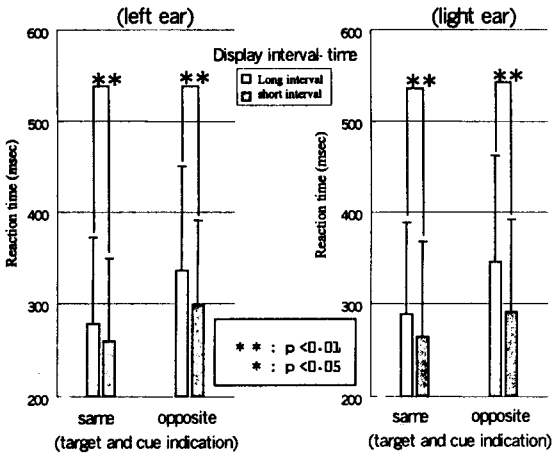

Fig 5 The reaction time in auditory task (a digit)

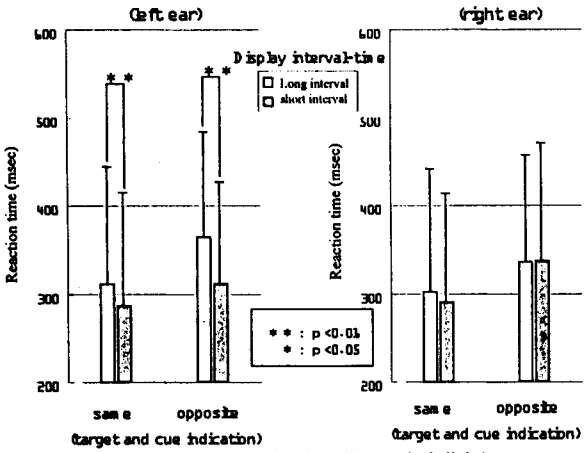

Fig 6 The reaction time in auditory task (2 digits)

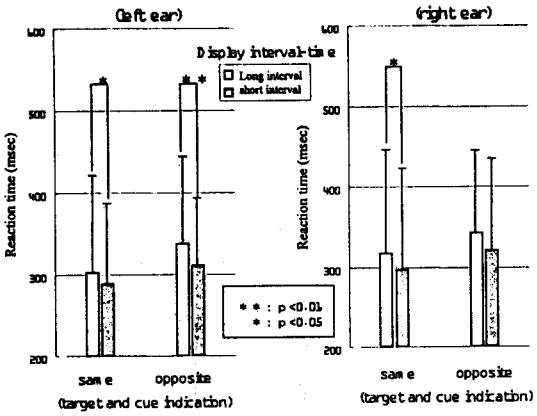

Fig 7 The reaction time in auditory task (clock-telling)

Differences in the reaction time with long and short cue display time-intervals in auditory tasks involving arithmetic addition with number of 2 digits (Fig. 6) were not observed when the target appeared in the same direction/position as the cue, or in a different direction from the cue in the case of listening via the light ear. There was a significant difference in reaction time identical to the non-auditory task in listening via the left ear.

Result of differences in the reaction time involving clock-telling with a long and short display time-interval, (Fig. 7) were similar to those verified with the auditory task in performing single-digit additions.

However, significant differences in the reaction time were not obtained with the target displayed in different direction/position while listening via the right ear. An adequately difficult auditory task was thus a prerequisite to producing the difference of listening via the left/right ear in auditory tasks that affected the reaction time of visual task. The right cerebral hemisphere of the human brain predominates in performing visual motor function, while the left cerebral hemisphere excels in linguistic interpretation/functions. The difference of processing in the right-left cerebral hemispheres affected the reaction time of visual task while performing on auditory task.