

ABSTRACT

The purpose of this study was to provide evidence that the low manual dexterity among people with mentally retarded came from the interference between an input of visual information and an output of motor control.

Previous studies had shown that gazing behavior during a reaching task got delayed about 200ms among mentally retarded people who engaged in practical work situations. The analysis of scan paths obtained from such work situations had indicated that persons with mentally retarded tended to gaze the target object repeatedly when their hands were about to reach to it, and then they monitor and engage in feedback control of their hand. It was hypothesized that the cause of this delay stemmed from the difficulty of getting visual information about the target object. To test this hypothesis, the present study compared the performance of a tracing task between normal and mentally retarded participants, with applying a forced visual delayed feedback to only the normal participants. Several conditions were set to manipulate the levels of the delay, and tracing errors were measured. The analysis revealed that the normal participants had shown a similar performance to mentally retarded participants when they had received 200ms of visual delayed feedback. The result of this study was relevant to the previous literature, and also providing new evidence that the low manual dexterity of persons with mentally retarded had largely stemmed from the difficulties of getting visual information in regard to reaching action. The implications of assisting and improving low dexterity among people with mentally retarded were discussed.

INTRODUCTION

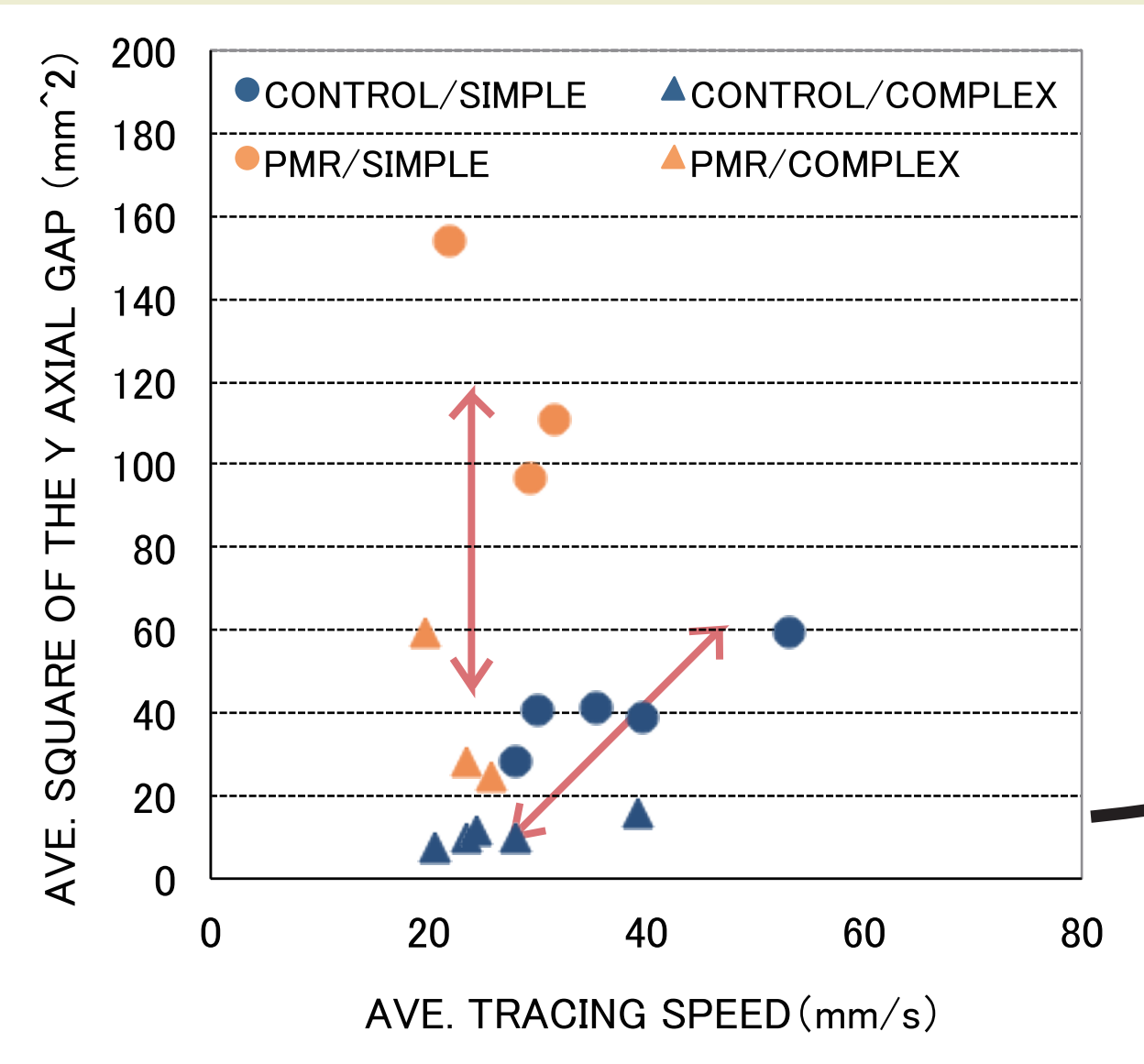
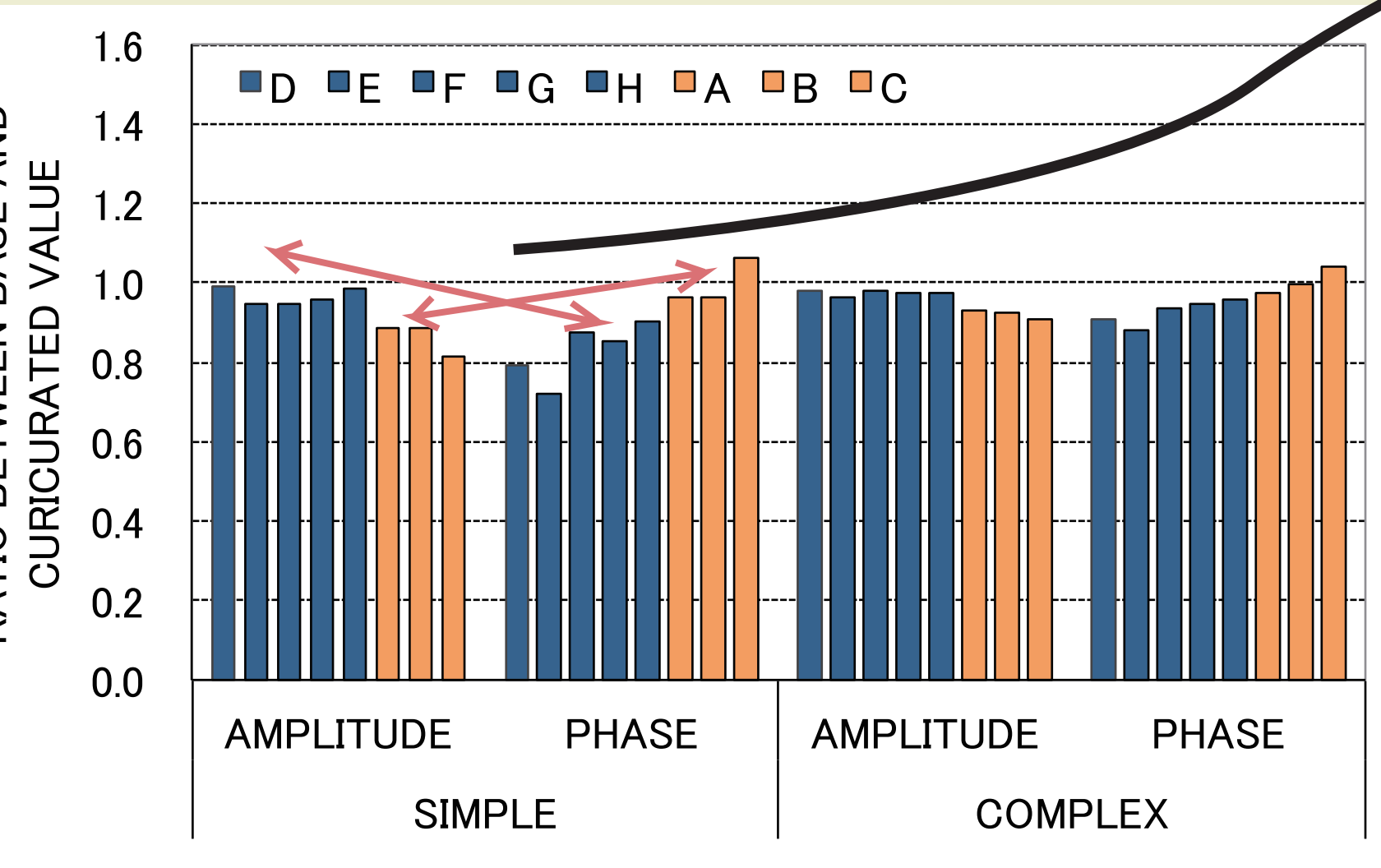
Persons with mental retardation (PMR) showed less dexterity (e.g. Bruininks, 1974). Why do they show less manual dexterity? Welsh & Klavora (2003) showed that the performance related to visuo-motor coordination of PMR was worse than persons without mental retardation. Oka & Miura (2008) showed that the less performance in dual-task was due to interferecne in perception and motion planning, not by a problem in allocation of attention.

We showed that a gaze to a target of PMR lag behind a reaching to the target (Oka & Miura, 2007). The lags were approximately 200 ms. The result indicated the PMR did not use feedforward (FF) control. Shumway-Cook & Woollacott (2001) pointed out that a reaching action needs two control systems. One is the feedforward system, the other is feedback (FB) system.

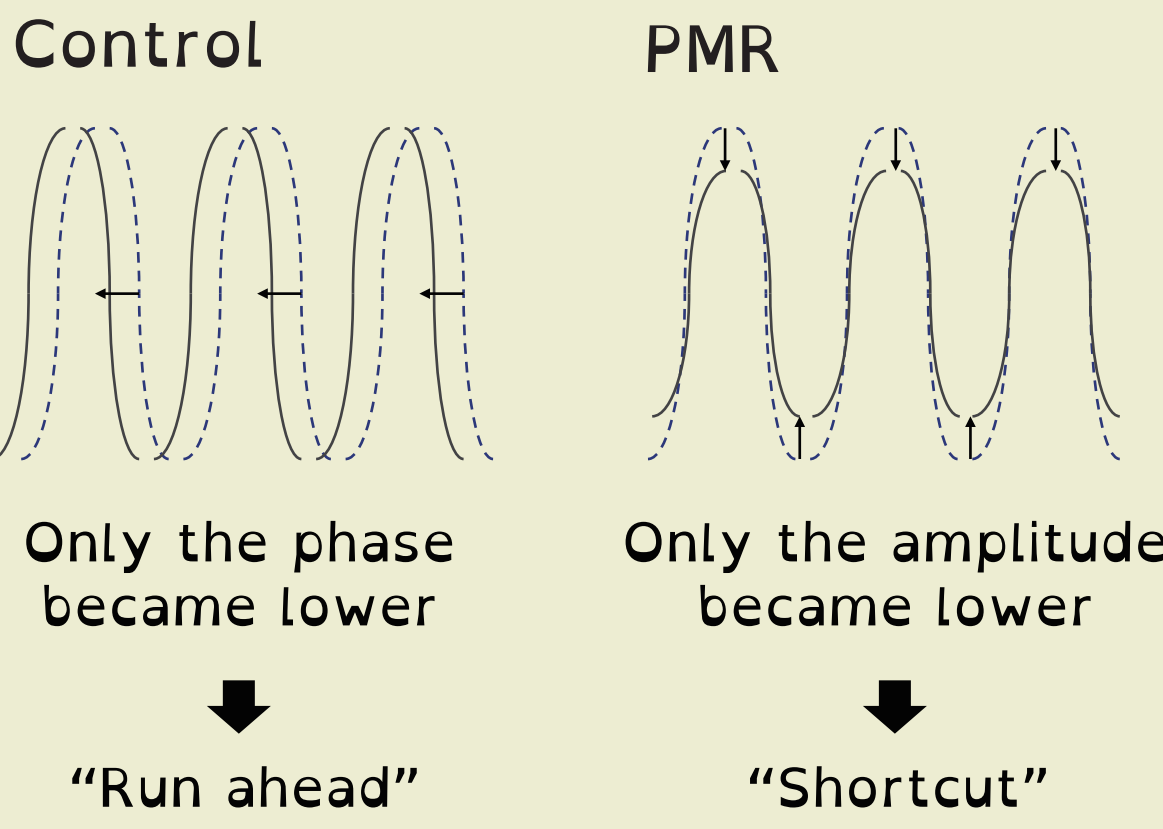
We investigeted
Whether PMR use two types of control system well or not.
Whether we can replicate the less dexterity observed among PMR by being restrected FF control or FB control of persons without MR.

RESULTS

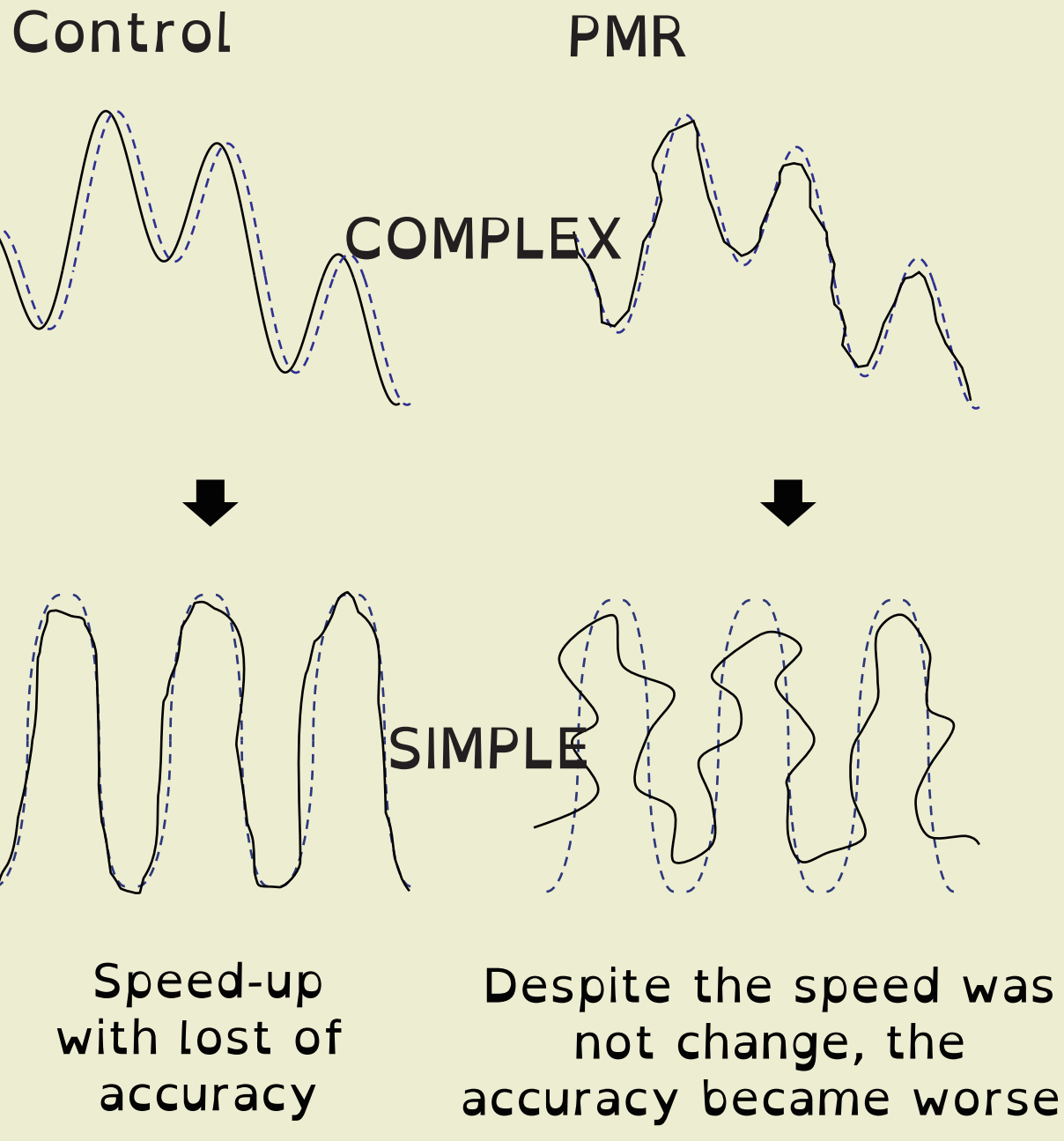
No restriction condition (control)



Interpretive model



Typical example



METHOD

Participants

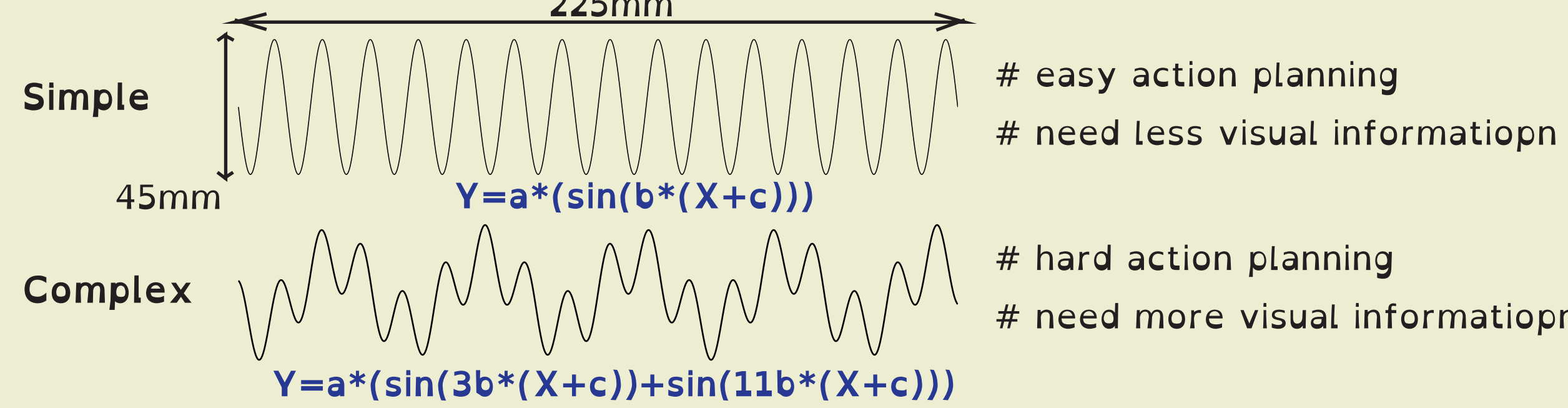
	with mental retardation (PMR)	without mental retardation (control)
N	3(Participant A,B,C)	5(Participant D,E,F,G,H)
Age	Ave. 32.6(28,30,40)	Ave. 32.4(29,36,34,36,27)
Sex	M,M,M	M,W,W,W,W
IQ(by WAIS-R)	Ave. 36.3(36,39,34)	-
VIQ	Ave. 46.0(46,46,46)	-
PIQ	Ave. 40.0(38,42,40)	-
Dominant hand/eye	R,R,R	R,R,R,R,L
Vision	all nomal	all nomal

Tasks and Design

#Tracing task with Digital Pen

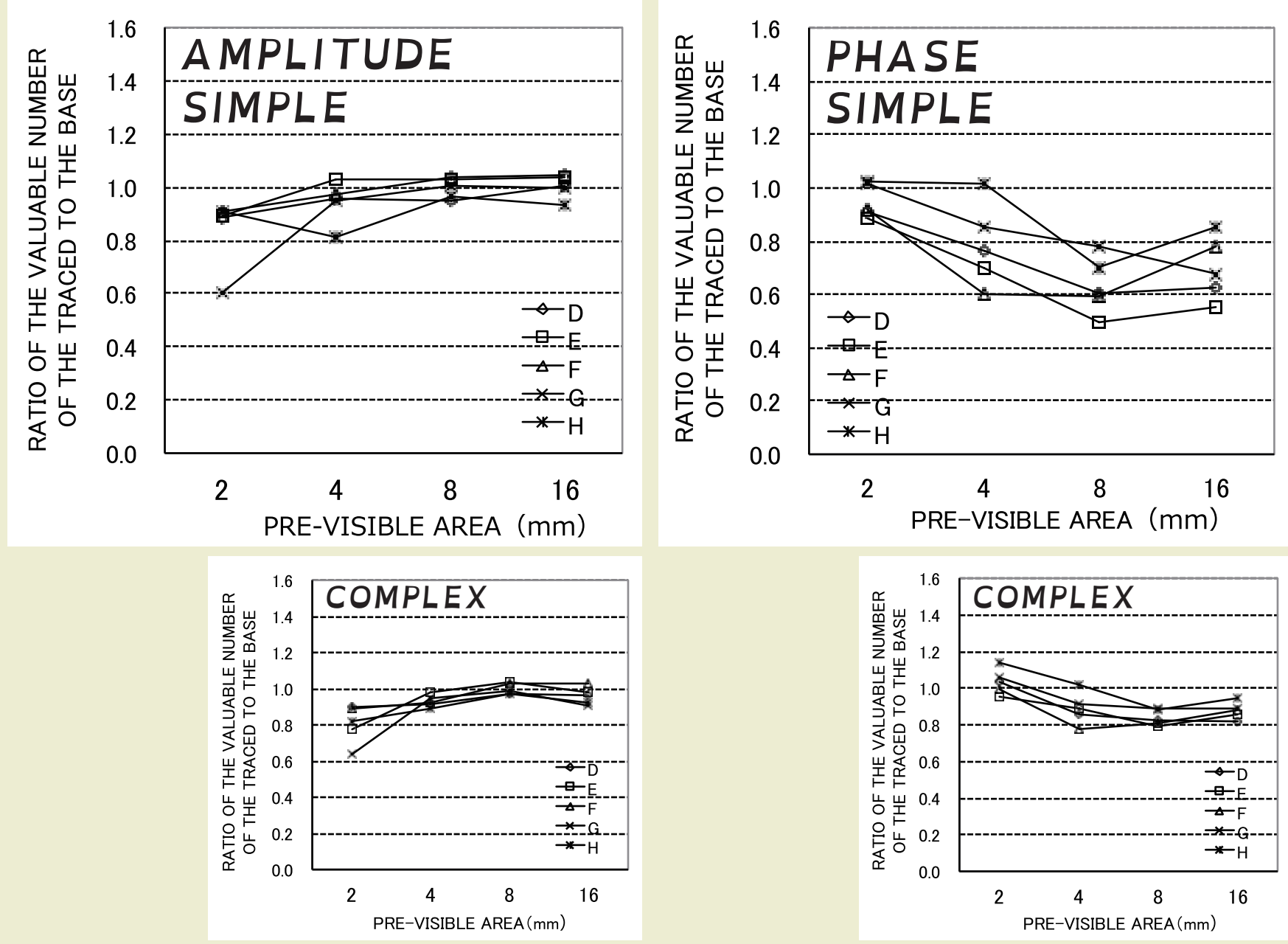
Anoto Maxell Co./ dia. 18mm / 30g / resolution capability: 0.3mm / sampling rate: 13ms

#Two types of sine curve line



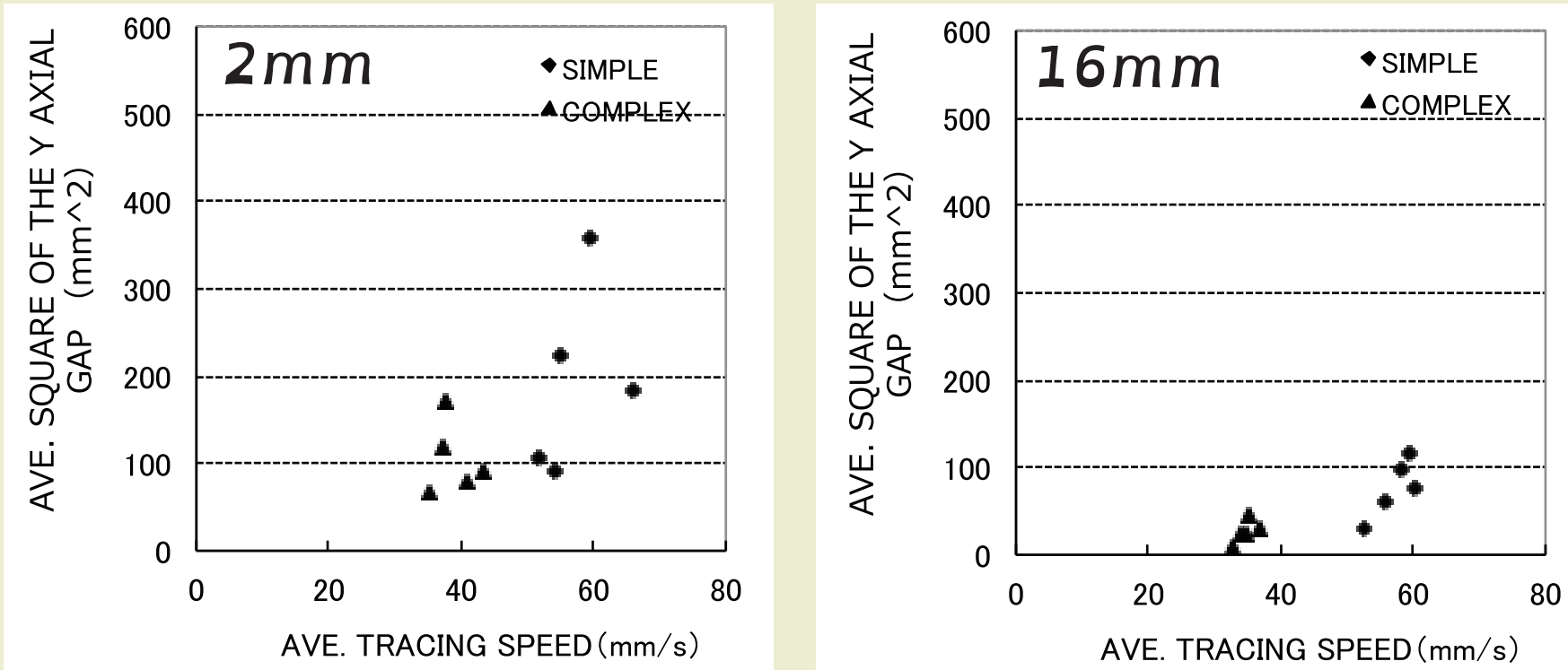
#Two experimental conditions and one control condition.

Feedforward control restriction condition



The narrower the pre-visible area, the lower amplitude. But, the phase did not chage.

-> This result agreed with the performance of PMR.



The narrower the pre-visible area, the less accuracy. But, the tracing speed difference between two conditions did not chage.

-> This result did not agree with the performance of PMR.

The Interference Between Input and Output among People with Mentally Retarded



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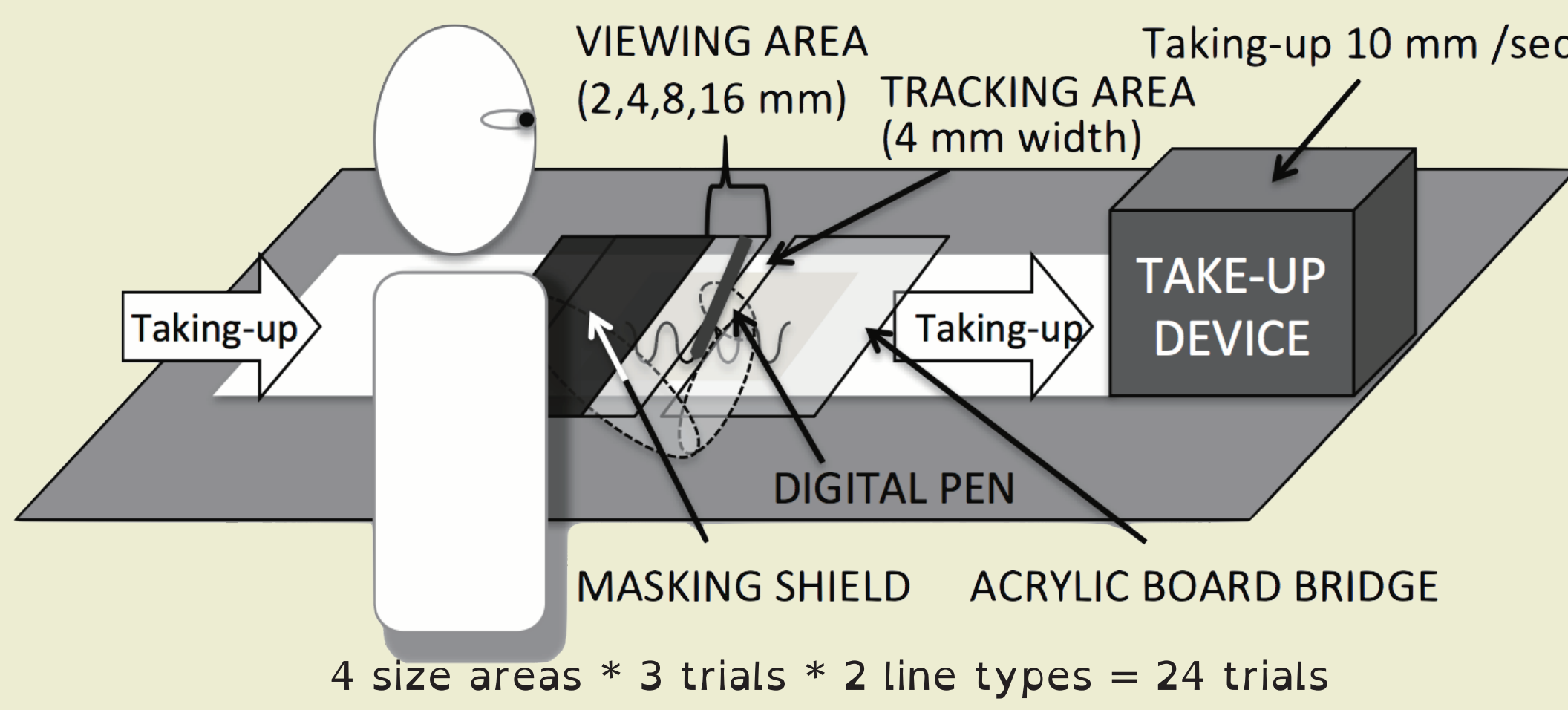
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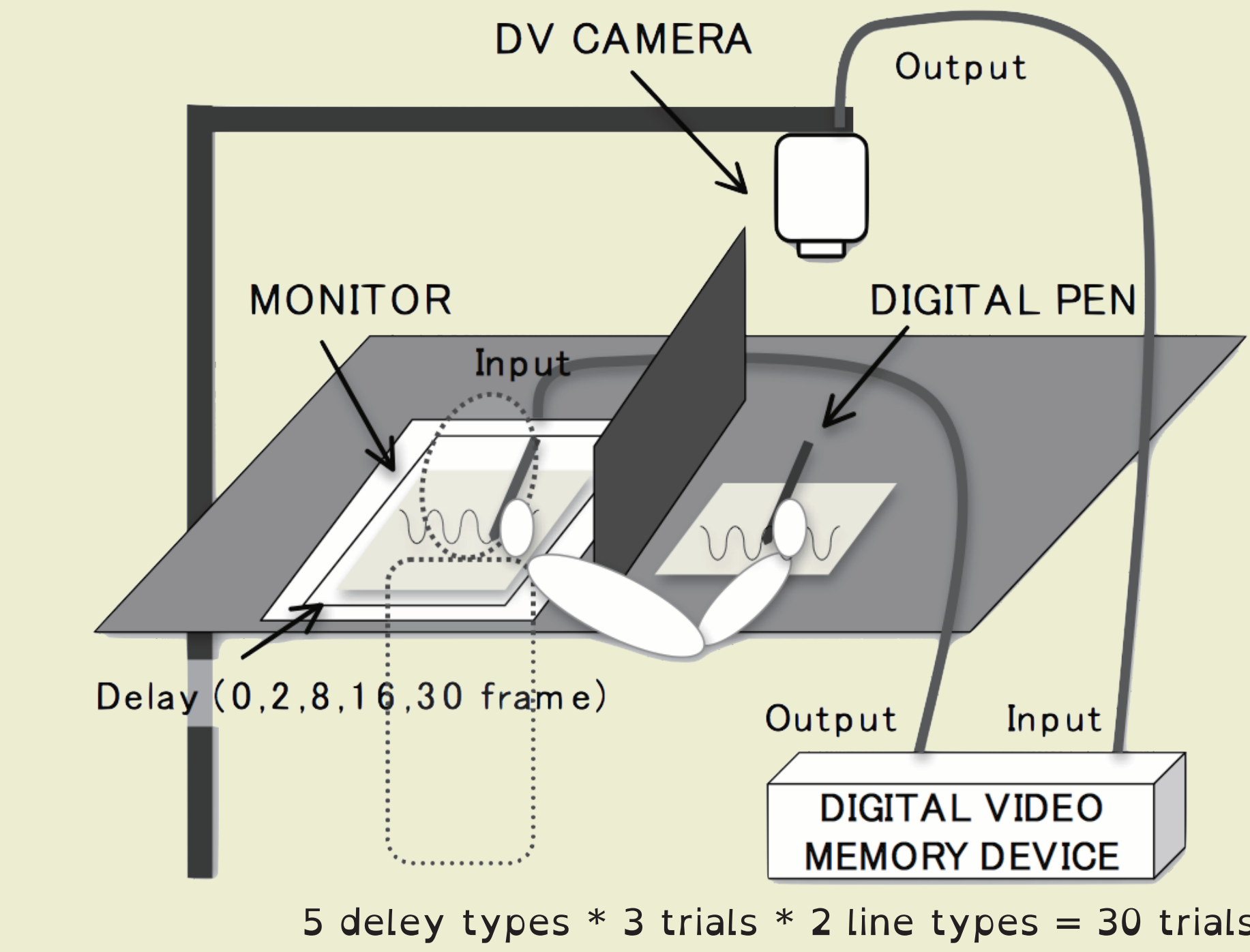


This work was supported by Grant-in-Aid for JSPS Fellows Grant Number 188708

Feedforward control restriction condition



Feedback control restriction condition (Delayed FB)



Design & Question

with mental retardation (PMR)	without mental retardation (control)
1) No Restriction * Line Types	1) No Restriction * Line Types
	2) FF Restriction * Line Types
	3) FB Restriction * Line Types

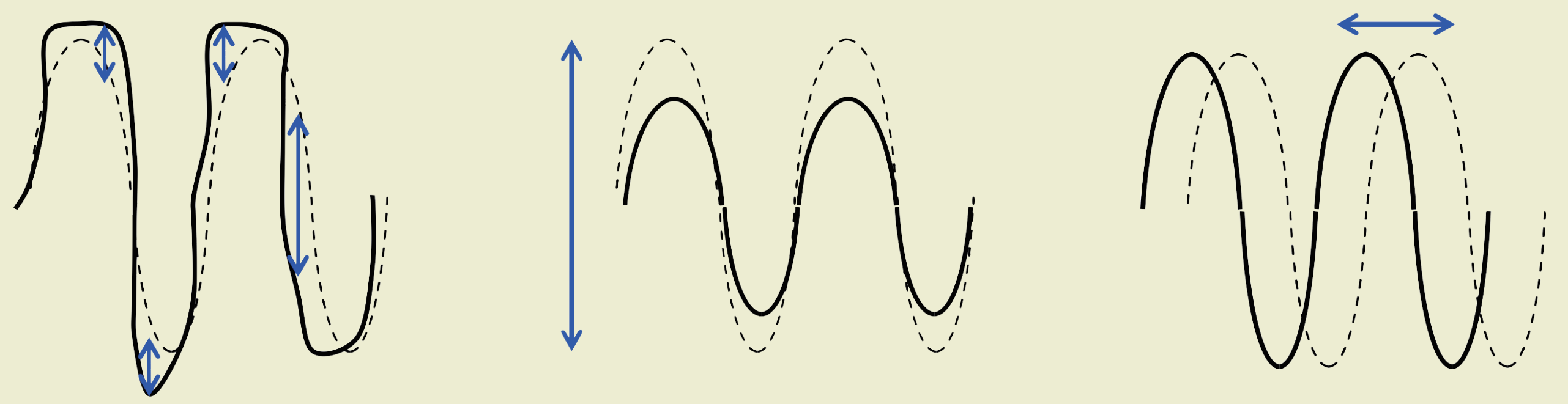
Which condition will replicate the performancce of PMR?

Analysis

The approximation formula was calaculated by non-linear least-squares method in the coordinate value of the traced line.

Y=a*(sin(b*(X+c)))+d

Y axial gap a: amplitude c: phase



CONCLUSIONS

The fetures of PMR performace were...

1. Comparing the base line, the amplitude became lower, but the phase was still same level.

-> This is well accorded with the result of the FF restricted condition on participants without mental retardation.

This result indicates that PMR with deficieting acquisition of pre visual informantion use FF control system mainly, which induces the poor performance. And then, they try to modify the motor control.

2. Comparing the complex line condition, the trace accuracy became lower, but the tracing speed was still same.

-> This is well accorded with the result of the FB restricted condition on participants without mental retardation.

This result indicates that the modification of the motor control provide a interference between on going motor programing and modified motor programing. And that should be the reason of the less of visuo-motor performance of PMR.