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力量調整課題の記憶における逆向抑制と再生反応の偏向

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Directional Errors in Retention of a Pressure Control Skill as a Function of the Nature of an Interpolated Task

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Abstract

The present study examined directional error shifts (assimilation or contrast) in the reproduction of a criterion pressure control task (2 kg) following either 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 kg and a noninterpolated pressure control task. Eight independent groups of subjects (N=120) were tested. The results showed that when an interpolated forces was greater in magnitude than the criterion one, the subjects produced a significantly smaller magnitude of force than the criterion one. These results supported the contrast effect and not the assimilation effect.

With respect to retroactive interference (RI), several researchers (Dickinson, 1977 ; Pepper & Herman, 1971) have suggested that the role of the interpolated task is important to understand the interference of memory traces. Specially, from the viewpoint of response biasing, Pepper and Herman (1970) reported that the relative magnitude of the interpolated force produced response biasing of the criterion force in a recall test proportionaly to the level of the interpolated force. This suggests that the traces of any sources of (RI) proprioceptive stimulation might interact with the trace from the criterion force and alter its represented magnitude.

Stelmach and Kolso (1975), however, pointed out that in the previous experiments only the temporal characteristics of the momory trace were manipulated and there was no direct effort toward strengthening either the trace of criterion task or that of the interpolated task. That is, only a few trials were administered on the criterion task and the interpolated one.

To clarify the effect of the relative strength of memory traces on the degree of response biasing, Stelmach and Kelso (1975) directly manipulated the strength of memory trace repetition and feedback conditions in two experiments. The increased repetition of the criterion response led to a reduction in response biasing, and also the increased feedback on the criterion task in the form of which were cues different perceptual

modalities produced less shifts in error at recall. It was suggested that the strength of memory trace might be one determiner of shifts in error at recall. However, in Stelmach and Kelso's study (1975), the effort to strengthen the memory trace was manipulated only for the criterion task and not for the interpolated task. This suggests that the memory trace for the interpolated task was unstable in their study. It can be assumed that a greater interference might be produced when a more stabilized memory trace exists.

In addition to this situation, the assimilation effect for response biasing, suggested by Pepper and Herman (1970), should be reconsidered. If the difference in magnitude between the criterion and the interpolated task is too great, then the two memory traces, one for the criterion and the other for the interpolated task, could be independent. In this case, with regard to the direction of response biasing, a contrast effect would be greater than an assimilation effect. The possibility of the contrast effect has been suggested by several studies on perceptual judgments of weight (Parducci, Marshall, & Degner, 1966 ; Sherif, Tauf, & Hovland, 1958). These researchers illustrated the contrast effect on comparative judgments by interpolating an extra stimulus between the standard and the comparison stimuli.

With the use of a pressure control task, the present study was designed to clarify directional error shifts (assimilation or contrast) in the reproduction of a criterion task that followed an interpolated task of less or greater level of force than the original one. Both memory traces were assumed to be strengthened according to the number of trials administered with each task.

Method

Subjects

The subjects were 120 female undergraduate volunteers who had not previously taken part in the experiment.

Task

The task employed in the present study was to apply a certain amount of force with the dominant hand, on the pressure control button, under which a spacial force transducer was attached.

Apparatus

An electrical strain gauge (Kyowa-Kogatakajuhenkanki) and strain amplifire (Kyowa DPW-1140) were used to measure the applied force on the button. Figure 1 illustrates the pressure control apparatus. The DC amplified outputs of these sensing units were recorded on a heat pen oscillograph (Watanabe Mini-Writer, WTR 751). The oscillograph record provided a subject with concurrent or terminal visual feedback as to the applied force. Ten mm on the

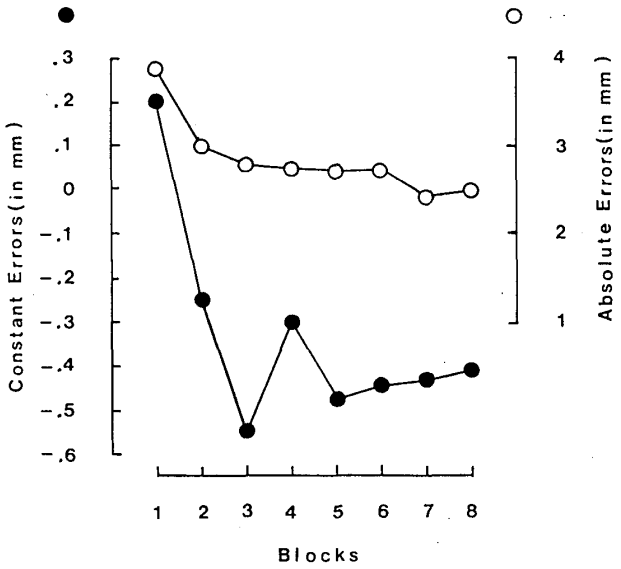

Figure 2 Constant error (CE) and absolute error (AE) for the eight five-trial blocks in original learning phase

oscillogragh was associated with a force of 1 kg and also the pen's moving distance was arranged in linear increments of force. The paper speed of the recorder was 2.5 mm per sec.

Procedure

The subjects were divided into one of the eight groups at random, 15 subjects for each group. These groups were : G_1, G_2, G_3, G_4, G_5, G_6, G_7, and G_8, respectively. After being seated, the subject was given information by means of a cassette tape recorder, and then a brief demonstration by an experimenter. The subject was required to place her dominant hand on the pressure control board. To prevent excessive hand movement, her forearm just below the elbow was strapped to the board with 5.0 cm-wide cloth belt.

Following three practice trials under a visual concurrent feedback condition, the subject was administered 40 trials on the task as the original learning phase. On these trials, she were required to perform the task without a visual cue (her eyes were covered with an eye mask). Immediately after each trial, the subject was asked to observe her performance on the oscillograph record. The criterion of force of the task was 2 kg. An interval of 20 sec. occurred between each two trials.

Following the original learning phase, eight different experimental conditions (criterion of applied force level) were interpolated. During the interpolated learning phase, the subjects of Groups G_1, G_2, G_3, G_4, G_5, G_6, and G_7 were administered 10 trials at 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, and 3.5 kg force levels, respectively. The Subjects in G_8, the control group, were required to rest during the interpolated phase. The interval between each two interpolated trials was also 20 sec.

Following the end of the interpolated learning phase, a 60 sec. interval elapsed to all groups before the first recall trial of the original learning task. Two recall test trials were administered to all subjects, with a 10 sec. interval between them. Table 1 contains the experimental design followed in this study. All the subjects were tested individually in a single experimental session.

Table 1 Experimental Design

Practice Phase	Rest	Original Learning Phase (2kg)	Rest	Interpolated Learning Phase							Rest	Recall
				G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	
sec 60	60	800	60	200							60	21
Trials 3		40		10								2

Results and Discussion

To assess the equality of the eight groups regarding the original learning, mean absolute and constant errors on the final five trials in the original learning phase were analyzed with the use of analysis of variance. No significant differences for absoulute error (F (7,112) = .19, P = .99), and constant error (F (7.112) = 1.19, P = .32) were detected among the eight groups. It was assumed that these eight groups were equivalent in their performance in the last phase of original learning.

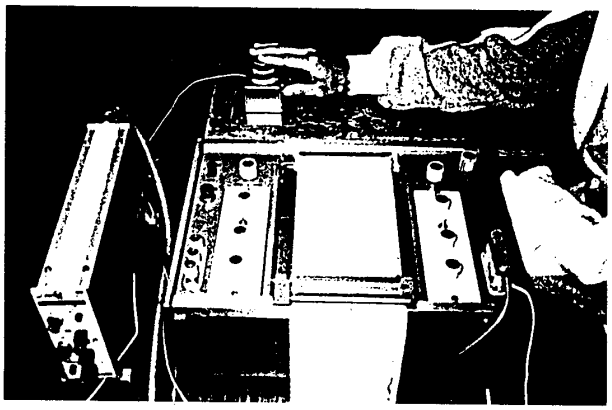

Figure 1 Pressure control apparatus

The mean performance curve for absolute and constant errors at each block of five trials during the original learning phase is shown in Figure 2. Absolute errors decreased over increasing practice while constant errors changed from positive (overshooting) to negative (undershooting) in direction. The trend of the mean performance curve for constant error suggested that the response set of oversooting for the force-application task, as reported by Annet (1959) and Pepper and Herman (1970), could be changed into undershooting with repeated trials. Pepper and Herman (1970) assumed that the response set of subjects remains constant over time. However, the response set might be altered by the knowledge of results of each trial, as employed in this study. Probably, a tendency to overshoot in a pressure control task, as reported by Pepper and Herman (1970), may be characteristically observed only in an early stage of learning.

According to Stelmach and Kelso (1975), absolute error do not reflect directional shifts. Therefore, in the present study, only the constant error scores were used to analyze the directional shifts in error.

The mean constant errors on recall tests 1 and 2 for the eight groups are illustrated in Figure 3. It can be seen that the constant error for 1.5 kg interpolated force level is clearly positive in sign, while for the 2.5 and 3.0 kg levels, it is predominantly negative. However, such a predominant tendency is not very clear at 0.5, 1.0, 2.0, and 3.5 kg interpolated force levels. A 2-way Analysis of variance with repeated measures was applied to the constant error for retests 1 and 2. Both the level of interpolated force and the retention interval were significant ($F(7,112)=3.98$, $P<.01$, and $F(7,112)=2.64$, $P<.03$, respectively). Scheffe's multiple-range test yielded a significant difference between G_4 (1.5 kg) and G_6 (3.0 kg), indicating a positive

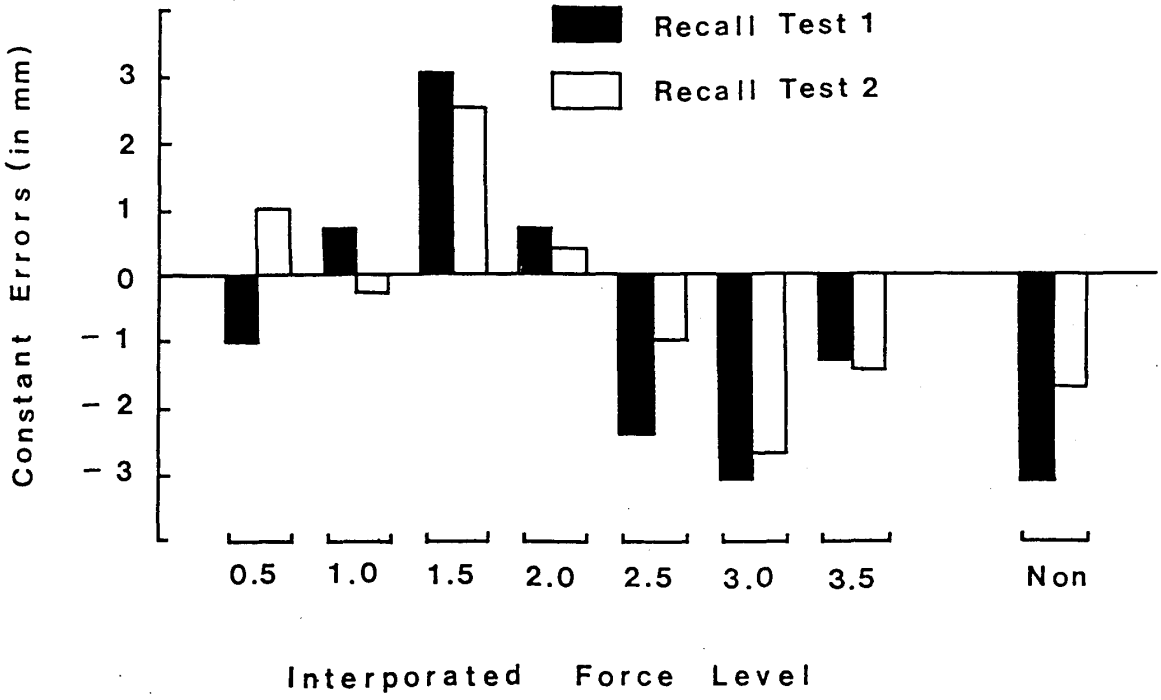

Figure 2 Constant error (CE) and absolute error (AE) for the eight five-trial blocks in original learning phase

direction for G_4 and nagative direction for G_6.

It was detected that performance in the retention session became more accurate with repeated tests at the same criterion as reflected by a positive shift in constant error in the direction of the criterion. This trend is consistent with the findings in several recent studies (Pepper & Herman, 1970 ; Wrisberg & Schmidt, 1975 ; Gentile & Nemetz, 1978). In considering the trend of reference to recent theoretical models, the reduction of constant errors in retention could be explained by Schmidt's (1975) schema theory. He suggests that a subject in repeating a response might develop a self-error detection mechanism which guides a response to the correct response.

The above results partly support the basic hypothesis of the present study of showing a contrast effect. However, it appears that the contrast effect was not proportionally related to the magnitude of the difference between the criterion and the interpolated task.

In contrast to the present study, Pepper and Herman (1970) reported that the greater the magnitude of the interpolated task force is than the criterion task force, the larger the forces are at recall. They assumed that the trace of the interpolated force and the trace of the criterion force interacted to produce a trace which was represented by both, perhaps a mean intensity. In the present study, however, it was suggested that the two memory traces—one of the interpolated task and the other for the criterion task—might not be confounded, if the both memory traces were sufficiently strengthened by means of repetition and feedback conditions. Such would also be the case if the difference in magnitude of the both memory traces were sufficiently discriminated. A further investigation is necessary to determine whether the contrast effect should change proportionally with the difference in the magnitude of the interpolated and the criterion tasks.

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