THE EFFECTS OF EXPERIMENTER'S SUPERVISORY BEHAVIOR PATTERNS UPON PERFORMANCE AND REMINISCENCE IN PERCEPTUAL-MOTOR LEARNING

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This study was designed to investigate the effects of the experimenter's supervisory behavior patterns upon performance and reminiscence in perceptual-motor learning. With the task performance (P) and the group maintenance (M) functional dimension used as the bases, the supervisory behaviors of the experimenter were operationally divided into four patterns: namely, PM, P, M and pm which are determined by the intensity of the two functions.

It was found that the amount of pre-rest performance tends to be higher among P-type groups, that of post-rest performance among PM-type groups. The results of reminiscence were the highest among PM-type groups, practically independent of the amount of pre-rest performance. The determinant of reminiscence effects was examined from the viewpoint of the experimenter's supervisory behavior patterns.

This study aims to examine experimentally how the supervisory behavior patterns of the experimenter have effects on performance and reminiscence in perceptual-motor learning.

As factors to determine the amount of reminiscence in perceptual-motor learning, there are intertrial rest intervals, the length of rest period following massed practice, the amount of pre-rest practice, etc. (Kientzle, 1946; Ammons, 1947; Kimble & Horenstein, 1948; Irion, 1949; Kimble, 1949; Archer, 1954; Bourne & Archer, 1956; Digman, 1959). These studies can be said to have aimed to test inhibition hypothesis (Hull, 1943; Kimble, 1949) which implies that the reactive inhibition (I_R) as a negative drive caused by a reaction evocation dissipates during rest, and for this reason, the growth of performance, i.e., reminiscence effect, may be observed.

As another factor which has effect on

reminiscence, there is a task motivation of the learners. The study of these factors may (as in Kimble, 1950; Wasserman, 1951) or may not (as in Eysenck & Maxwell, 1961; Eysenck & Willett, 1961; Willett & Eysenck, 1962) support the inhibition hypothesis that, depending upon the strength of motivation, accumulation of I_R can be determined. According to the inhibition hypothesis, the accumulation of I_R is a function of a drive or a motivation. The higher the motivation of the subject, the higher becomes the accumulation, or the critical level, of the I_R . As a result, it can be predicted that high drive levels should give rise to greater reminiscence scores than low drive levels, while, according to the inhibition theory, there should be a premise that the amount of performance under the conditions of high drive levels should be higher than that of low drive levels.

Kimble (1950) operated the drive by having the subjects compete on the one-to-one basis and used a pursuit rotor as a task. He has discovered that the performance and reminiscence of high-drive

¹ This research was conducted under the direction of and in cooperation with Dr. Jyuji Misumi, Professor of Group Dynamics of Kyushu University.

groups become higher in their amounts than those of the low-drive groups. Wasserman (1951) operated the motivation by means of verbal instruction (ego-oriented instruction and task-oriented instruction). In his experiment by means of the inverted alphabet printing task, Wasserman obtained the same result as Kimble's (1950). That is, it can be said that both of the above mentioned studies support the inhibition hypothesis, and show that the pre-rest performance amount and reminiscence effect become significantly higher under highly motivated conditions than under poorly motivated conditions.

Eysenck and others, however, found a contradictory result to the prediction based on the inhibition hypothesis (Eysenck & Maxwell, 1961; Eysenck & Willett, 1961; Willett & Eysenck, 1962). They made a comparison between two groups: (1) the highly motivated group of industrial apprentices imposed a pursuit rotor task on as part of an entrance examination for engineering apprentices and (2) the poorly motivated group without any such restriction. As a result, it was discovered that although high-drive subjects did not perform better than low-drive subjects during pre-rest practice period, they nevertheless, showed greater reminiscence scores.

In connection with this, Eysenck (1964), in the experiment of controlling a motivational factor under high-drive conditions and with pursuit-rotor as a task, reported that the highness and lowness of the pre-rest performance and task-ability were independent of those of reminiscence. Eysenck and others, therefore, explained that the amount of reminiscence rose independent of the amount of performance during pre-rest trials and it was not possible to explain it based on the inhibition hypothesis. He asserts that the amount of reminiscence is due to the consolidation of learning which makes progress during a rest period.

As the experiment which verifies this consolidation hypothesis, we can refer to the experiment conducted by Rachman & Grassi (1965), after practicing on the pursuit rotor for five minutes without a rest, the controlled groups to which an interfering task was given and the groups to which no interfering task was given were compared, and it was discovered that the effect of reminiscence of the former were relatively low. This is regarded to have been caused by the fact that the interfering task interfered with the consolidation of learning.

In an inclusive consideration of the amount of reminiscence, Eysenck (1965) determines that the effect of reminiscence in the tasks—such as memory learning and pursuit-rotor task—that require new learning may be explained by the consolidation hypothesis. However, in the case of well-practiced task, including no new learning, such as tapping and vigilance, the effect of reminiscence may be verified based on the inhibition hypothesis. Further he comments that inverted alphabet printing task of the same kind as the one for this particular experiment has an intermediate quality.

By referring to the above mentioned various experiments, this study tries to analyze the effect of supervisory styles of experimenters upon reminiscence effect considering the fact that the various activities of the subjects are conducted under the influence of the experimenters upon the subjects. The reason is that the supervisory styles of the experimenters in the experimental process may be thought to have a direct or an indirect effect upon task-performance or motivation of the subjects.

In this experiment, based on the framework of PM-patterns leadership concepts, we classified the experimenter's influence process upon the subjects into four functional patterns, i.e., PM-type, P-type, M-type and pm-type. Here PM stands for the concept of group functions; the

letter "P" is the first letter of "Performance", which means the function aiming at goal attainment or task solution; the letter "M" stands for "Maintenance", representing function aimed to maintain and strengthen group process as such or the self-preservation of the group. The P-type is, therefore, a supervisory behavior of experimenter which is directly concerned with the achievement of tasks. The M-type means a style of supervisory behavior directly concerned with maintaining and strengthening the group itself. The PM-type is the style of supervisory behavior emphasizing both of task performance and group maintenance, whereas the pm-type is the style of supervisory behavior weak in either of them.

According to the research on the effect of the PM-patterns leadership conducted by Misumi & Shirakashi (1966) and Misumi & Tasaki (1965), the order of effectiveness in productivity and morale indices showed that the PM-type was in the highest degree, the pm-type in the lowest and the P- and M-types in the medium degree. As to the productivity indices, the P-type was in the second highest degree, and the M-type was in the second highest degree under the morale indices.

Will a similar consequence mentioned above be also discovered in the case of an extremely short period of practice? In the study mentioned above, Misumi & Shirakashi (1966), an experiment was conducted in the long-range practice period with several rest intervals. From this particular experiment we can predict that an intensive and a continuous experiment conducted in an extremely short period without taking any rest, under the conditions of the P-type supervision as the performance-centered type, the amount of performance will reach the highest degree.

In connection with these problems, we have assumed the following hypotheses in this study; Hypothesis 1: under

supervision of the P-type as the performance-centered type, the amount of performance during the pre-rest trials will reach the highest degree followed by that of the PM-type in the second highest degree, and that of the M and pm-types will be the lowest; Hypothesis 2: during the post-rest performance, the amount of the PM-type will become much greater and tend to be far greater than that of the P-type. The amount of the M- and pm-types performance will relatively be low even during the post-rest trials; Hypothesis 3: in connection with motivation, the reminiscence effects will show the best result under supervision of the PM-type, followed by that of the P-type. The reminiscence effects under the supervision of the M- and pm-types will be the lowest.

This study aims at verifying the above mentioned three hypotheses and also examining the inhibition hypothesis and the consolidation hypothesis, especially in relation to the performance of pre-rest practice.

METHOD

Subject. A total of 15 groups of subjects were utilized, each group being a class in a girls, senior high school.

The experiment was administered to one group at a time, and a total of 834 subjects were used. The number of one experimental group (one class) was ranged from 53 to 58.

Task. Learning task was the inverted "hiragana" printing task (hiragana are the cursive scripts constituting the Japanese syllabary).

A test paper was prepared on which were printed at random the reversed letters of hiragana on every other line of a checkered sheet.

One line consisted of 44 squares, with a letter of inverted hiragana printed in each.

Supervisory behavior of the experimenter. The supervisory behavior of the experimenter in practice period were classified into the following four types:

Performance-centered type (called P-type

for short), Group-process maintenance-centered type (called M-type for short), a type with a strong function in the both fields, P and M (called PM-type for short) and a type with weak function both in P and M (called pm-type for short).

P-type is the supervisory style mainly concerned with expedition the task performance, i.e., as the phrases to hurry their task, the experimenter says "More quickly!", "You are slow!", "Hurry up!", "We haven't much time left!" and "Don't fool around, get to work!". In order to put pressure on the subjects to do their work accurately, he says:

"More accurately!" and "Don't make any mistake!".

M-type is the style of supervisory behavior directly concerned with maintaining and strengthening the group itself, i.e., in order of encourage the subjects, the experimenter says such phrases as: "Let's be pleasant and merry!", "Let's be more friendly!", etc. In order to show sympathy toward the subjects, the experimenter says such phrases as: "That's a big job, isn't it?", "Stick it out a little longer!", etc.

This type of experimenter sees to it that interpersonal tensions are eased by cracking jokes and laughing, depending on the group atmosphere. PM-type is the style of experimenter's supervisory behavior emphasizing both aspects. That is, an experimenter of this type not only puts pressure on the subjects to expedite their work and to do them accurately, but he also attempts to adjust interpersonal relations within the group by offering encouragement or showing sympathy toward the subjects. In other words, this is the style of supervision that combines both the first and the second types. With pm-type, both P- and M- are weak, which is, so to speak, a supervisory behavior pattern lacking in leadership.

Experimenter and associate. One postgraduate student majoring in psychology was recruited to play the role of experimenter. Prior to this experiment the student had been orientated about the patterns of the experimenter's supervisory behavior. As an observer, one

TABLE 1
Composition of experimental groups

Experimental group	Pre-rest trials	Rest	Post-rest trials
PM ₁₀	10	10 min	5
PM ₂₀	20		5
PM ₃₀	30		5
PM ₄₀	40		5
P ₁₀	10		5
P ₂₀	20		5
P ₃₀	30		5
P ₄₀	40		5
M ₁₀	10		5
M ₂₀	20		5
M ₃₀	30		5
M ₄₀	40		5
pm ₂₀	20		5
pm ₃₀	30		5
pm ₄₀	40		5

associate observed and recorded experimenter's behavior while the experiment was being conducted. As will be stated later in the item "Working Procedure" the associate further subjects a free association test during a 10-min rest period. After the experiment, he also asked the subjects to answer the questionnaire designed to obtain the subjects' perception of the particular supervision style the experimenter followed.

Composition of experimental groups. Under four different supervisory styles of the experimenter, such as PM-type, P-type, M-type and pm-type, as shown in Table 1, a total of fifteen experimental groups, each having a different length of pre-rest trials were formed.

For the post-rest practice, 5-massed 30-sec trials were applied to every experimental group. We had planned to have pm₁₀ group conducting 10 trials under pm-type, but we were not be able to execute it because we could not get as many groups, i.e., as shown in Table 1, fifteen experimental groups were organized, not including the pm₁₀ group.

Introduction of supervisory style. From the first trial to the third trial of the pre-rest practice,

any particular PM supervisory conditions were not applied to any of the experimental groups so that the subjects' performance level could be marked out prior to introducing the styles of supervisory behavior of the experimenter. During the last pre-rest trials and all the post-rest practice, this supervisory styles were not introduced, for it was necessary to observe the reminiscence effects.

Thus, the PM-patterns supervision or the P- and/or M-utterances were applied twice per one trial on an average to each group, except for one under the pm-type supervision, from the fourth to the second-from-the last trial.

Procedure. The subjects were assigned the task of copying the inverted hiragana arranged at random in a printed line into the blank squares below that line. At the supervisor's word of command "Start!", the subject began his work. After the first 30-sec trial, he was given the order, "Now, next!" and the second trial was carried on for 30 sec.

Thus, each trial, with a 30-sec working period was repeated continuously up to the last pre-rest trial under the same working procedure. All groups were given a single 10-min rest after the last pre-rest trial. After a 10-min rest, the same working procedure was resumed, but during the 5-massed 30-sec trials, the subject was free from any form of supervisory behavior of the experimenter.

The experimenter left the room (classroom) when the 10-min rest began, and during the rest period, the assistant gave the subject an association test with a view to diverting his attention from task performance. Prior to the experiment, the supervisor gave the following common instruction to each experimental group: "The task you are now given has nothing to do with the intelligence or testing of your learning ability. It is a preliminary experiment for the experiment which we are now starting. For that purpose, we would like to collect the widest possible data from senior high school students. We shall appreciate if you cooperate with us and do your work as quickly and correctly as you can." Then the following explanation on the working

TABLE 2
Totals and means per trial of P- and M-
behaviors of experimenter

Experimental group	P-dimension	M-dimension
	Total (mean† per trial)	Total (mean† per trial)
PM ₁₀	5 (.71)	4 (.57)
PM ₂₀	7 (.41)	12 (.71)
PM ₃₀	19 (.70)	22 (.81)
PM ₄₀	24 (.65)	29 (.78)
Mean	(.63)	(.76)
P ₁₀	9 (1.29)	0 (.00)
P ₂₀	22 (1.29)	0 (.00)
P ₃₀	34 (1.26)	0 (.00)
P ₄₀	39 (1.05)	1 (.03)
Mean	(1.18)	(.01)
M ₁₀	0 (.00)	8 (1.14)
M ₂₀	0 (.00)	24 (1.41)
M ₃₀	0 (.00)	32 (1.19)
M ₄₀	1 (.03)	39 (1.05)
Mean	(.01)	(1.17)
pm ₂₀	0 (.00)	0 (.00)
pm ₃₀	0 (.00)	0 (.00)
pm ₄₀	0 (.00)	0 (.00)
Mean	(.00)	(.00)

† the value of division of the total behaviors by the number of pre-rest trial, into which those trials without specific supervisory behavior conditions are not introduced.

procedure was given: "On the test sheet are printed at random hiragana inverted upside down. What you are asked to do is to correctly copy the inverted hiragana in the blank square right below each letter. Start from the lower right corner and go on leftward and upward, filling each square without omission."

"Start writing at my word 'Start!' and keep working until I say 'Stop!'. While your work is being done, you will hear my word saying 'Now, next!' every 30 sec. At this signal, fill out the next square with an oblique line (/) and after that keep up working as you have done till then." In order to mark the

end of the last pre-rest trial, the subject was made to fill the next blank square with a double oblique line (/) instead of one (·).

RESULTS

Validity concerning the types of supervisory behavior of the experimenter

Result of observation. Table 2 shows the observed behavior of the experimenter. The supervisory behavior of the experimenter as experimental conditions (independent variables) is shown in Table 2, and it was verified by observation that the supervisory behavior was along the line originally intended by the experimenter.

Perception by the subjects. After the experiment, the subjects were asked to answer the questionnaire designed to obtain the subject's perception of the particular supervisory style of the experimenter.

This questionnaire carried three items regarding P function and M function respectively. A seven-point scale (1 for "Not at all" through 7 for "Very much") was prepared to each question.

Questions concerning the P function :

1. To what extent did your supervisor endeavor to raise the efficiency of your work?
2. To what extent did your supervisor endeavor to have your work done correctly?
3. To what extent did your supervisor endeavor to make you work as much as you could?

Questions concerning the M function :

1. To what extent did your supervisor pay attention to your feelings?
2. To what extent did your supervisor endeavor to pay attention to creating an amicable atmosphere so that you could work comfortably?
3. To what extent did your supervisor endeavor to help you out with your work so that you could work with ease?

Table 3 and Fig. 1 show the result of the questionnaire inquiring about the

TABLE 3
Subject's perception of experimenter's
supervisory behavior patterns (1-7)

Experimental group	N	P-dimension Mean scores per question	M-dimension Mean scores per question
PM ₁₀	18	5.4	6.0
P ₁₀	16	4.7	3.6
M ₁₀	17	3.4	5.5
PM ₂₀	30	5.1	5.9
P ₂₀	25	5.5	3.7
M ₂₀	29	4.2	5.8
pm ₂₀	23	3.4	2.5
PM ₃₀	36	5.6	5.8
P ₃₀	31	5.4	2.9
M ₃₀	26	3.8	5.8
pm ₃₀	30	3.7	2.8
PM ₄₀	28	5.8	5.9
P ₄₀	17	6.0	3.0
M ₄₀	20	4.5	5.7
pm ₄₀	22	3.8	3.7
Total	368	4.6	4.7

* $P < .01$, ** $P < .001$ (t -test)

subject's perception of the styles of the experimenter's supervisory behavior. As to the number of the subjects, those who have not done the work properly as previously instructed were left out of consideration—for example, those who were absent then, who began to work from the upper left corner, who forgot to put an oblique line (/) after a 30-sec trial, and who changed the line after a 30-sec trial—as

well as those who failed to correctly perceive the intended styles of supervisory behavior.

Judging from the result of Table 3 and Fig. 1, it can be said that the reaction perceived by the subjects to the supervisory style of the experimenter were

FIG. 1. Subject's perception of the experimenter's supervisory behavior patterns.

FIG. 2. Amount of performance under 10-pre-rest-trial condition.

along the lines originally intended, i.e., the subjects had performed each work properly under the different types such as PM-, P-, M- and pm-. Thus the different styles of PM-patterns leadership introduced into the experiment were supervisory behaviors as independent variables and were selected on the subjects perception level.

Results of performance. In Fig. 2, 3, 4 and 5 are shown the result of performance in each experimental group during the pre- and post-rest trials.

The amount of performance by each experimental group on the 1st, 2nd and 3rd trials before the rest show the task ability of the subject not influenced by PM-styles supervisory behavior. No significant differences were found in the mean performance or the variance per trial given to each experimental group (means— $F=1.08$, $df=14/353$, n.s.; variances— $X^2=18.00$, $df=14$, n.s.). Consequently we can regard each experimental group as a homogeneous group in task ability.

As a result of analysis of variance after the 4th trial, the amount of performance under the pre-rest trials did not show any significant differences among the experimental groups under the 10-pre-rest-trial condition ($F=0.99$, $df=2/336$, n.s.). However, significant differences could be observed among another experimental

Fig. 3. Amount of performance under 20-pre-rest-trial condition.

groups under each pre-rest-trial conditions (20-pre-rest-trial: $F=11.53$, $df=3/1751$, $p<.005$; 30-trial: $F=10.47$, $df=3/3213$, $p<.005$; 40-trial: $F=33.48$, $df=3/3071$, $p<.005$). In the case of the 20-trial, the amount of performance of PM₂₀ group became significantly higher ($t=5.00$, 4.00 , 5.00 , $df=1751$, $p<.001$) than that of the other three pertinent groups (P₂₀, M₂₀ & pm₂₀). No significant differences were found among the groups, P₂₀, M₂₀ & pm₂₀. In the case of the 30 trials before the rest, P₃₀ group showed significantly higher growth of performance than the other three groups (PM₃₀, M₃₀ & pm₃₀) ($t=5.38$, 4.29 , 4.62 , $df=3213$, $p<.001$). No significant differences were found among PM₃₀, M₃₀ & pm₃₀. In the case of 40 trials before the rest, the amount of performance was significantly high in the order of P₄₀, PM₄₀, pm₄₀ & M₄₀ (P₄₀: PM₄₀, $t=2.14$, $df=3071$, $p<.05$; PM₄₀: pm₄₀, $t=3.08$, $df=3071$, $p<.01$; pm₄₀: M₄₀, $t=4.29$, $df=3071$, $p<.001$). During the pre-rest trials, the factor of trial was significant (the 10-pre-rest-trial: $F=4.24$, $df=6/336$, $p<.005$; 20-trial: $F=3.48$, $df=16/1751$, $p<.005$; 30-trial: $F=9.02$, $df=26/3213$, $p<.005$; 40-trial: $F=9.59$, $df=36/3071$, $p<.005$). The interaction between the supervisory behavior pattern and the trial did not show any significant effects respectively ($F<1$ in every pre-rest condition).

As a result of analysis of variance, the amount of the performance during 5 post-

rest trials showed significant differences among the groups different in the number of the pre-rest trials (10-pre-rest-trial: $F=15.94$, $df=2/240$, $p<.005$; 20-trial: $F=11.27$, $df=3/515$, $p<.005$; 30-trial: $F=6.81$, $df=3/595$, $p<.005$; 40-trial: $F=17.31$, $df=3/415$, $p<.005$). That is, in the case of the 10-pre-rest-trial, the amount of PM₁₀ was the highest among the experimental groups followed by M₁₀ group and P₁₀ group which showed the lowest degree (PM₁₀: M₁₀, $t=3.13$, $df=240$, $p<.01$; PM₁₀: P₁₀, $t=5.63$, $df=240$, $p<.001$; M₁₀: P₁₀, $t=2.35$, $df=240$, $p<.02$). In the 20-pre-rest-trial, the amount of PM₂₀ group was the highest and followed by M₂₀ group. The amount of performance under P₂₀ and pm₂₀ was the lowest (PM₂₀: M₂₀, $t=2.58$, $df=515$, $p<.01$; M₂₀: P₂₀, $t=6.45$, $df=515$, $p<.001$; M₂₀: pm₂₀, $t=2.26$, $df=515$, $p<.05$). No significant differences were found between the amount of P₂₀ group and that of pm₂₀ ($t=.29$, $df=515$, n.s.). With the 30-pre-rest-trial, the amount of performance of P₃₀ was the highest ($t=2.58$, 3.53 , 4.19 , $df=595$, $p<.01$, $p<.001$, $p<.001$) compared with that of three other experimental groups (PM₃₀, M₃₀ & pm₃₀). No significant differences were found among PM₃₀, M₃₀ and pm₃₀ groups. With 40-pre-rest-trial, the amount of performance of PM₄₀ and P₄₀ was significantly higher than that of M₄₀ and pm₄₀ (PM₄₀: M₄₀, $t=6.43$, $df=415$, $p<.001$; PM₄₀: pm₄₀, $t=3.10$, $df=415$, $p<.01$;

FIG. 4. Amount of performance under 30-pre-rest-trial condition.

FIG. 5. Amount of performance under 40-pre-rest-trial condition.

TABLE 4
Amount of reminiscence in each experimental group together with *t*-value

Experimental group	Mean	SD	<i>t</i> -value
PM ₁₀	2.1	1.8	2.56**
P ₁₀	1.0	1.4	1.32
M ₁₀	1.3	1.3	1.92
PM ₂₀	2.3	3.3	3.81***
P ₂₀	2.2	2.5	2.50**
M ₂₀	1.5	1.8	2.60**
pm ₂₀	.3	2.0	.34
PM ₃₀	2.9	2.5	4.55***
P ₃₀	1.1	2.2	1.53
M ₃₀	.8	2.9	1.16
pm ₃₀	.0	2.8	.00
PM ₄₀	3.6	4.5	4.77***
P ₄₀	1.8	2.9	2.13*
M ₄₀	— .6	2.6	.51
pm ₄₀	1.1	2.4	1.27

* $P < .05$, ** $P < .02$, *** $P < .001$

P₄₀: M₄₀, $t=5.12$, $df=415$, $p<.001$;
P₄₀: pm₄₀, $t=2.50$, $df=415$, $p<.02$).

No significant differences were found between the two groups, PM₄₀ and P₄₀ ($t=.20$, $df=415$, n.s.), and with M₄₀ and pm₄₀, the amount of pm₄₀ was significantly higher than that of M₄₀ ($t=3.11$, $df=415$, $p<.01$). No significant differences were found as to the factor of trial under each pre-rest-trial conditions (10-pre-rest-trial: $F=1.53$, $df=4/240$, n.s.; 20-trial: $F<1$, $df=4/515$, n.s.; 30-trial: $F<1$, $df=4/595$, n.s.; 40-trial: $F<1$, $df=4/415$, n.s.).

The interaction between the trial and the pattern of supervisory behavior was significant only in the 10-pre-rest-trial ($F=6.14$, $df=8/240$, $p<.005$).

Reminiscence. As shown in Table 4, the reminiscence scores were obtained by subtracting performance scores of the last 30-sec pre-rest trial from the scores of the first 30-sec post-rest trial. As can

be judged from Table 4, under any condition of supervisory behavior, the groups supervised by PM-type showed a significant reminiscence effect, while the groups supervised by P-type showed a significant reminiscence effect under the conditions of the 20- and 40-trial. The groups supervised by M-type showed a significant reminiscence effect only under the 20-trial. On the contrary, no significant reminiscence effects were found among the groups of pm-type under any of the conditions. Under each condition, the 20-, 30- and 40-trial, except the 10-pre-rest-trial, a significant differences were found among each of the experimental groups (10-pre-rest-trial: $F=2.21$, $df=2/48$, n.s.; 20-trial: $F=4.32$, $df=3/103$, $p<.01$; 30-trial: $F=6.93$, $df=3/119$, $p<.01$; 40-trial: $F=19.55$, $df=3/83$, $p<.01$). With the 20-pre-rest-trial, the reminiscence scores of PM₂₀, P₂₀ and M₂₀ were significantly higher than that of pm₂₀ (PM₂₀: pm₂₀, $t=3.21$, $df=103$, $p<.01$; P₂₀: pm₂₀, $t=2.93$, $df=103$, $p<.01$; M₂₀: pm₂₀, $t=1.90$, $df=103$, $p<.10$). No significant differences were found among PM₂₀, P₂₀ and M₂₀ groups. With the 30-pre-rest-trial, the score of reminiscence of PM₃₀ was comparatively higher than that of the other three experimental groups (PM₃₀: P₃₀, $t=2.83$, $df=119$, $p<.01$; PM₃₀: M₃₀, $t=3.14$, $df=119$, $p<.01$; PM₃₀: pm₃₀, $t=4.52$, $df=119$, $p<.001$). No outstanding differences of reminiscence were found among the groups, P₃₀, M₃₀ and pm₃₀ (P₃₀: M₃₀, $t=.43$, $df=119$, n.s.; P₃₀: pm₃₀, $t=1.67$, $df=119$, n.s.; M₃₀: pm₃₀, $t=1.15$, $df=119$, n.s.). Further with regard to the 40-pre-rest-trial, the score of reminiscence of PM₄₀ was the highest, followed by that of P₄₀ and pm₄₀, and the lowest score was of M₄₀ (PM₄₀: P₄₀, $t=2.38$, $df=83$, $p<.05$; PM₄₀: M₄₀, $t=5.38$, $df=83$, $p<.001$; PM₄₀: pm₄₀, $t=3.56$, $df=83$, $p<.001$; P₄₀: M₄₀, $t=2.95$, $df=83$, $p<.01$; M₄₀: pm₄₀, $t=2.24$, $df=83$, $p<.05$). No outstanding differences were found in reminiscence

score between P_{40} and pm_{40} ($t=.88$, $df=83$, n.s.).

DISCUSSION

In 10-pre-rest-trial, there are not any significant differences among the patterns of supervisory behavior as far as the performance amount is concerned. However, under 20-pre-rest-trial, the performance amount is the highest among PM-type group, and under 30- and 40-pre-rest-trial, among P-type groups. On the contrary, the performance amount of post-rest trials is the highest with PM-type groups under 10- and 20-pre-rest-trial, and with both of PM-type and P-type groups, it was so under 40-pre-rest-trial, and with P-type group, it was so under 30-pre-rest-trial. Both, M-type and pm-type show relatively lower amount of performance from pre-rest trials through postrest trials.

In considering the above result inclusively, it can be said that the amount of performance with PM-type and P-type groups become higher than that of M-type and pm-type groups. In comparison between PM-type and P-type it may be said further that the amount of performance of P-type is the higher of the two under pre-rest trials, and that of PM-type the higher under post-rest trials. This fact will verify the hypotheses 1 and 2.

The effect of reminiscence of PM-type groups was relatively and significantly higher than that of the other supervisory behaviors (P-, M-, pm-types). With P-type groups, a significant reminiscence effects were observed under 20- and 40-pre-rest-trial, while under 10- and 30-pre-rest-trial, no significant reminiscence effects were observed. The reminiscence of M-type groups showed the same score as that of P-type groups under up to 30-pre-rest-trial, but the score of reminiscence under 40-pre-rest-trial, was relatively low. No significant effects of reminiscence were obtained in the case of P-type groups ex-

cept for that under 20-pre-rest-trial. In the case of pm-type groups, no significant reminiscence effects were found under any of pre-rest-trial. Every case showed the lowest reminiscence score, except under the condition of 40-pre-rest-trial. It can be said that the hypothesis 3 has been verified based mainly on the above findings.

Although we have discussed as to the connection between the conditions of experimenter's supervisory behavior on the one hand, and the performance amount and the reminiscence score on the other, a consistent and a corresponding relation was not necessarily seen between the reminiscence and the pre-rest performance. Although as to the pre-rest performance of each experimental group under the 10-pre-rest-trial condition, no significant differences were found, an outstanding reminiscence effect only PM-type group showed. The P-type groups showed relatively higher amount of performance than any other types under either of 30- and 40-pre-rest-trial conditions, but showed lower reminiscence effect than PM-type groups. When we try to explain the relation between the reminiscence and performance obtained in our experiment on the basis of the inhibition hypothesis assumed by Hull and Kimble, the following problems will be on our way.

Firstly, if, as Hull (1943, p. 300) maintains, "Whenever a reaction (R) is evoked in an organism, there is created as a result a primary negative drive (D); (a) this has an innate capacity (I_R) to inhibit the reaction potentiality (${}_sE_R$) to that response; (b) the amount of net inhibition (I_R) generated by a sequence of reaction evocation in a simple linear increasing function of the number of evocation (n); and (c) it is positively accelerated increasing function of the work (W) involved in the execution of the response; (d) reactive inhibition (I_R) spontaneously dissipates as a simple negative growth function of time (t''')", the score of re-

miniscence according to the extent of work performance will have to be obtained in any of P-, M- and pm-type groups. Secondly, our experimental results seem to be inconsistent with the I_R critical level hypothesis raised in relation to motivation by Kimble (1949). As to the high rise of reminiscence under the condition of high motivation, Kimble and others assert that the higher motivation will lead to the higher critical level of I_R . This means further that the performance level will also rise higher. In other words, the rise of the critical level of I_R means the rise of resistance in organism to I_R as a reaction depressing power, and it may be considered as being greater expenditure of effort for task performance. The result of this experiment, thus, shows that there is not always a corresponding relation between the amount of performance and that of reminiscence. This fact leads to a difficulty in considering such a result based on the hypothesis of critical level of I_R .

On the contrary, if we attempt to explain the reminiscence effects, based in the consolidation hypothesis defining the effects as the consolidation of learning during a rest period, the following similar difficulty will also arise: Provided the learning progress is made without any preliminary practice, with consolidation progressed during a rest period, a significant effect of reminiscence should naturally be found in each of the experimental groups. As considered previously, however, among most of the groups (except for P_{20} , M_{20} and P_{40}) other than the PM-type groups no reminiscence effect was found.

Why is it that during the course of this experiment, the previously mentioned results of reminiscence were obtained? In order to verify this fact, it seems to be necessary to analyze further the effect of experimenter's supervisory behavior patterns upon the amount of performance during a pre- and post-rest period. The

reason is that we can consider that the reminiscence effect obtained in this experiment has been due not so much to learning consolidation or reactive inhibition (I_R) as to the difference of the subject's motivation brought about by the effects of supervisory behaviors of experimenter. In short, the difference in the motivation directly determined the effect of reminiscence. As previously considered, it was with the P-type groups that the highest amount of performance was obtained during a pre-rest trial, while under a post-rest trial, the amount of performance of PM-type groups showed a tendency to be superior to that of the P-type groups.

Why is it that, despite the fact that P-type is a performance-centered supervisory type, it is less productive than PM-type group? Conversely, why is it that even though PM-type includes an unproductive type M, a combination of M and P is the most productive? As the experiment directly connected with this problem, the experiment by Misumi and Shirakashi (1966) may be referred to: They made an experimental examination on the influence of PM-type supervisory behaviors upon productivity and morale. An experiment was conducted in which the task of counting holes punched in IBM cards was done for a long time: 13 sessions, each lasting 50 min. Productivity proved highest under supervision of PM-type, second highest under P-type, and lowest under M-type. The degree of an interest found in task or a favorable attitude of the subjects toward the supervisor proved highest under PM-type. As a result, they consider that it is when M function and P function are combined, thus enabling the former to act as a catalyst on the latter, that they provide optimum stimulation for the increment of productivity and morale.

It will be possible to apply such consideration to the result of performance obtained in this study, in which PM-type

groups showed higher results of performance than P-type groups during the post-rest trials, which will be because the subject's motivation is heightened most under PM-type in which M function is combined with P function as a catalyst. The same consideration will be true of the result of reminiscence, i.e., the difference of motivation influenced by the style of supervisor, will determine the effect of reminiscence. The reason is that it is during the first post-rest trial that the difference of motivation influenced by the style of supervision of the experimenter was indicated most manifestly. That is, it is thought that the subject's spontaneous act is apt to become highest when, passing a rest period after finishing their particular task, they are again beginning to cope with the pertinent task. In other words, the amount of performance during the first post-rest trials can be thought to grow highest, depending upon the subject's spontaneous motivation.

In opposition to this, task during the pre-rest trials is rather performed by the external conditions than by a spontaneous action—it may be under the condition of a so-called semi-forced compliance. From the above viewpoint, we can consider that the difference of motivation influenced by the style of supervision directly defined the effect of reminiscence. In the case of PM-type groups, the highest positive motivation was brought about, compared with that of other three styles of supervision, such as P-, M- and pm-type groups. In the case of P-type groups, the motivation was, under any conditions, on the relatively lower level, compared with PM-type groups, while it will be said that a higher motivation was brought about as compared with M- and pm-type groups. In the case of M- and pm-type groups, a relatively lower motivation was aroused among the subjects.

SUMMARY

The purpose of this study is to experimentally examine the effect of the experimenter's supervisory styles upon performance and reminiscence in perceptual-motor learning.

As the styles of supervision, the four different patterns were introduced: P-type—performance-centered type; M-type—group-process maintenance-centered type; PM-type—combined type of both, of P- and M-; pm-type—with low degree in both types. Under these supervisory conditions, we had the subjects copy inverted hiragana. The task of 30 sec per trial was performed intensively and continuously by the fifteen groups of 10-pre-rest-trial (PM₁₀, P₁₀ and M₁₀), 20-pre-rest-trial (PM₂₀, P₂₀, M₂₀ and pm₂₀), 30-pre-rest-trial (PM₃₀, P₃₀, M₃₀ and pm₃₀), and 40-pre-rest-trial (PM₄₀, P₄₀, M₄₀ and pm₄₀). With a 10-min rest after the entire pre-rest practice, all the groups equally performed 5 trials intensively and continuously. The subjects were high school girls and 15 classes were chosen for experimental groups. One post-graduate student majoring in psychology acted as an experimenter.

Introduction of supervisory styles was not made during the period from 1 pre-rest trial through 3 pre-rest trial, the last pre-rest trial and all the post-rest trials.

Briefing of the result is as follows:

1. The result of pre-rest performance did not show any significant differences under 10-pre-rest-trial, but under 20-pre-rest-trial, PM₂₀ group showed the first highest amount of performance, and under 30- and 40-pre-rest-trial, P-type groups showed the highest amount of it.

2. As to the result of post-rest performance; the PM-type groups showed the highest amount of performance under 10-, 20- and 40-trial.

3. As to the result of reminiscence; the highest effects of reminiscence were found among the PM-type groups than among

the other groups.

It can rather said that the subjects' drive motivation influenced by experimenter's supervisory behavior directly defined the effects of reminiscence than that the reminiscence effects were due to learning consolidation during a rest-period or to reactive inhibition.

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