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The Effect of Achievement Motivation on Learning of Rotary Pursuit Tracking under Massed Practice Condition

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To examine the effectiveness of achievement motivation on motor skill learning under massed practice condition, high (n=18) and low (n=18) need-achievers selected by the Mehrabian Measure of Achieving Tendency were required to perform the rotary pursuit tracking. As the result, the high need-achievers showed relatively higher TOT scores than the low need-achievers. The high need-achievers also showed relatively higher scores on task motivation and significantly clearer mental image for the task than the low need-achievers in the process of motor skill learning. From these results, it was considered that the high need-achievers received greater learning effect from the motor task under the massed practice condition in comparison with the low need-achievers.

Achievement motivation may be assumed to be one of the most important factors for motor skill learning[1),16)].

A review of research on achievement motivation and motor skill learning could not lead to consistency. For example, Burton (1971[6)]) reported no relationship between achievement motivation and skill attainment in riflery ($r=.09$) and a negative relationship in bowling skill ($r=-.32$). Smith and Johnson (1982[15)]) obtained a significant relationship between achievement motivation and learning to type for adolescents, but not for adults. Nishida (1983[12)]) reported that individuals designated as high need-achievers did not show higher performance in the spontaneous learning of a ball juggling task than those as low need-achievers. Such research would belong to a kind of " field study " and several factors could relate to the effectivess of motor skill learning. In these cases, it appears that the individual differences in achievement motivation were not directly concerned with the motor skill learning.

On the contrary, Nishida and Inomata (1982[11)]) examined the effect of achievement motivation on the early learning of a rotary pursuit tracking under strictly control conditions. Male undergraduates were required to practice the tracking task with 30-sec. intertrial rests. As the result, high need-achievers were superior to low need-achievers in learning effectiveness. In the case of such distributed practice, high need-achievers particularly would be able to pursue the tracking task with higher task motivation throughout the experiment because accumulated inhibitory factors such as reactive inhibition, fatigue, and psychical satiation could dissipate during the intertrial rests. Therefore, it might appear that the learning effect was dominantly affected with the individual differences in achievement motivation which the subjects naturally had.

In the case of massed practice, on the other hand, it would not be easy to keep up higher task motivation for good achievement do to the lack of intertrial rests. It might appear that the differences in achievement motivation would not be directly concerned with performance in the mas-

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sed practice. Performance, however, may fluctuate from time to time and might be affected by the inhibitory factors mentioned above. Since learning is generally defined as relatively permanent changes in performance (Singer, 1980[14]), it is necessary to take a rest period after the massed practice so that such inhibitory factors will dissipate during the rest, and to employ the post-rest scores as an index of learning. Concerning the post-rest scoes, some researchers reported that performance increment from pre-rest to post-rest trials (reminiscence effect) was relatively greater for high-motivated subjects than for low-motivated ones[7),8),13),17)]. Therefore, it could be expected that high need-achievers would show a greater learning effect from the motor skill task than low need-achievers.

As viewed from the previous research on achievement motivation[2),3),4),5),9)], it could be predicted in the process of motor skill learning that high need-achievers who have a tendency to obtain good achievement or success would perform the task with higher motivation and clearer imagery than low need-achievers.

This study was aimed at testing the following hypotheses in the massed practice. High need-achievers would have a greater learning effect from motor skill task than low need-achievers. In the process of motor skill learning, high need-achievers would show higher task motivation and clearer imagery than low need-achievers.

METHOD

Subjects and Sampling

The subjects in this study were 36 male undergraduate students ranging in age from 18 to 23 yrs., with a mean age of 19.6 yrs. They were screened from a total sample of 187 male undergraduates on the basis of their responses to the Mehrabian Measure of Achieving Tendency (MMAT; Mehrabian, 1969[10)]).

The MMAT was translated into Japanese and administered about two weeks before the experiment. According to pre examination, split-half reliability (Spearman-Brown) of the MMAT was 0.691 and α coefficient (Cronbach) was 0.714. Mean and standard deviation of the MMAT scores for 18 high need-achievers (High n Ach group) were 20.67, 4.91 and those for 18 low need-achievers (Low n Ach group) were -15.00, 6.26, respectively.

All the subjects were right-handed and had no previous experience in the present motor task.

Motor Task

Rotary pursuit tracking was employed as the motor learning task in this study. A 30 cm. diameter turntable rotated in a clockwise direction at 55 r.p.m. with a 1.2 cm. diam. metal target set flush with the turntable. The metal target was located 10.5 cm. from the center. The seated subjects were required to maintain contact of a 30 cm. long metal stylus' tip with the rotating target as long as possible. Only the time which the stylus was held in contact with the target was recorded in 0.01 sec. unit by use of an electric digital timer.

Experimental Procedure

The experiment was pursued in accordance with the following procedure.

(1) All subjects were required to practice the tracking task for 30 seconds after instructions and demonstrations of the task were presented.

(2) A 10-item task motivation questionnaire and a 4-item image test were administered in the form of 5-point scale. The former included desire, interest, will, and need for good achievement on the tracking task. The latter consisted of vividness of visual and kinesthetic imagery concerned with the present task.

(3) In the training session, the subjects were given 20 30-sec. trials without intertrial rests (massed practice).

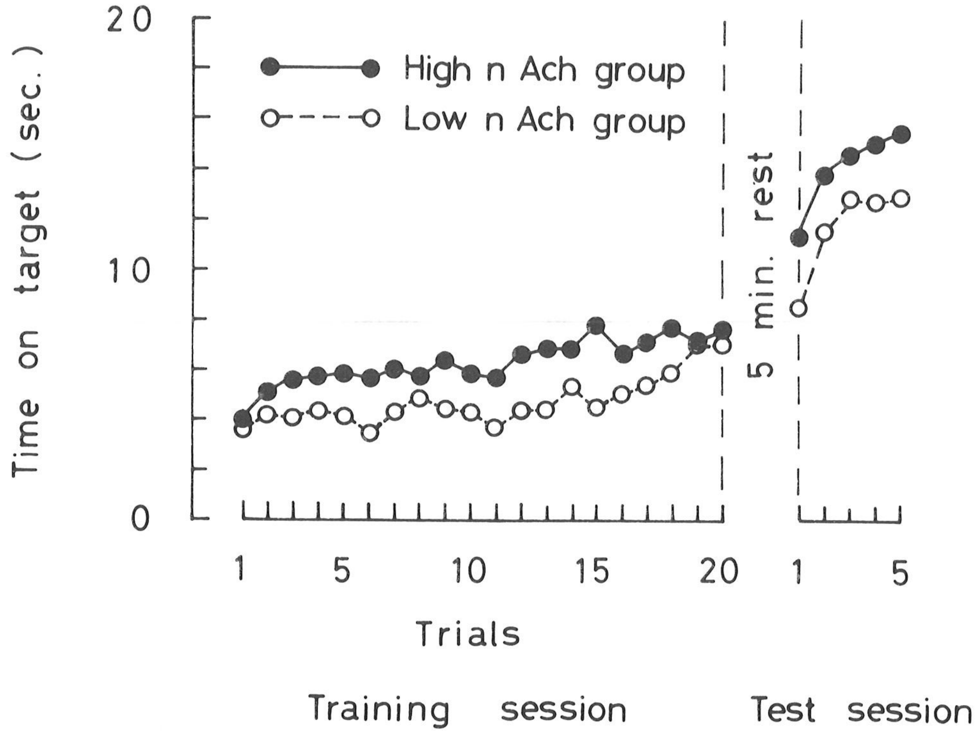

Fig. 1. Mean scores on the time on target for the two groups.

(4) Following 5 min. rest, 5 30-sec. trials with 30-sec. intertrial rests were given as the test session.

(5) The task motivation questionnaire and the image test mentioned above were administered again.

RESULTS

Time on Target

Mean scores on the time on target (TOT) for the High and Low n Ach groups are shown in Fig. 1. As these scores had no equal variance among trials, Student t test was applied to these data for testing the differences between the two groups.

In the training session, the High n Ach group showed a tendency toward relatively higher TOT scores than the Low n Ach group. The differences between the two groups were statisticaly significant for trials 6, 7, 11, 12, 13, and 15 ($p<.05$). Also, concerning the TOT scores after 5 min. rest, the same tendency as in the training session was evident. That is, the High n Ach group showed relatively higher scores than the Low n Ach group. A significant difference between the two group, however, was obtained only for trial 1 in the test session ($t=2.21$, $df=34$, $p<.05$).

Mean and standard deviation of reminiscence scores for the High and Low n Ach groups are presented in Table 1. The reminiscence scores yielded a significance for the High n Ach group ($t=6.27$, $df=17$, $p<.01$), but not for the Low n

Table 1. Amount of reminiscence for the two groups.

Group	$\bar{x}$	s	t
High n Ach (n=18)	3.79	2.49	6.270**
Low n Ach (n=18)	1.59	5.67	1.156

**… $p < .01$

Table 2. Mean and standard deviation of the task motivation scores for the two groups in the pre and post-trial periods.

Group	Pre-trials		Post-trials	
	$\bar{x}$	s	$\bar{x}$	s
High n Ach (n=18)	35.83	5.47	37.83	7.10
Low n Ach (n=18)	33.94	5.30	34.44	3.91

Ach group (t=1.16, df=17).

Task Motivation

Task motivation scores in the pre and post-trials periods were relatively higher for the High n Ach group in comparison with the Low n Ach group (Table 2). A 2 (n Ach) × 2 (periods) factorial analysis of variance with repeated measures on the second factor, however, yielded no significant main effects (n Ach : $F_{1,34}=2.830$, periods : $F_{1,34}=1.604$). The interaction of n Ach × periods was also not significant ($F_{1,34}=0.520$).

Image Test

The vividness scores on the image test for the two groups in the pre and post-trial periods are presented in Table 3. The High n Ach group showed relatively higher scores on the visual and the kinesthetic imagery than the Low n Ach group.

Concerning the vividness scores on the visual imagery, significant main effects of n Ach ($F_{1,34}=5.993$, $p<.05$) and periods ($F_{1,34}=33.932$, $p<.01$) were obtained from a 2 (n Ach) × 2 (periods) analysis of variance. The interaction of the two factors was not significant ($F_{1,34}=0.842$). These results indicated that both High and Low n Ach groups significantly increased in the vividness scores on the visual imagery from the pre-trial periods to the post-trial periods, and the scores for the High n Ach group were significantly higher than those for the Low n Ach group in each period.

A 2 (n Ach) × 2 (periods) analysis of variance for the kinesthetic imagery yielded significant main effects of n Ach ($F_{1,34}=7.025$, $p<.05$) and periods ($F_{1,34}=68.370$, $p<.01$), and the interaction of the two factors ($F_{1,34}=4.360$, $p<.05$). *Post hoc* analyses indicated the following differences. Both High and Low n Ach groups significantly increased in the scores for kinesthetic imagery from the pre-trial periods to the post-trial periods. Although the difference between the two groups in the pre-trial periods was not significant, the High n Ach group showed significantly higher scores than the Low n Ach group in the post-trial periods.

DISCUSSION

Concering the TOT scores in the training session, the High n Ach group showed relatively higher scores than the Low n Ach group. The differences between the two groups were significant for trials 6, 7, 11, 12, 13, and 15. It was considered that such performance difference would depend on the strength of motivation for the tracking task in this sudy. The fact that the High n Ach group showed relatively higher scores on the task motivation questionnaire than the Low n Ach group could support this interpretation. Also, such difference in the task motivation

Table 3. Mean and standard deviation of the vividness scores of imagery for the two groups in the pre and post-trial periods.

Group	Imagery	Pre-trials		Post-trials	
		$\overline{X}$	s	$\overline{X}$	s
High n Ach (n=18)	Visual	6.83	1.38	8.17	1.38
	Kinesthetic	4.94	1.59	8.39	1.34
Low n Ach (n=18)	Visual	5.61	1.69	7.44	1.29
	Kinesthetic	4.56	1.50	6.61	1.85

between the two groups could be mainly attributed to the need for achievement which the subjects originally had. However, the TOT scores in the training session could be partially affected by the inhibitory factors to those scores because of the massed practice.

The TOT scores in the test session which might eliminate such inhibitory factors during the 5-min. rest were employed as a more valid index of the motor skill learning. As a result, the TOT scores for the High n Ach group were relatively higher than those for the Low n Ach group. The differences between the two groups were significant at trial 1. This result partially supported the present hypothesis on motor skill learning. Therefore, it was suggested that the High n Ach group received a relatively greater learning effect from the motor skill task under the massed practice condition than the Low n Ach group.

The superiority for the High n Ach group could be closely concerned with amount of reminiscence. The reminiscence effect for the High n Ach group was significant, but not for the Low n Ach group. In other words, although the performance for the High n Ach group increased significantly after the 5-min. rest, the performance increment for the Low n Ach group was not statistically significant. These results supported the previous research on the reminiscence effect mentioned above. It could be considered that such difference in reminiscence effect would depend upon the amount of accumulated reactive inhibition in the massed practice. Judging from the relatively higher task motivation in the High n Ach group, the accumulated reactive inhibion in the High n Ach group would be relatively greater than that in the Low n Ach group. Therefore, it appears that the High n Ach group showed significantly high reminiscence because such accumulated reactive inhibition would dissipate during the rest.

The High n Ach group showed higher scores on the vividness test of the visual and kinesthetic imagery in comparison with the Low n Ach group. Particularly, the differences in vividness scores between the two groups were significant in the post-trial periods. These results supported the hypothesis that the High n Ach group would show clearer imagery in the process of the motor skill learning than the Low n Ach group. Judging from the relatively higher task motivation and the greater reminiscence effect for the High n Ach group, it appears that the High n Ach group could strive for better achievement or success and also could practice the motor task concentrically more than the Low n Ach group. Therefore, it seems that such difference in the vividness scores might have resulted from the strength of motivation for pursuing the motor skill task.

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