

MOTOR PERFORMANCE OF MENTAL RETARDATES
AS A FUNCTION OF SOCIAL SITUATION,
COMPETITIVE ATMOSPHERE,
AND SEX DIFFERENCE

By

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I. INTRODUCTION

Few research studies have been reported that investigate the effects of competitive social situations on the motor performance of mental retardates. Due to this lack of background information the following review will include pertinent research studies on "normal" and mentally retarded subjects.

According to Ausubel (1958, p. 473), "Competition is an ego-oriented, self-aggrandizing activity in which the individual vies with others for hierarchical pre-eminence." There is a great deal of research which suggests that ego-oriented motivation is competitive in our culture. Behavior in a competitive situation, however, would seem to be influenced by many factors.

Research findings suggest that "true competition," in the sense that an attempt is made to do better than others, first appears in children's behavior when they are approximately three or four years of age (Greenberg, 1932; Leuba, 1933). There is evidence that this becomes more characteristic of their behavior as they grow older (Gesell and Ilg, 1934; Greenberg, 1932; Leuba, 1933; McKee and Leader, 1955). It has also been reported that children two years old and younger are seldom, if ever, affected by a competitive situation. Though three and four year olds

demonstrate competitive behavior it appears that a competitive situation seems to reduce their level of performance. The performance level appears to be more frequently increased in competitive situations for five year olds (Leuba, 1933). It has also been reported that pre-school and kindergarten children exhibit competitive behavior in the form of increased work output (Greenberg, 1932). Other research suggests that children of elementary school age put forth more effort in competition with others than they do in self-competition (Ausubel, 1951). Competition in arithmetic has been found to vary directly with a child's liking for or desire to do well (Ausubel, 1951). One researcher cites evidence to support the view that very little, if any, competition can be initiated with unfamiliar material (Greenberg, 1932).

In one of the early studies in this area it was reported that competition had the effect of increasing the effectiveness of stimulation for those competing. In some cases these competitors were even overstimulated and their motor movements became so uncoordinated as to impair their performance on a simple motor task (Triplett, 1898). A later study suggested that when one individual competed with another or when one group competed with another group the quantity of work was increased but the quality of the work was decreased (Whittmore, 1924). In a substitution test a variation of these findings was reported

by Sims (1928) who found that competition between individuals resulted in the greatest amount of improvement.

In examining the variables apparently related to competition it has been found that in play activities children from the lower socio-economic classes are more competitive than those from the middle classes (McKee and Leader, 1955). A competitive situation appears, in general, to increase work efficiency and to facilitate learning (Vaughn and Diserens, 1938). Many studies indicate that competition between individuals results in wide variations of performance (Greenberg, 1933; Vaughn and Diserens, 1938; Vaughn and Geldreich, 1938). Stendler, Damrin, and Haines (1951) also report wide variations in the performance level in the case of team members. In general, competitive behavior is apt to occur when goals or competitors are most obvious, but the conditions that are necessary to evoke competitive responses in a particular individual may not be apparent until after an analysis of that individual's behavior (Vaughn and Diserens, 1938).

In research with the mentally retarded, Walton and Begg (1958) have reported that competition improved the performance of imbeciles on routine tasks but under conditions of little or no competition their performance deteriorated. One study (Albee and Pascal, 1951) has shown that there is a significant correlation between dominance order and mental age in the mentally retarded. No correlation between dominance and chronological age was reported in this study.

Another study (Abel, 1938) dealing with subnormal subjects reported that individuals with IQ's from 70 to 79 profited more on a paper and pencil maze when working in pairs than did individuals with IQ's from 50 to 59. This study also reported that the more intelligent subjects appeared to gain more from social facilitation than did those who were less intelligent. Phillip (1940) found that pairing kindergarten children with either friends or strangers had little effect on the efficiency of their performance.

The choice of apparatus for the present study was, in part, determined by prior research findings. While many tasks were considered appropriate for a mentally retarded population, the previous utilization of the pursuit-rotor with mentally retarded subjects suggested that this task would be an excellent one to use in this study.

Ellis and Sloan (1957) are among some of the first investigators who have utilized the pursuit-rotor in studying the mentally retarded. They report a positive correlation between rotary pursuit performance and mental age in a group of mental retardates with mental ages ranging from 3.6 to 9.4 years. Ellis and Distefano (1959) found that mental retardates performed significantly better on a pursuit rotor task when they were both urged to do their best and were praised than when they were not.

Rubin (1957) reported that motor proficiency was not related to sex differences, however, he found that motor proficiency was significantly related to age.

Research has also been completed which indicates that mental retardates respond differentially to variations in incentives (Heber, 1958). Specific goals seem to have a more facilitative effect on increasing performance levels than do abstract verbal goals (Gordon, O'Connor and Tizard, 1954).

The specific goals which individuals set for themselves when they obtain knowledge of results has generally been found to result in increased work efficiency and a higher level of performance.

Wright (1906) reported an increase of from 14% to 16% in the performance level of adult subjects when they were given knowledge of their results. Other studies with adults have generally confirmed this result (Crawley, 1926; Arps, 1920; Brown, 1932).

Students who have been informed of their academic successes or failures appear to do better than those who have not been so informed (Panlasigui and Knight, 1930). This was found to be especially true for the better students.

II. STATEMENT OF THE PROBLEM

The present study is an investigation of the relationship between performance on a motor learning task and certain varied conditions of social situation, competition and sex difference in mental retardates.

The results of this study may indicate the role of each of these main variables (social situation, competition, sex difference) and their possible interaction effects upon a motor learning task. Such information might facilitate the training of mental retardates in certain motor skills.

The null hypothesis will be tested. It is hypothesized that motor learning will not be affected by variations in social situation, competition, sex difference or a combination of these variables.

III. EXPERIMENTAL PROCEDURE

A. General Methodology

This experimental study is based on a factorial type design which was constructed in such a way as to allow a 2 X 2 X 2 analysis of variance technique to be utilized in analyzing the obtained data. This procedure also enabled the experimenter to employ "t tests" where necessary.

Subjects in this study were assigned to the following experimental groups in which the independent variables were competition, social situation, and sex difference:

1. Group I was composed of 10 mentally retarded males who performed the task alone (that is, with only the experimenter present) under conditions in which competition was not encouraged.
2. Group II consisted of 10 mentally retarded males who performed the task alone under conditions in which competition was encouraged.
3. Group III was comprised of 10 mentally retarded females who performed the task alone under conditions in which competition was not encouraged.
4. Group IV contained 10 mentally retarded females who performed the task alone under conditions in which competition was encouraged.

5. Group V was composed of 10 mentally retarded males who performed the task in the presence of one other mentally retarded male who also performed the task (that is, another subject and the E were present). Competition was not encouraged.
6. Group VI consisted of 10 mentally retarded males who performed the task in the presence of one other mentally retarded male who also performed the task. Competition was encouraged.
7. Group VII was comprised of 10 mentally retarded females who performed the task in the presence of one other mentally retarded female who also performed the task. Competition was not encouraged.
8. Group VIII contained 10 mentally retarded females who performed the task in the presence of one other mentally retarded female who also performed the task. Competition was encouraged.

B. Subjects

A total of 80 subjects (Ss) were used in this study which consisted of 40 males and 40 females. These subjects were selected randomly from a population of institutionalized mental retardates at Enid State School and assigned in a random order to eight experimental groups whose mental ages (MA) were equivalent. Subjects' chronological age (CA) ranged from 18 to 40 with a mean CA of 29.6 years. Mental

age (MA) ranged from 4 years 9 months to 11 years 4 months with a mean MA of 7 years 9 months. All subjects had been previously diagnosed as familial retardates.

After each subject was assigned to an experimental group an attempt was made to schedule the subjects in a random order. This procedure was not always possible, however, and it was frequently necessary to schedule the subjects as they were available.

All subjects were required to obtain a standard criterion of performance which was a minimum cumulative time on target score of .50 seconds during the first five trials. Subjects who were unable to meet this criterion were replaced with subjects who were randomly assigned from an equivalent MA group.

C. Apparatus

The apparatus used in the present experiment was a Koerth type pursuit rotor with a brass target one inch in diameter. The turntable rotated in a clockwise direction at a constant speed of 60 rpm. The stylus was six and three-fourths inches in total length.

Trials were timed automatically and consisted of a 30 second practice period with a 10 second intertrial interval.

Time on target was measured in .01 seconds by a Standard Electric timer which recorded the total time the stylus

was in contact with the target. Time on target was recorded by the experimenter who manually re-set the timer after each trial.

D. Procedure

Subjects were selected from a population of institutionalized adult mental retardates and were then randomly assigned to the various experimental conditions. Care was taken to maintain a comparable mental age level for each of the experimental groups. All subjects who were to perform the task in the presence of another subject were further assigned randomly as to who was to perform the task first in his (or her) sub-group.

The experimenter attempted to establish a competitive atmosphere by urging the subjects to "do better." Subjects who performed the task in the presence of another subject were told to "do better" than the other subject had done (or was going to do).

Each experimental group was composed of members of the same sex. Thus, the male subject in the groups (experimenter plus one other subject) performed the task in the presence of another male. Likewise, females assigned to this experimental condition practiced in the presence of another female.

In all subgroups of two subjects, one subject performed the task while the other subject observed his (or her) performance. The observing subject was always seated to the right of the subject performing the task. This arrangement

enabled the subject performing the task to see the observing subject by merely turning his head slightly to the right. This arrangement was designed to keep distracting influences to a minimum and yet make the visual presence of the other subject readily available.

All subjects were given 20 consecutive trials on the pursuit rotor task. No warm-up or practice trials were given before the experimental variables were introduced.

Subjects were always told that they had done "good" after the first trial. Thereafter subjects were told, following a given trial, that their performance had been "good" if their time on target was greater than it had been on the previous trial. Likewise, they were informed that their performance had been "poor" if their time on target had been less than on the previous trial.

Subjects performing the task under "competitive" conditions were encouraged to "do better" after each group of five trials.

IV. RESULTS

A 2 X 2 X 2 analysis of variance was used to analyze the effect which the independent variables of competitive atmosphere, social situation and sex difference had on the motor performance of mental retardates.

Table I illustrates the results of this treatment of the data. The table indicates a significant difference at the .05 level of confidence for (1) the effects of sex difference and (2) the interaction effects of sex difference and competitive atmosphere. Obtained F values were 6.74 for sex difference with 1 and 72 degrees of freedom (df) and 4.98 for the interaction between sex difference and competitive atmosphere with 1 and 72 df. Figure 1 depicts the performance of all groups of subjects who performed the task under social condition of experimenter plus one subject. Figure 2 illustrates the performance of all groups of subjects who performed the task under social condition of experimenter plus two subjects.

Since a significant difference between the groups was obtained, a Bartlett's test of Homogeneity was applied to the data in order to determine whether or not the assumption of homogeneity of variance was met. The Bartlett's test resulted in an F value of 7.34. This indicated

TABLE I
ANALYSIS OF VARIANCE OF PERFORMANCE SCORES AS A FUNCTION
OF SOCIAL SITUATION, COMPETITIVE ATMOSPHERE
AND SEX DIFFERENCE

Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Between groups:				
Situation	29.5002	1	29.5002	3.2233
Competition	18.4128	1	18.4128	2.0119
Sex difference	61.6656	1	61.6656	6.7379*
Interaction:				
Situation X competition	11.6587	1	11.6587	1.2739
Situation X sex	1.1092	1	1.1092
Competition X sex	45.5718	1	45.5718	4.9794*
Competition X situation X sex	.5803	1	.5803
Within groups	<u>658.9483</u>	<u>72</u>	9.1521	
Total	827.4469	79		

*p < .05

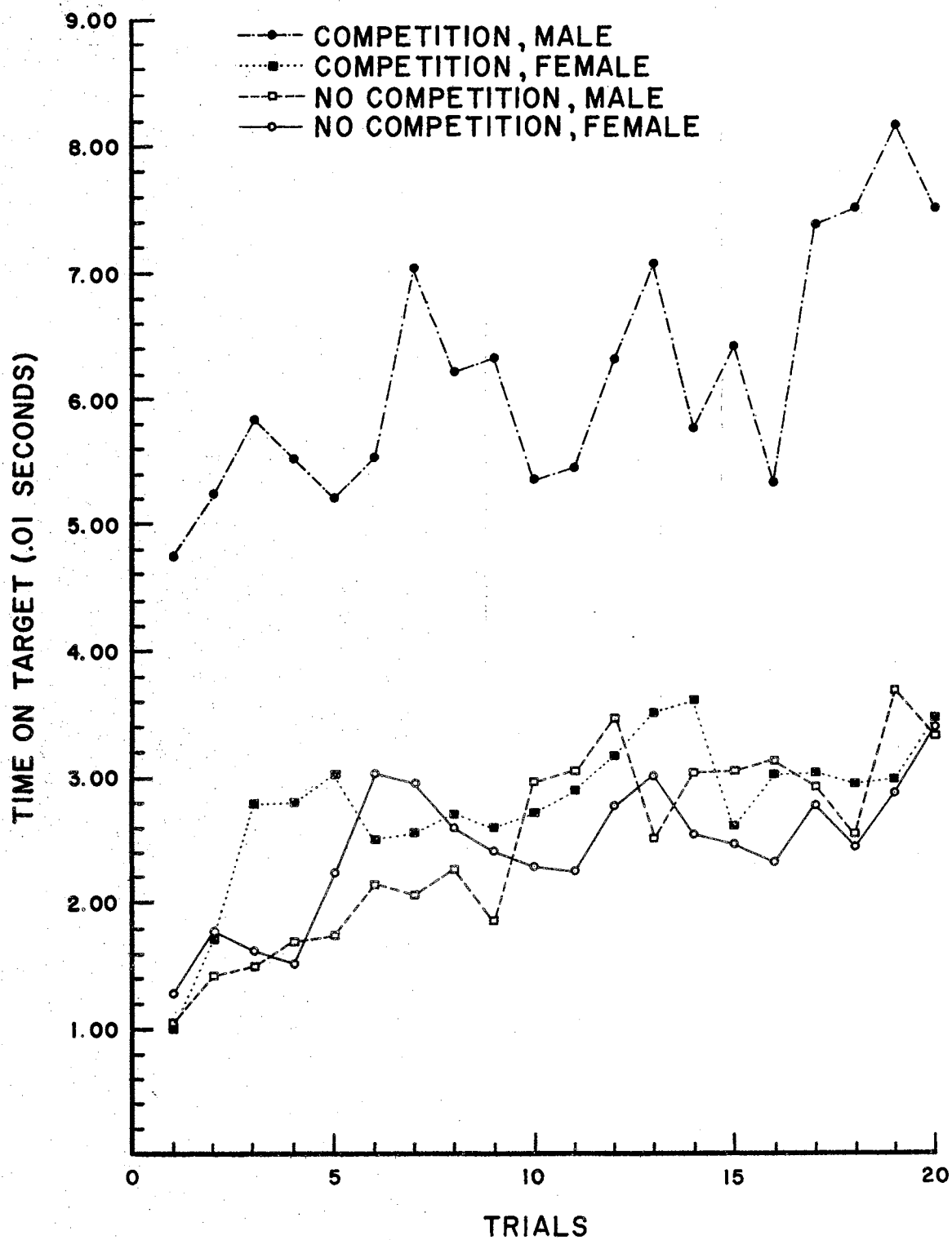


Figure 1. Motor performance as a function of competition and sex difference with social situation (E plus I) held constant.

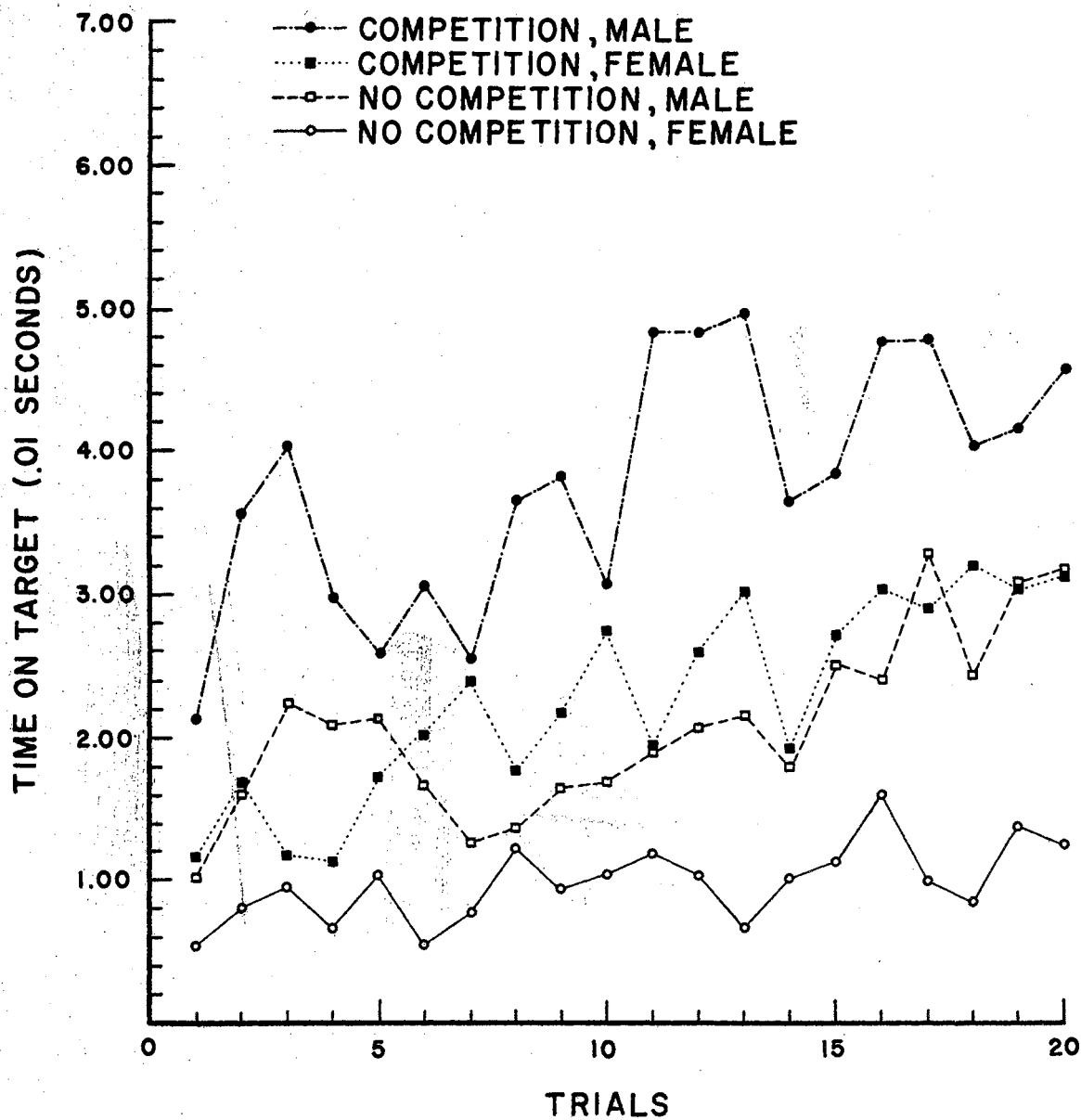


Figure 2. Motor performance as a function of competition and sex difference with social situation (E plus 2) held constant.

that the assumption of homogeneity of variance had been fulfilled.

In addition, a simple (2 X 2) analysis of variance was applied to the performance data that was obtained as a result of encouraging both male and female subjects to compete with their own performance. No significant difference was found, although it can be noted from Table II that the effect of sex difference on performance approaches the significant (.05) level of confidence. Figure 3 graphically illustrates the performance of these subjects. Figure 4 depicts the performance of subjects who were not encouraged to compete.

Table III summarized the results of a simple analysis of variance which revealed no significant differences between the groups when the social situation (E plus 2) was held constant. Figure 2 depicts the performance level of these groups

From Table IV it can be seen that a simple analysis of variance treatment of female performance data resulted in no significant differences between the groups. This point is illustrated by Figure 5.

The results of the final analysis of variance treatment of male performance data is summarized in Table V. As indicated in this table, a difference that was significant at the .01 level of confidence was obtained.

TABLE II

ANALYSIS OF VARIANCE OF PERFORMANCE SCORES AS A FUNCTION
OF SELF-COMPETITION AND SEX DIFFERENCE

Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Between groups:				
Competition	29.6874	1	29.6874	2.5477
Sex	39.6410	1	39.6410	3.4019
Interaction:				
Competition X sex	28.8370	1	28.8370	2.4747
Within groups	<u>410.4969</u>	<u>36</u>	11.6527	
Total	517.6623	39		

TABLE III

ANALYSIS OF VARIANCE OF PERFORMANCE SCORES
AS A FUNCTION OF COMPETITION BETWEEN
INDIVIDUALS AND SEX DIFFERENCE

Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Between groups:				
Competition	.3842	1	.3842
Sex	23.1040	1	23.1040	2.9173
Interaction:				
Competition X sex	17.4502	1	17.4502	2.2034
Within groups	<u>242.3461</u>	<u>36</u>	7.9198	
Total	283.2845	39		

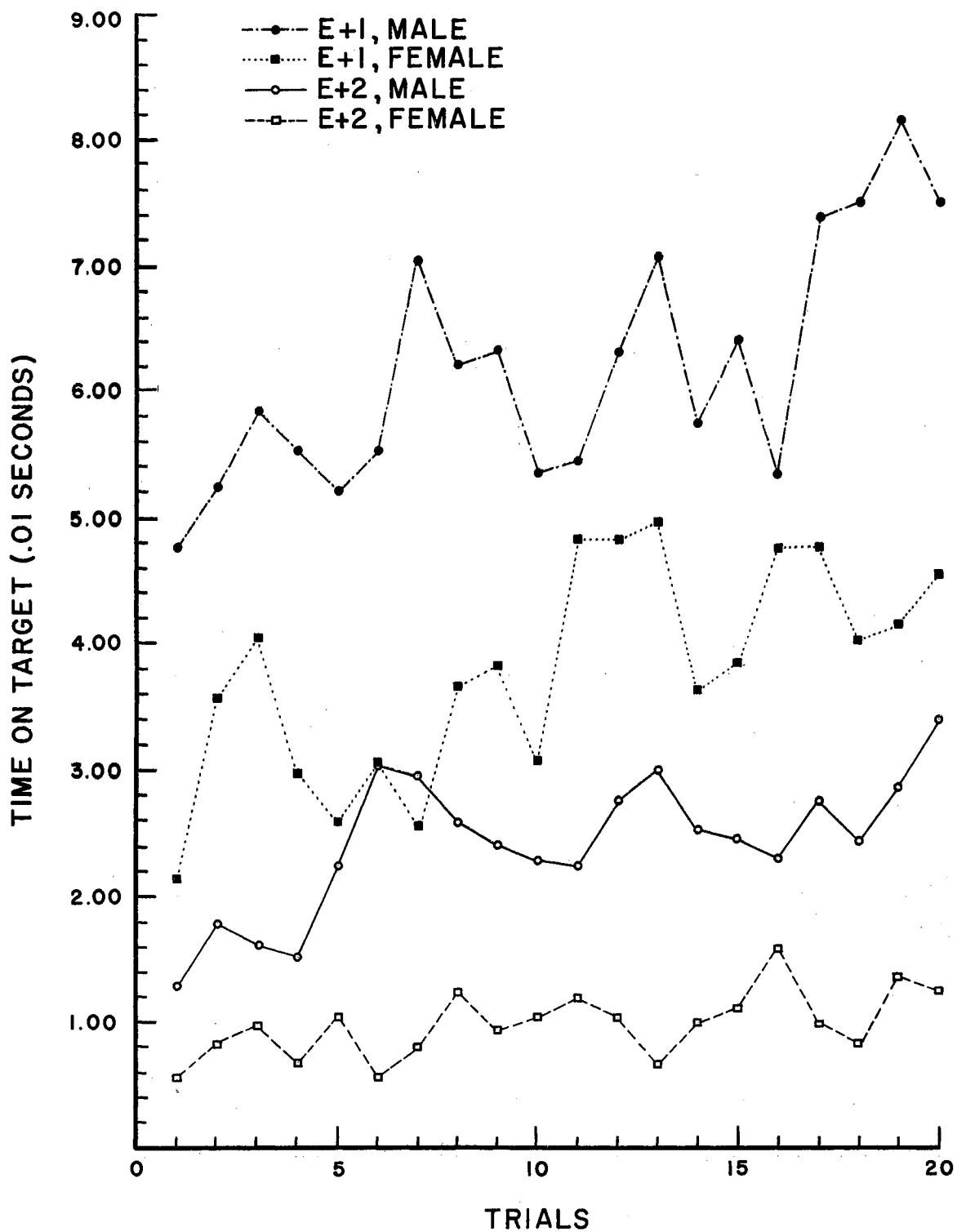


Figure 3. Motor performance as a function of social situation and sex difference with competition (competition encouraged) held constant.

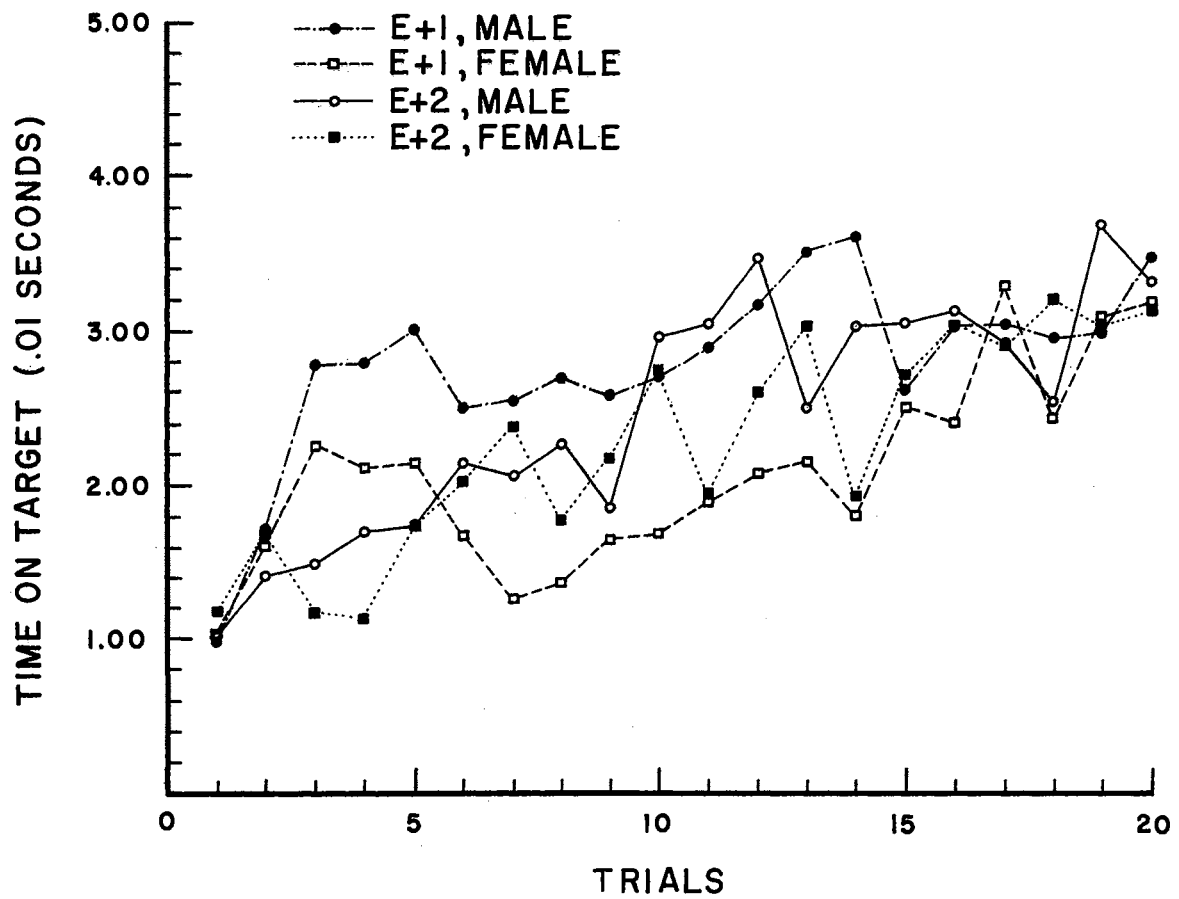


Figure 4. Motor performance as a function of social situation and sex difference with competition (competition not encouraged) held constant.

TABLE IV

ANALYSIS OF VARIANCE OF PERFORMANCE SCORES AS A
FUNCTION OF COMPETING AND NONCOMPETING
FEMALES IN VARIOUS SOCIAL SITUATIONS

Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Between groups:				
Competition	3.0250	1	3.0250
Situation	9.5844	1	9.5844	1.5513
Interaction:				
Competition X situation	3.3063	1	3.3063
Within groups	<u>222.4183</u>	<u>36</u>	6.1783	
Total	238.3340	39		

TABLE V

ANALYSIS OF VARIANCE OF PERFORMANCE SCORES AS A
FUNCTION OF COMPETING AND NONCOMPETING
MALES IN VARIOUS SOCIAL SITUATIONS

Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Between groups:				
Competition	60.9596	1	60.9596	4.9941*
Situation	21.0250	1	21.0250	1.7225
Interaction:				
Competition X situation	9.0635	1	9.0635
Within groups	<u>439.4297</u>	<u>36</u>	12.2064	
Total	533.4778	39		

* $p < .05$

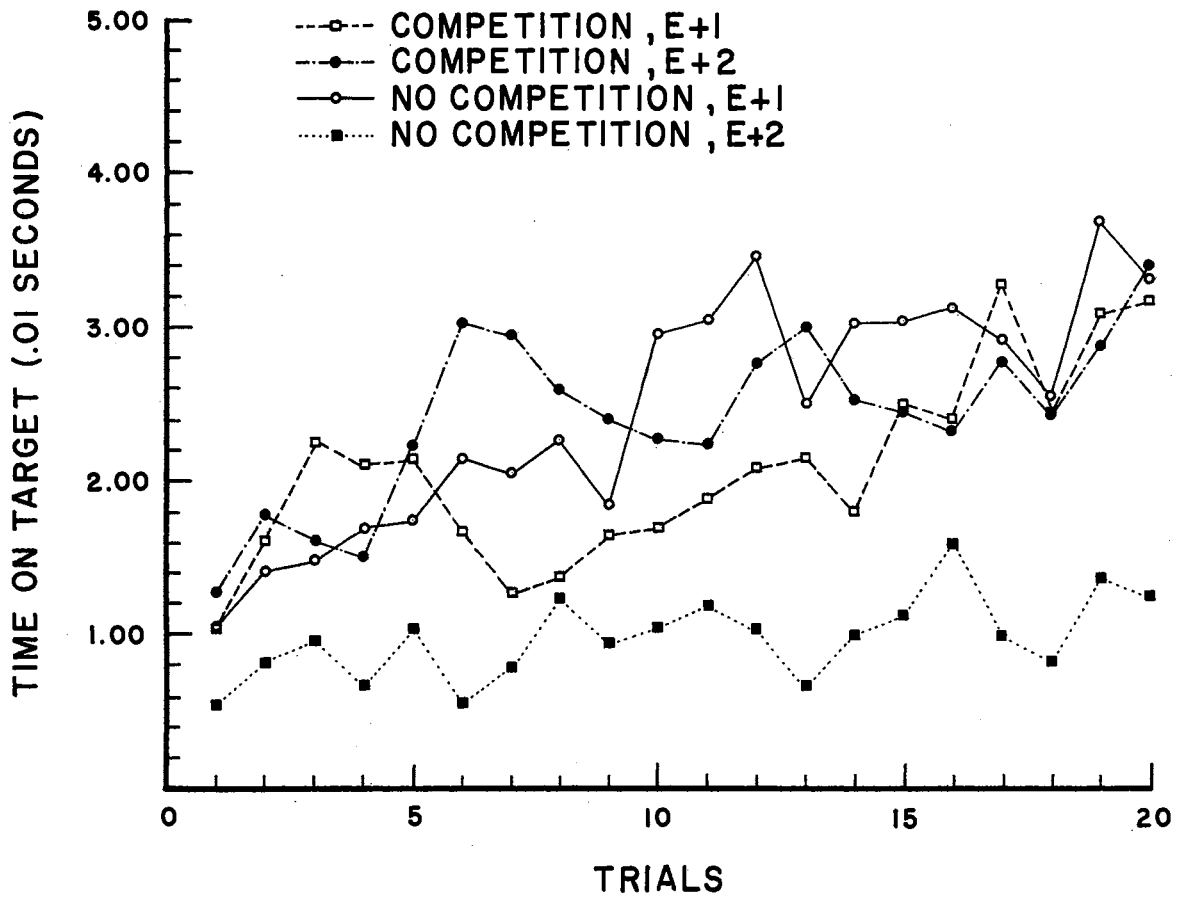


Figure 5. Motor performance as a function of social situation and competition with sex difference (females) held constant.

This finding suggests that male retardates who are encouraged to compete with their own performance or another male retardate do significantly better than male retardates who are not encouraged to be competitive. Figure 6 illustrates these performance levels.

The results of "t tests" which were applied to the remaining combinations of male groups indicate that there is a significant difference between males who are encouraged to compete with their own performance and males who are not encouraged to compete with their own performance. This difference is significant at the .01 level of confidence ("t" value 3.60).

These results also indicate that males who are encouraged to compete with their own performance do significantly better than male retardates who are not encouraged to compete with another male retardate. This difference is significant at the .02 level of confidence with a "t" value of 2.64.

All other possible comparisons of the three variables of social situation, competition and sex difference revealed no significant difference in pursuit rotor performance.

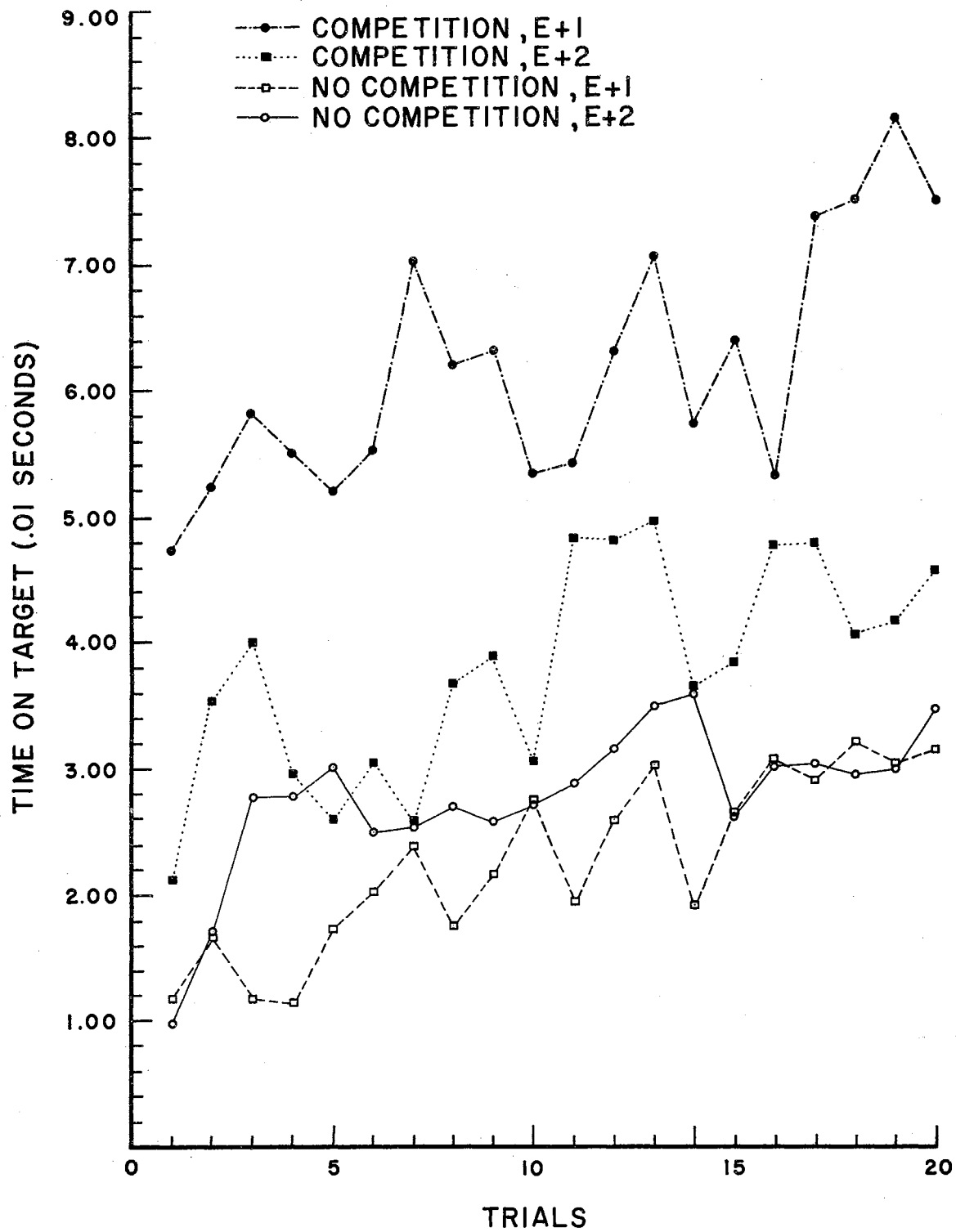


Figure 6. Motor performance as a function of social situation and competition with sex difference (males) held constant.

V. DISCUSSION

The statistical analyses indicated that the null hypotheses should be rejected for sex difference and the interaction between sex difference and competition. These differences were all significant at the .05 level of confidence. No other variables or interactions between variables were significant in the 2 X 2 X 2 analysis of variance.

The statistical treatment of the results also indicated that social situation had little or no effect on the motor performance of non-competing subjects. In the case of "competing" subjects, those subjects who were in "competition" with their own performance tended to function at a higher level of motor competency than did those subjects who competed with another subject (see Figure 3).

Variations in social situation did not result in significant differences in performance though performance for both sexes approached significance under the "competitive" condition for these variations in social situation. When sex difference was held constant and the effects of the variables analyzed, it appeared that competition had had a considerable influence on male motor performance.

It can be noted from Figure 3 that in "competitive" situations where male subjects performed the task alone (in the presence of the experimenter) they began their motor performance at a much higher level than did male or female subjects who "competed" with another subject (in the presence of the experimenter). This initial superiority of performance was maintained throughout the 20 trials.

Male mental retardates who were encouraged to compete with their own performance did significantly better than did males who were not so encouraged, and who either performed the task alone or in the presence of the experimenter and another subject.

"Competition," in general, appeared to have little or no effect on female motor performance on the pursuit rotor.

From the above discussion of the results it would appear that competition had little influence on the motor performance of female mental retardates. "Competition" appeared, however, to have had a facilitative effect on the motor performance of male retardates. A further examination of the performance curves for both male and female retardates indicated that in most cases (but especially with male subjects) the performance level increased immediately after subjects were urged to do better on the task. Frequently, the sharpest increase in performance level occurred on the

second trial after the subjects had been urged to do better. This rate of increase was not maintained, however, and the fourth or fifth trials after the subjects had been told to do better usually resulted in a drop in performance level (see Figure 5). This rather consistent fluctuation in the curve for "competing" males suggests that future research designed to investigate the characteristics of such curves might well be productive.

Thus, it has been noted that there is a significant difference between the performance level of male and female mental retardates. This finding is consistent with other research studies (Maller, 1929; McClelland, Atkinson, Clark, & Lovell, 1953) that have investigated sex differences between "normal" subjects.

The finding that variations in social situation had little or no effect on the level of performance is somewhat at variance with one study (Abel, 1938) on the facilitative effects of social situations involving pairs as versus single subject situations.

The effects of competition on motor performance is consistent with other research (Greenberg, 1932; Leuba, 1933; Sims, 1928; Ausubel, 1951). This consistency is most apparent in male performance. Female retardates appear to be little affected by a competitive situation.

It is apparent that there are many individual differences in mental retardates' motor performance. Some individuals appear to be more highly motivated and their

motor performance facilitated by attempts to encourage "competition." Others, however, seem to be unable to perform as well and attempts to encourage "competition" are detrimental, resulting in a drop in performance level.

It was observed, in the course of this research, that in some cases where subjects were encouraged to compete with their own performance or with that of another subject, their motor movements became more uncoordinated and their subsequent level of performance dropped.

It was also noted that even though many subjects seemed to expend greater effort under competitive conditions, the accuracy of their motor performance was frequently impaired. It is possible that, like "normals" (Whittmore, 1924) the quantity of their performance increased but the quality and accuracy decreased. Further research is needed to clarify these observations.

VI. SUMMARY AND CONCLUSIONS

The current study has investigated the effects of social situation, competition, and sex difference on the motor performance of institutionalized adult mental retardates.

No significant differences were produced by varied social situations (subjects working alone and subjects working in the presence of another subject).

"Competition," in the sense that subjects were encouraged to "do better" was a significant factor only for those males who were encouraged to compete with their own performance as compared to those who were not so encouraged.

In general, there was a significant difference between male and female performance levels.

Interaction effects were found to be significant only in the case of sex difference and competition.

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APPENDICES

APPENDIX A

INSTRUCTIONS

"The object of this task is to make the highest score you can. In order to make a high score you must keep the point of this stylus on the round brass target as it goes around in a circle (E indicates stylus point and brass target). Three seconds before the target starts to move you will hear a warning buzzer.

"When you hear the warning buzzer hold the stylus above the target. When the target starts moving put the point of the stylus on the target and try to keep the stylus on the target as long as the target is moving. When the target stops, lift the point of the stylus off the target (E demonstrates). You will have several trials with a short rest period between each trial.

"Hold the stylus handle with your thumb and fingers (E demonstrates). Hold the cord like this (E demonstrates). Now take the stylus and stand here (E makes any necessary corrections of the subject's position).

"If you make a high score, I will say 'that was good' but if you make a low score, I will say 'that was poor.'

"Do you have any questions?"

Groups 3, 4, 7, and 8 will be given only the above instructions.

Groups 1 and 2 will be given the above general instructions and then told, "See how well you can do on this task." After each fifth trial, subjects in these two groups will be told, "try to do better."

Groups 5 and 6 will be given the general instructions and told, "Try to do better than he (she) is going to do (did). See if you can make a higher score than he (she) is going to make (made)." After each fifth trial, subjects in these two groups will be told, "Try to do better than he (she) is going to do (did)."

APPENDIX B

APPENDIX TABLE I

MEAN PERFORMANCE SCORES (IN .01 SECONDS)
 SOCIAL SITUATION
 (EXPERIMENTER PLUS ONE SUBJECT)

Trials	Competition		No Competition	
	Males Group I	Females Group II	Males Group III	Females Group IV
1.	4.74	1.24	.98	1.05
2.	5.23	1.82	1.72	1.42
3.	5.82	1.61	2.77	1.50
4.	5.50	1.55	2.79	1.72
5.	5.18	2.21	3.02	1.76
6.	5.53	3.04	2.48	2.15
7.	7.04	2.97	2.54	2.05
8.	6.24	2.60	2.69	2.27
9.	6.33	2.41	2.57	1.88
10.	5.36	2.28	2.73	2.99
11.	5.47	2.23	2.88	3.08
12.	6.33	2.76	3.17	3.49
13.	7.09	3.04	3.53	2.52
14.	5.75	2.53	3.62	3.05
15.	6.42	2.49	2.65	3.09
16.	5.34	2.34	3.04	3.16
17.	7.40	2.78	3.05	2.93
18.	7.55	2.45	2.92	2.56
19.	8.19	2.90	2.99	3.72
20.	7.51	3.42	3.49	3.34

APPENDIX TABLE II
 MEAN PERFORMANCE SCORES (IN .01 SECONDS)
 SOCIAL SITUATION
 (EXPERIMENTER PLUS TWO SUBJECTS)

Trials	Competition		No Competition	
	Males Group V	Females Group VI	Males Group VII	Females Group VIII
1.	2.14	.56	1.18	1.03
2.	3.57	.81	1.68	1.62
3.	4.02	.97	1.17	2.26
4.	2.98	.68	1.14	2.12
5.	2.59	1.03	1.74	2.16
6.	3.07	.57	2.03	1.68
7.	2.56	.78	2.40	1.26
8.	3.66	1.22	1.79	1.38
9.	3.82	.94	2.18	1.66
10.	3.08	1.05	2.76	1.69
11.	4.83	1.18	1.95	1.91
12.	4.83	1.04	2.60	2.09
13.	4.98	.67	3.04	2.17
14.	3.65	1.01	1.93	1.81
15.	3.85	1.16	2.66	2.52
16.	4.77	1.62	3.07	2.46
17.	4.79	1.01	2.91	3.29
18.	4.05	.86	3.21	2.44
19.	4.15	1.20	3.06	3.12
20.	4.59	1.15	3.16	3.19

VITA

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