THE EFFECT OF PRETRAINING ON DISCRIMINATION AND REVERSAL LEARNING WITH PRESCHOOL CHILDREN

by

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CHAPTER I

INTRODUCTION

Previously, psychologists have assumed that learning begins at the start of the experiment. This assumption is an erroneous one because it ignores the type and amount of learning the subject has experienced prior to the beginning of the experiment. For example, in nearly all learning studies certain adaptation or habituation experiences are given to the subject prior to the arbitrarily designated beginning of learning trials.

Purpose

Spence (1936) acknowledged the existence of an effect of prior experience. Spence assumed that at the beginning of a discrimination experiment the subject had stimulus-response connections established to some degree and that these connections will each have certain finite strengths. The strength is dependent upon the type and amount of previous experience. Even though at this time he was not interested in the effect of previous experience, he did acknowledge that in some way the subject was predisposed to respond in a set fashion at the beginning of the experiment.

The proposal of this investigation is that the subject

is not only predisposed to respond in a set fashion, but that past experience has imposed upon the subject a set to expect a certain percentage of reinforcement. The present experiment examines the effect that past experience has on a subject's performance on a given learning task. The purpose is to determine whether the frequency or schedule of previous reinforcement can influence the subject's present performance and ability to learn. The subject's ability to reverse what was previously learned was also investigated. The learning situation was a simple 2-object, single discrimination task.

Review of the Literature

Psychologists have done little investigation as to the effect of prior experience; consequently, the literature referred to does not always have a direct bearing on the present investigation.

There are three areas that can be related to this study: (1) approach-avoidance, (2) probability learning, and (3) expectancy. The first area has been most throughly investigated by Harlow (1959) and his associates. Although most of his work was done in the context of discrimination learning, he has some studies relating to prediscrimination training (King & Harlow, 1962). The study refered to investigated the effect of trial 1 reward and nonreward on trial 2 performance. On the first trial a single object

was rewarded a certain percentage of the time and then a 2-object discrimination was presented on trial 2. Each animal was tested 720 times with trial 1 being rewarded either 75%, 50%, or 25% of the time. Performance on trial 2 was used for analysis.

King and Harlow's findings indicate, "that the efficiency with which the Ss utilized a particular Trial 1 event (reward or nonreward), increases with the percentage of time that particular Trial 1 event occurs." That is, the performance of the 75% group improved rapidly after rewarded Trial 1 but remained at the chance level following nonrewarded Trial 1. This also holds true for the 25% group because their performance improved rapidly after nonrewarded Trial 1 and remained at chance for the rewarded Trial 1 (p. 875). The predominant cue (rewarded or nonrewarded) is the one most influential in determining a subject's discrimination performance.

The subjects in King and Harlow's study all had previous experience in learning experiments. Even though the subjects were equated as to the type of experience they had, the subjects could possibly not be equated as to the efficiency they had in the previous experiments. Since these previous experiments will serve as pretraining for the subjects, the type would not be as important as the frequency with which the subject received reward.

The second approach to the problem is in the study of probability learning in children. A probability learning situation is one in which subjects are given a choice of a number of identical stimulus objects. Each object has its own unique percentage of time that it will be rewarded. Pretraining is sometimes added to see how it influences the subject's choice of stimulus objects.

Goodnow (1955) says that one condition influencing whether or not the subject will maximize (choose the object that is reinforcing the greater percentage of the time) his guesses is the level of success the subject will accept in the task.

It has been shown in a number of studies (Stevenson & Zigler, 1958 & Stevenson, 1961) that the higher the frequency of reinforcement in pretraining, the lower the frequency of choice of the reinforcing stimulus in the probability situation. This is shown when a subject with 100% pretraining seeks to reach this level in the probability situation. Since there is no way to discriminate among the different stimulus objects, the subject has to rely on guessing and therefore will make more mistakes. Conversely, a subject with 50% pretraining experience will stay with the stimulus object that reinforces the greater percentage of the time. Therefore, behavior in a probability learning task is dependent upon the subject's

expectations concerning the level of reinforcement (Stevenson & Zigler, 1958).

The third approach to the problem is that of expectancy. As Sheffield & Temmer (1950) put it, "Responses are given because the subject expects (or learns to expect) reinforcement to occur." Presently, this could be revised to read that the subject learns to expect reinforcement a certain percentage of the time.

The present investigation contains two basic groups: 100% and 50% reinforcement pretraining trials. The results are expected to be just the opposite as those found in the probability learning tasks but they are expected for the same reasons. The subjects with 100% reinforcement will again try to maximize; but in this case there is a discriminative difference between the stimulus objects and consequently guessing is eliminated. The subject will be able to "learn" to choose the stimulus object that will maximize his performance. The 50% group can reach their level of expectancy by responding to only one side since the correct stimulus will appear on each side 50% of the time. Thus the 100% pretraining groups will be superior in performance to the 50% pretrained groups in discrimination learning.

Even though at the end of discrimination learning the subjects in all groups will be near 100% reinforcement,

the 100% groups should perform better than the 50% groups since the subjects are starting a different learning task. They should again be influenced by pretraining.

CHAPTER II

METHOD

Subjects

The subjects were 48 boys and girls from the ages of 2 to 6 years. None of the 6 year-olds had started school. Nine of the subjects had to be dropped from the experiment for various reasons. Three were dropped because of continuous absence after the first couple of days, one was dropped because of a change of leaving time, two were dropped because of vacations, and two were dropped because of an aversion to the testing situation when presented with discrimination learning. The subjects dropped were from all four groups so consequently this would rule out any systematic bias. The remaining population consisted of 21 girls and 19 boys with an average age of 4.6 years. The subjects were taken from the Lubbock Day Nursery #2 in Lubbock, Texas.

Apparatus

The apparatus was a modified Wisconsin General Test Apparatus (WGTA) for children as described by Vaughter and Cross (1965).

Procedure

Initially, the subjects were given pretraining

experience using a neutral discriminanda. They were then trained to make a response in a spatial discrimination problem. After discrimination learning the subjects were confronted with the same problem but were required to learn the previously nonrewarded object.

Pretraining

Each subject was talked to for a few minutes before testing. The talk was to establish rapport and nothing was said about the testing procedure.

The subject was placed on one side of the testing apparatus and the tray was pushed to them with no discriminanda on it. The center food well was baited with an M and M candy. Nothing was said unless after 15 seconds the subject had made no move to take the candy. At this point the subject was told either to "take the candy" or "the candy is for you." After this, the tray was pulled back and either the center well or one of the side wells was baited and covered with a neutral, unpainted block of wood like those used for the base of the discriminanda.

Again, nothing was said unless the subject failed to move the block after a period of time. The subject was then told to "move the block" and if it was necessary, the subject was also told to "take the candy." The only other instructions given were to point out a container that they

could put the candy in if they did not want to eat it then.

The subjects were randomly placed into one of the four groups and given 60 pretraining trials. Using this method there was one day between the first and the last 30 trials.

Discrimination

After pretraining, the subject was presented with the tray with two different discriminanda on it to begin discrimination learning. The only instructions given here were to "pick up only one of the blocks." The subjects were given 20 trials a day and were tested every other day until the criterion of 18 out of 20 was reached. If the subject failed to reach criterion after 6 test days and 120 trials, testing was discontinued.

Reversal

Reversal learning followed the standard pattern with the previously nonrewarded object now being rewarded and the previously rewarded object now nonrewarded. The subjects were again given 20 trials every other day with criterion being 18 out of 20 trials and testing was discontinued after 120 trials without reaching criterion.

Design

Pretraining consisted of four groups. Group I

received 60 trials that were always rewarded. The trials were randomly distributed between the two side wells (Group 100S). Group II also received 60 trials in the side wells but they were rewarded only 50% of the time. The reward was randomized so that an equal number of rewards were received on each side (Group 50S). Group III received 100% reward in the center well for 60 trials (Group 100C). Group IV received 50% reward in the center well for 60 trials. The order of reward was randomized (Group 50C).

In both discrimination and reversal learning, the position of the rewarded object was randomized individually for each step and each block of trials. The random units table in the C.R.C. Standard Mathematical Tables (1959) was used and a restriction of the rewarded object not being on the same side for more than three times in a row was placed on the randomization.

Basically the experimental design consists of (a) two levels of reward (50% & 100%) and (b) two types of position (center vs. side). This results in a 2 X 2 factorial design.

Since a number of the subjects did not reach criterion, an analysis of variance was done with the basic datum being the number of errors in each of six test blocks. For those not tested 120 trials, the score of the criterion block was projected through the remaining blocks.

CHAPTER III

RESULTS

The overall discrimination learning curves for the four groups are shown in Figure 1. The figure is based on all subjects and includes those who did not reach criterion. Its basis is the mean number of errors per 20 trials for 6 test days. As shown in Table 1, an analysis of variance applied to the four groups indicated that there was a significant difference between the reinforcement conditions with the 100% group being superior. The effect is significant beyond the .05 level. The analysis of variance also showed that there was no significant difference between the side vs. center conditions and also that there was no significant interaction. The analysis also showed that there was significant learning from one test day to another and that there were no reinforcement or position effects on learning over time and no significant interactions.

The overall reversal learning curves for the four groups are shown in Figure 2. It is based on the mean number of errors per 20 trials for 6 test days. Table 2 is a summary of the analysis of variance. As in discrimination learning, there was a significant difference between the reinforcement conditions with the 100% being superior. This effect is significant beyond the .05 level. The

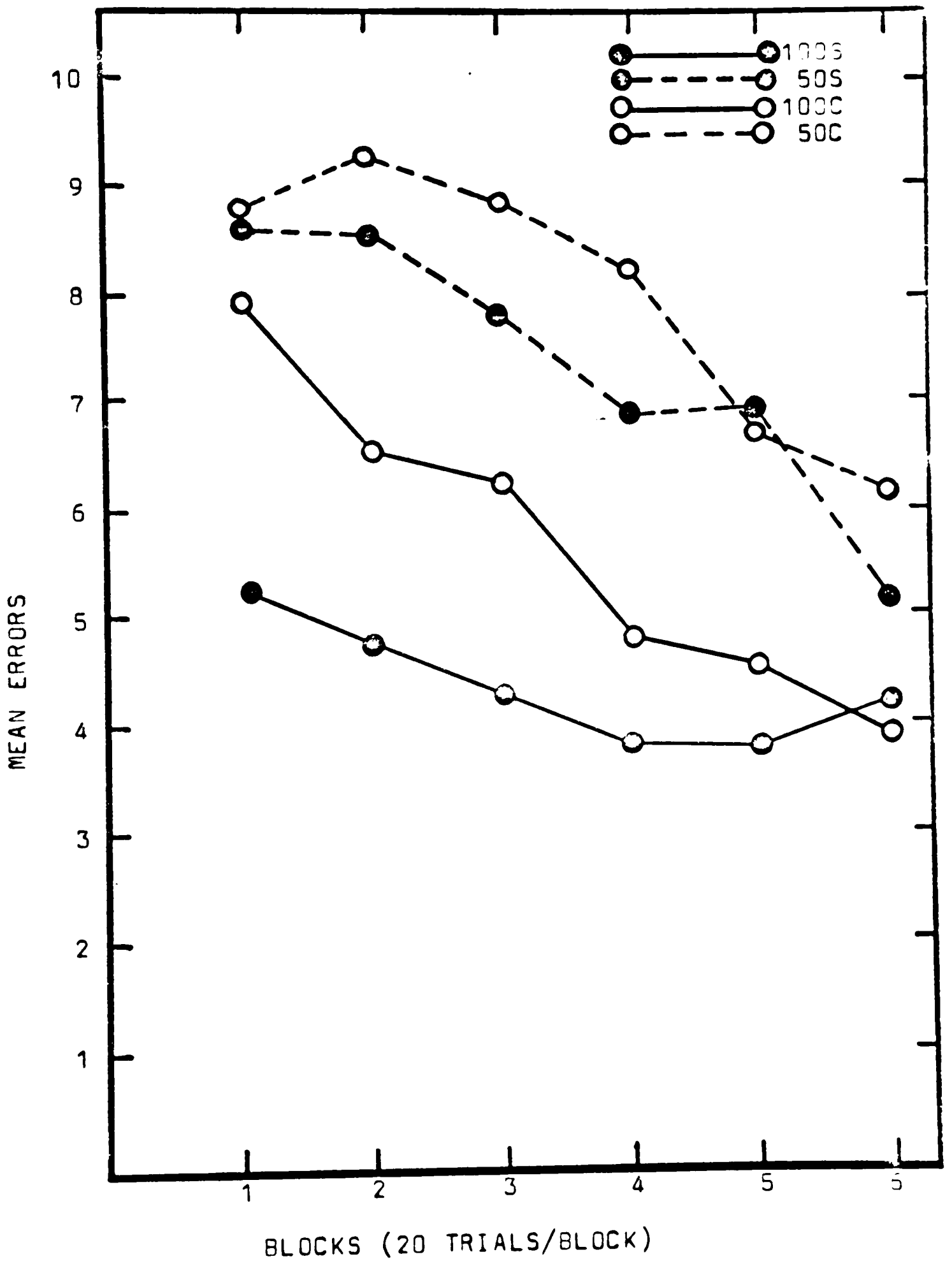

FIGURE 1. Overall Learning-Set Curves Based on Discrimination Performance for Subjects Receiving Reward on Differing Proportions and Positions of Pretraining

analysis also showed that there was no significant difference between the side vs. center conditions and that there was no significant interaction. Again, as in discrimination learning, there was significant learning from one test day to another and there were no reinforcement or position effects on learning over time.

TABLE 1. Summary of Analysis of Variance for Discrimination Learning

Source of Variability	Degrees of Freedom	Sum of Squares	Mean Square	F
Position (A)	1	62.01	62.01	.77
Reinforcement (B)	1	421.34	421.34	5.24[a]
A X B	1	4.83	4.83	.06
Error Term (B)	36	2893.40	80.37	. .
Blocks (C)	5	228.43	45.69	11.56[b]
A X C	5	14.14	2.82	.71
B X C	5	23.51	4.70	1.19
A X B X C	5	24.52	4.90	1.24
Error Term (W)	180	711.40	3.95	. .
Total Variability	239	4393.58		

[a]Above the .05 level of significance.

[b]Above the .001 level of significance.

A cursory examination of the data shows that it would be profitable to analyze the different age groups in some

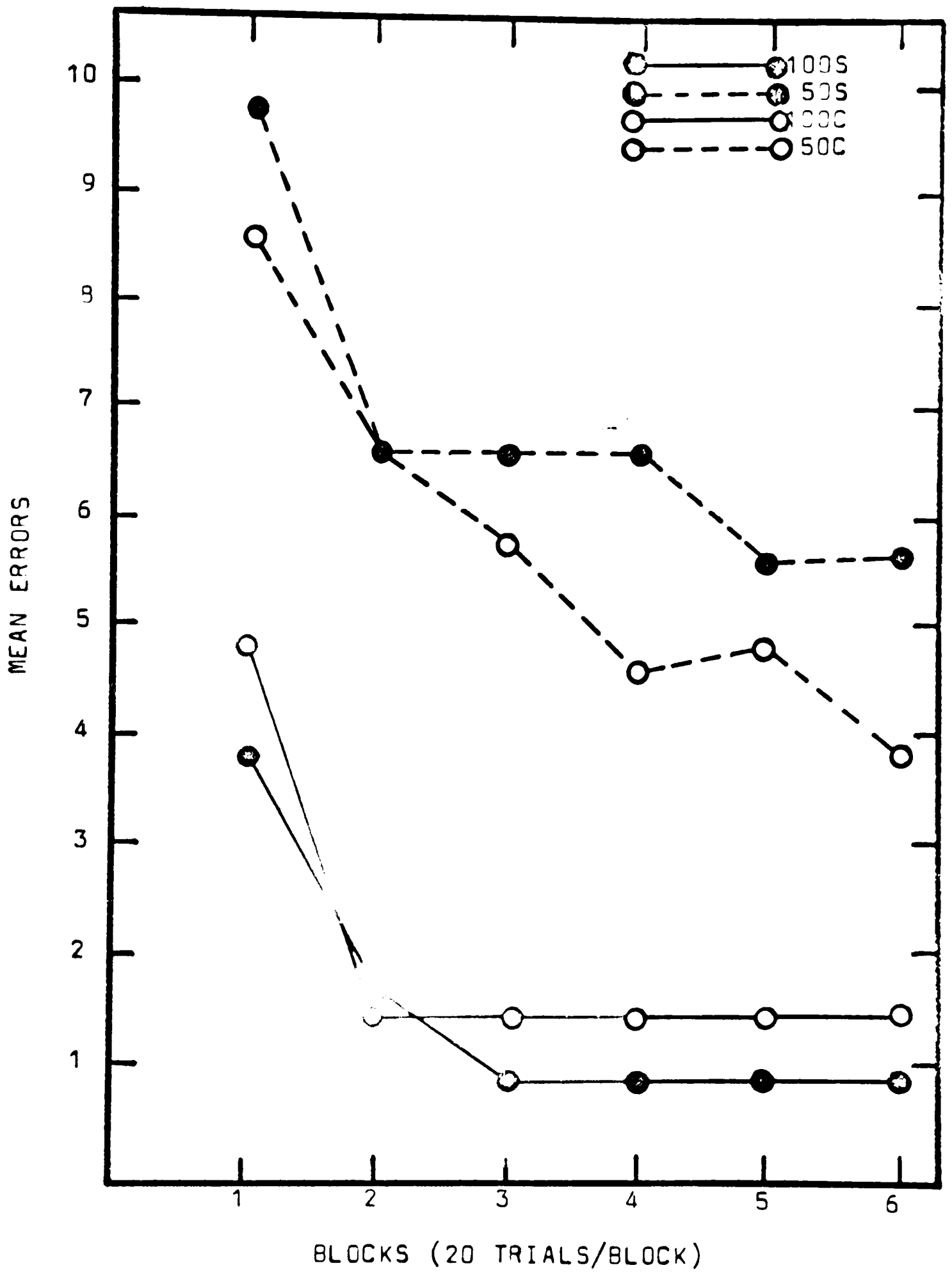

FIGURE 2. Overall Learning-Set Curves Based on Reversal Performance for Subjects Receiving Reward on Differing Proportions and Positions of Pretraining

manner. It is thought that there is a significant difference between the 2, 3, and 4 year-olds and the 5 and 6 year-olds. There is possibly a difference between all pairs of groups. The difference between the two groups is shown in Figure 3.

TABLE 2. Summary of Analysis of Variance for Reversal Learning

Source of Variability	Degrees of Freedom	Sum of Squares	Mean Square	F
Position (A)	1	2.93	2.93	.00
Reinforcement (B)	1	605.14	605.14	5.30[a]
A X B	1	14.91	14.91	.01
Error Term (B)	17	1940.99	114.97	. .
Blocks (C)	5	197.08	39.41	11.94[b]
A X C	5	1.51	.30	.01
B X C	5	9.67	1.93	.06
A X B X C	5	6.49	1.29	.04
Error Term (W)	85	280.76	3.30	. .
Total Variability	125	3059.47		

[a]Above the .05 level of significance.

[b]Above the .001 level of significance.

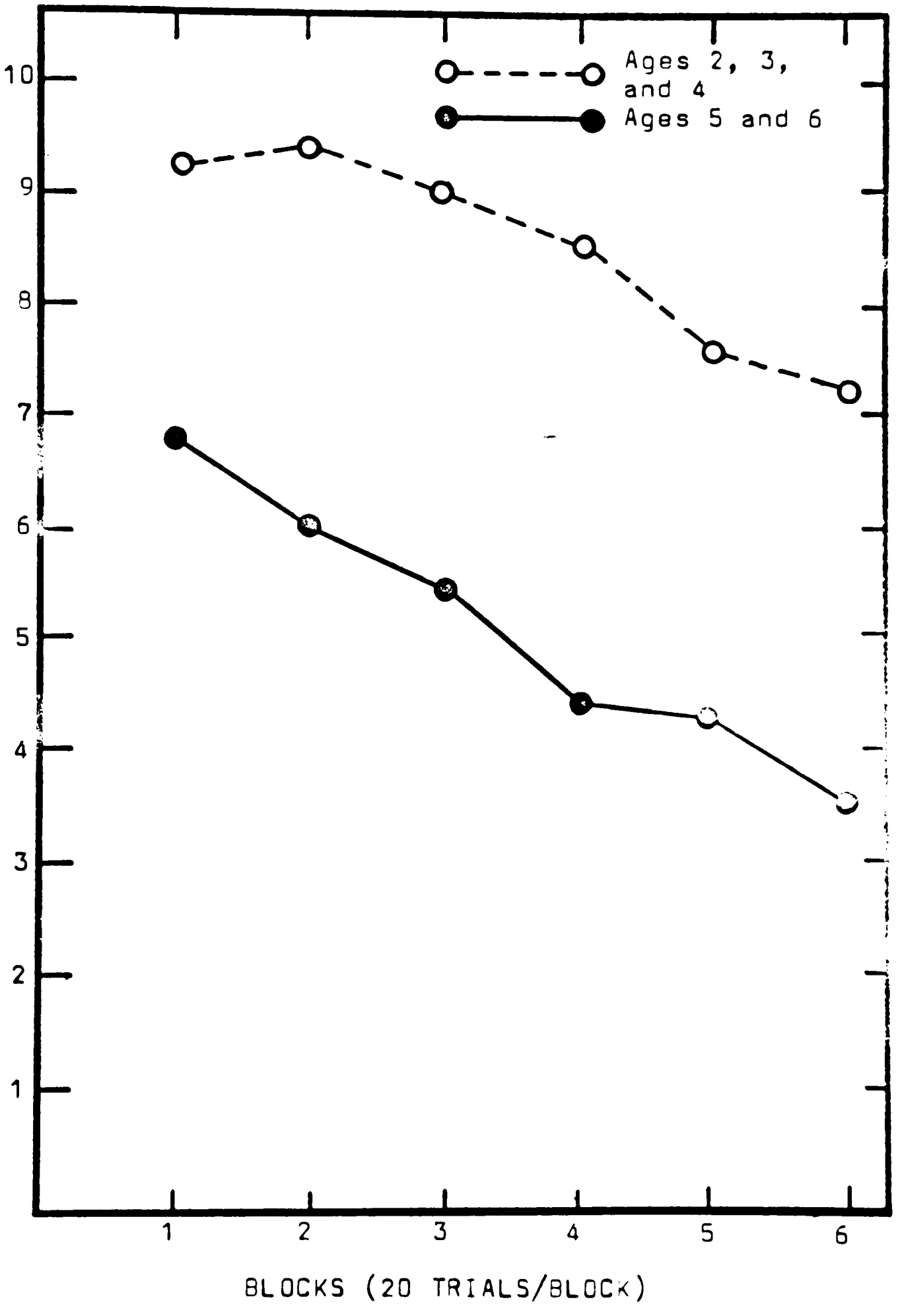

FIGURE 3. Ovarall Learning-Set Curves Based on Discrimination Performance for Subjects of Two Different Age Groups

CHAPTER IV

CONCLUSION AND SUMMARY

Conclusion

As in the investigations of others (King & Harlow, 1962, Grant, Hake, & Hornseth, 1951, Stevenson, 1961, & Stevenson & Zigler, 1958), the discrimination learning curves follow similar paths and start to slightly converge at the ends. Consequently, the differences between the 50% and the 100% groups are fairly consistent throughout discrimination learning. All groups would eventually produce comparable learning but the major difference is in the speed of learning. The 100% groups produce the highest percentage of learning, the fastest of the two groups. The 50% pretraining condition causes an inhibition of learning, whereas the 100% groups cause a facilitation of learning.

Reversal learning presents a similar picture. The 50% and the 100% groups are significantly different at the start of reversal and end up significantly different with no converging trend. From this, it is possible that pretraining had the same effect on reversal as it did on discrimination.

These results indicate that the effects of pretraining, regardless of the type, are long lasting and not easily

erased. This erasure could have occurred at the end of discrimination learning when the subject was receiving nearly 100% reinforcement, but in many cases it did not.

Upon close examination of the individual scores on both discrimination and reversal, a definite trend is apparent. If, in the last two blocks of trials during discrimination learning the subject received 70% or more reinforcement, he reached criterion in the first or second test day of reversal. The trend would seem to be that if the subject receives as many trials as was given in pre-training, at a significantly different percentage of reinforcement, then the latter percentage will most effect the learning task.

Recommendations

A few recommendations need to be made for further research. First of all, there needs to be a systematic varying of different percentages of reinforcement. Both 25% and 75% reinforcement need to be investigated in conjunction with 50% and 100% reinforcement. Another suggestion would be to systematically vary the number of trials in pretraining to see if and when the effect becomes asymptotic. A third suggestion is to systematically compare and analyze different age groups to see if certain conditions effect certain age groups more than others.

Summary

The main purpose of the study was to investigate the effect of different percentages of reinforcement on discrimination and reversal learning.

Twenty-one girls and 19 boys were given 60 pretraining trials. The subjects were randomly placed in four different groups: (1) 100% reinforcement in the side wells, (2) 50% reinforcement in the side wells, (3) 100% reinforcement in the center well, and (4) 50% reinforcement in the center well. The results showed that in both discrimination and reversal learning the 100% groups were significantly better than the 50% groups. There was no difference between the side and center conditions.

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APPENDIX

A. Classification of Subjects by Age and Group

B. Table of Errors of Subjects in Blocks of 20 Trials

APPENDIX A: CLASSIFICATION OF SUBJECTS BY AGE AND GROUP

	Age				
Group	2	3	4	5	6
100S	1	1	2	3	3
50S	1	2	1	4	2
100C	. .	1	1	4	4
50C	. .	3	2	4	1

APPENDIX B: TABLE OF ERRORS OF SUBJECTS IN BLOCKS OF 20 TRIALS

DISCRIMINATION

Subject	Blocks of 20 Trials					
GROUP 100S						
1	1	1*	1*	1*	1*	1*
2	7	8	7	4	2	2*
3	4	0	0*	0*	0*	0*
4	0	0*	0*	0*	0*	0*
5	4	0	0*	0*	0*	0*
6	1	1*	1*	1*	1*	1*
7	10	10	9	8	9	11
8	8	10	10	10	10	10
9	9	11	10	10	10	10
10	8	6	4	4	5	7
GROUP 50S						
11	13	9	10	8	6	2
12	3	1	1*	1*	1*	1*
13	8	10	0	0*	0*	0*
14	2	2*	2*	2*	2*	2*
15	9	10	12	10	12	9
16	10	10	10	10	10	10
17	10	10	12	11	6	5
18	15	12	12	11	10	8
19	7	11	9	6	12	9
20	9	10	9	9	9	5

APPENDIX B: (CONTINUED)

Subject	Blocks of 20 Trials					
GROUP 100C						
21	3	3	1	1*	1*	1*
22	9	5	2	2*	2*	2*
23	9	10	14	9	7	1
24	10	2	2*	2*	2*	2*
25	1	1*	1*	1*	1*	1*
26	4	1	1*	1*	1*	1*
27	12	10	8	2	2*	2*
28	11	10	10	10	10	10
29	11	10	10	10	10	10
30	10	13	13	9	9	9
GROUP 50C						
31	2	2*	2*	2*	2*	2*
32	8	8	8	11	4	0
33	10	10	10	10	1	1*
34	10	10	10	2	2*	2*
35	11	10	10	11	10	10
36	12	11	10	10	10	10
37	10	12	10	10	10	9
38	7	9	8	7	8	9
39	7	10	10	10	10	10
40	10	10	10	10	10	10

APPENDIX B: (CONTINUED)

REVERSAL

Subject	Blocks of 20 Trials					
GROUP 100S						
1	3	0	0*	0*	0*	0*
2	8	6	2	2*	2*	2*
3	5	0	0*	0*	0*	0*
4	0	0*	0*	0*	0*	0*
5	2	2*	2*	2*	2*	2*
6	4	1	1*	1*	1*	1*
GROUP 50S						
11	10	1	1*	1*	1*	1*
12	4	5	5	5	1	1*
13	5	0	0*	0*	0*	0*
14	20	20	20	20	20	20
GROUP 100C						
21	5	0	0*	0*	0*	0*
22	10	2	2*	2*	2*	2*
23	4	1	1*	1*	1*	1*
24	5	1	1*	1*	1*	1*
25	1	1*	1*	1*	1*	1*
26	2	2*	2*	2*	2*	2*
27	6	2	2*	2*	2*	2*
GROUP 50C						
31	1	1*	1*	1*	1*	1*
32	2	2*	2*	2*	2*	2*
33	19	13	9	4	5	2
34	12	10	11	11	11	10

*Indicates scores that were projected from the criterion block score.