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ABSTRACT

A series of investigations which simultaneously manipulated parameters of reinforcement and age and sex of children were conducted in order to further describe the learning process in children. In addition, an attempt was made to relate perceived parental discipline to performance in the discrimination learning tasks employed in this research. The overall findings of this research, while complex, were that children perform better for punishment for incorrect choices, whether verbal ("wrong") or material (response cost), than for reinforcement for correct responses, whether verbal ("right") or material (token). In addition, the effect of reinforcement and punishment on discrimination learning were found to vary both with the age and sex of the child and the sex of the reinforcing agent. No relationship was found between perceived parental discipline and performance. (Author/LAA)

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FINAL REPORT

Project No. 1-0534  
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The Effects of Reinforcement and Developmental  
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U.S. Department of Health, Education, and Welfare  
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### Abstract

A series of investigations which simultaneously manipulated parameters of reinforcement and age and sex of children were conducted in order to further describe the learning process in children. In addition, an attempt was made to relate perceived parental discipline to performance in the discrimination learning tasks employed in this research.

The overall findings of this research, while complex, were that children perform better for punishment for incorrect choices, whether verbal ("wrong") or material (response cost), than for reinforcement for correct responses, whether verbal ("right") or material (token). In addition, the effects of reinforcement and punishment on discrimination learning were found to vary both with the age and sex of the child and the sex of the reinforcing agent. No relationship was found between perceived parental discipline and performance.

## I. Background and Relevant Research

A central problem in education is to determine the conditions of reinforcement under which the child learns best. Leo Postman writes:

Many of our educational, social, and legal practices are based on the assumption that rewards and punishments are effective and reliable tools for the modification of behavior. The general belief is that actions followed by rewards are strengthened, and actions followed by punishments are weakened. These assumptions of common sense have not received undivided support from experimental study. In fact, the role played by rewards and punishments has become one of the most controversial issues in modern learning theory (1962, p. 331).

### A. Punishment versus Reward

Recent confirmation of Postman's statement has come from research by various investigators, including the Principal Investigator, and leads to the conclusion that normal subjects learn better for punishment for incorrect choices (i.e., aversive tone) than for either reinforcement for correct choices (i.e., candy, tokens) or for reinforcement-punishment combinations for correct and incorrect responses (Brackbill & O'Hara, 1958; Buckwald, 1959; Buss & Buss, 1956; Penney & Lupton, 1961; Ratliff & Tindall, 1970; Ratliff & Root, 1973; Schlichter & Ratliff, 1971; Tindall & Ratliff, 1973). Although the literature is not entirely consistent on the performance of subjects in the reward-punishment condition, the literature is consistent on the performance of both the punishment and reward groups. Various explanations have been offered to account for the superior performance of subjects in the punishment groups (cf. Buss & Buss, 1956; Buckwald, 1959; Spence, 1966a, 1966b), but such explanations generally attribute to punishment an unusual motivational or informational component. Of equal interest is the finding that the performance of the reinforcement groups remains approximately at chance level.

Several investigators have advanced the hypothesis that material

rewards serve to distract the subject's attention from the cues that are relevant to the learning task and interfere with learning (Spence & Segner, 1967; Marshall, 1969), whereas other investigators have suggested that the critical variable may be number of training trials (Murphy & Miller, 1959). In response to the latter suggestion, Tindall and Ratliff (1973) increased the number of training trials from sixty to 100 and, again found no appreciable gain in performance. In a further effort, Ratliff and Root (1973) increased the number of training trials and employed rewards of high value selected by the individual subject in a paired comparisons task (modeled after Bisset & Rieber, 1966; Witryol & Fischer, 1967). Again subjects failed to show appreciable performance gains in the reward group.

Thus, overall, punishment (aversive tone) for incorrect responses has been found to lead to faster learning than either reward for correct responses or reward-punishment combinations for correct and incorrect responses, at least when subjects are not informed of the meaning of nonreinforced trials (cf., Hamilton, 1969; Spence & Segner, 1967).

#### B. Modality of Reinforcement

As previously discussed, not all investigators have found performance superiority for groups punished for incorrect choices, with various researchers including Spence (1966a), Spence and Segner (1967), and Hamilton (1969), finding no performance differences between groups when subjects are instructed as to the meaning of the nonreinforced trial. In addition, Whitehurst (1969) noted that, in most studies comparing the effects of reinforcement and punishment, punishment was delivered in a different sensory modality than the reinforcement, making the results hard to interpret. In a thorough study examining the effects of reinforcement and punishment on the performance of two different age groups

on a task with two levels of difficulty, Whitehurst found no significant difference between reinforcement and punishment. Although the results of Whitehurst's study are straightforward, the data are difficult to interpret since Whitehurst failed to compare the effects of punishment presented in the same sensory modality as the reinforcement with the effects of punishment presented in a sensory modality different from that of the reinforcement. Further, although punishment superiority seems to disappear when subjects are informed of the significance of the nonreinforced trial (cf., Hamilton, 1969), Whitehurst's use of such instructions for all groups confounded the effects of type of punishment with instructions. Thus, both the question of the effect of instruction on performance for incorrect responses and the question of the effect of modality of presentation of punishment remain unanswered.

### C. Individual Characteristics

#### 1. Sex of the Subject

In addition to the main treatment effect, in which groups punished for incorrect choices performed significantly better than groups reinforced for correct responses, Ratliff and Tindall (1970) found a significant sex of subject x reinforcement interaction in which male subjects performed well for punishment for incorrect responses and female subjects showed minimal evidence of learning for punishment.

In an elaboration of this design, Tindall and Ratliff (1973) performed a study in which subjects at three different age levels (second, fourth, and eighth grades) were run under either reward for correct choices, punishment for incorrect choices, or a reward-punishment combination for correct and incorrect choices. In addition, the male and female experimenters ran equal numbers of male and female subjects at each age

level. Again, a sex of subject x reinforcement condition interaction was found, with an additional significant interaction of sex of subject x sex of experimenter x reinforcement condition. Such findings, while similar to those of Stevenson (1961, 1964, 1965), are perhaps more germane to the study of reinforcement in that the treatment conditions involve punishment as opposed to the experimenter neutrality employed by Stevenson.

In summary, the results in this laboratory, to date, suggest that the sex of subject x reinforcement interaction observed by Ratliff and Tindall (1970) was part of a more elaborate interaction of organismic variables with treatment condition in which subjects perform better for punishment delivered by experimenters of the same sex. Thus, attention is directed to the importance of organismic variables (i.e., individual characteristics) in specifying reinforcer effectiveness.

## 2. Sex of Subject, Sex of Experimenter, and Social Reinforcement

Given that basic research with normal children should both enrich our theoretical understanding of learning and provide the base for more effective educational techniques, material rewards and punishments seem less likely to provide the base for classroom behavioral management than social reinforcers, despite the proliferation of token economies and the advent of precision teaching technology. In short, social reinforcement is a very common means of providing children (and adults) with information about their performance.

With this assumption, Ratliff and his colleagues began a series of investigations designed to further our understanding of social reinforcement. Ratliff, Morganstern, and Ratliff (1973), in a series of studies on verbal discrimination learning for social reinforcement ("right") and social punishment ("wrong") and a combination of the two, found a complex

interaction of sex of subject x sex of experimenter x reinforcement condition x trials. Across two replications of the initial study, the results held with smaller order interactions of the terms also being significant. Thus in two separate social reinforcement studies (involving two replications), with six different experimenters (three males and three females), and with 540 subjects, the initial observations of Ratliff and Tindall (1970) and Tindall and Ratliff (1973) were extended to young adult subjects in a verbal discrimination task as opposed to a visual discrimination task.

While suggesting that organismic variables may have a profound influence on performance and responsivity to social reinforcement, Ratliff, Morganstern, and Ratliff (1973) note the relationship of this research to previous research on verbal discrimination learning and, in addition, offer an alternative theoretical formulation. More specifically, much of the literature on nurturance and punitiveness of parents has been evaluated in terms of parents' responses to children of different sexes (cf., Becker, 1964) and seems to account adequately for these data.

First, it has been repeatedly reported that children of both sexes perceive their mothers as being more nurturant (i.e., reinforcing) than their fathers (cf., Kagan & Lemkin, 1960; Emmerich, 1959, 1962). Based on a history of such reinforcement, one would predict that, as the child develops into a young adult, he would learn well for social reward from a female regardless of his sex. These studies confirm such an expectation.

Secondly, parents of both sexes are perceived as being more permissive with opposite sex children (cf., Droppleman & Schaefer, 1963). One might predict from this finding that (1) females would learn better for reinforcement from a male than for punishment from a male, and that (2) males would

learn better for reinforcement from a female than for punishment from a female. Again, these assumptions are supported by these studies. Thirdly, parents are perceived as being more punitive and restrictive with same sex children (cf. Emmerich, 1962). From this finding one might assume that (1) males would learn better for punishment from a male E than for reward from a male E, and that (2) females would learn better for punishment from a female E than for reward from a female E. In this case, the former prediction was confirmed; but the latter was not, since female Ss with female Es performed better for right-wrong than for wrong-blank. Here, it seems probably that the mother's nurturance (i.e., reinforcement) combines with her punitiveness with the daughter, resulting in the female learning as well or better for right-wrong as for wrong-blank.

It might be noted here that in the right-blank group performance was slightly higher for female Ss with female Es than for female Ss with male Es, suggesting that the reward history for a female from the nurturant parent is equally, if not more, powerful than her reward history from the opposite-sex parent. In addition, particular male groups conform in the extreme to the observed pattern. Specifically, males learn very poorly for a male E when being rewarded, very well for a male E when being punished, and very much better for a female than for a male when being rewarded. It seems plausible that with the son, parental nurturance and discipline are more clear-cut. That is, the son expects punishment and little reward from the father because the father is both the like sex parent and the punitive parent. By the same token, he expects reward and little punishment from the mother because she is both the nurturant and the opposite-sex parent.

Thus it is hypothesized that the pattern of parental reinforcement under which the child perceives himself as being reared becomes an expectancy.

This expectancy, in turn, is reflected in the pattern of social reinforcement and punishment from which he learns most effectively as an adult. Thus, some obvious steps in our investigations are to determine 1) if and in what way the child's probably history of reinforcement in the home influences his responses to reward and punishment, and 2) how sex variables influence such responses, and, perhaps more important, 3) whether these results could be generalized across age groups or across populations that differ on other characteristics.

#### D. Other Characteristics of the Child

In discussing the possible differential evolution of reinforcement and punishment systems in children from different socioeconomic and cultural backgrounds, Havighurst (1970) offers us an additional theoretical rationale for the developmental approach to understanding the learning process in children. Specifically, Havighurst (1970) speculates that, for all children, reinforcements and punishments initially consist of tangible objects such as toys or food or aversive stimulation. With physical growth and experiential maturation, additional classes of reinforcement systems begin to develop, with verbal praise and censure being among the first to emerge. For disadvantaged and lower class children, Havighurst hypothesizes that systems of reinforcement other than material systems emerge more slowly. Although the data have not always been consistent in support of this hypothesis, a host of investigators have compared the performance of subjects from different socioeconomic backgrounds with different types of reinforcement (cf., Douvan, 1956; Spence, 1970, 1971, 1972; Spence & Denton, 1967; Spence & Segner, 1967; Terrell, 1958; Terrell & Kennedy, 1957; Cameron & Storm, 1969; Cradler & Goodwin, 1971; Sigler & de Labry, 1962; Sigler & Kanzer, 1962; Strain, Unikel, & Adams, 1969).

While both these results and the theory are intriguing, the empirical issue of matching the reinforcements the school has to offer with the reinforcement system within which the child operates has profound implications for designing educational techniques for specific classes of children. Indeed, studies of reinforcer effectiveness across different age groups (cf., Tindall & Ratliff, 1973) and across different populations (Schlichter & Ratliff, 1971; Ratliff & Shoulders, 1973; Ratliff & Bashore, 1973; Ratliff & Gutierrez, 1973) have become critical in the Principal Investigator's program of research. However, simply to describe such differences is hardly enough; rather, such findings must be sufficiently complete to allow them to be cast in a theoretical framework such as that proposed by Ratliff, Morganstern, and Ratliff (1973) which relates specific influences, such as parental discipline, to specific behavioral outcome. Thus, it seems that specifying the relationship of such parameters as age and sex of the child, patterns of parent (and teacher) discipline, and type of reinforcement becomes a critical issue in education.

## II. Summary and Specific Aims

In summary, a substantial literature on the performance of children with discrimination learning tasks has developed. Among the many parameters that have been investigated have been the 1) incentive value of the reinforcements employed (cf. Bissett & Rieber, 1966; Ratliff & Root, 1973); 2) task difficulty (cf. Meyer & Offenbach, 1962; Whitehurst, 1969); 3) age of subject (cf. Meyer & Sidman, 1960; Ratliff & Tindall, 1973); 4) sex of subject (cf. Curry, 1960; Stevenson, 1961, 1964, 1965; Ratliff & Tindall, 1970); 5) sex of subject and sex of experimenter (cf. Tindall & Ratliff, 1973; Ratliff, Morganstern, & Ratliff, 1972); and 6) nature of instruction (cf. Spence, 1966a, 1966c; Ratliff, 1973). While the results of each of the above

areas of investigation have proven fruitful, the development of a more comprehensive theory of learning in children has been hampered by a number of problems. Chief among these problems has been the unsystematic examination of groups of 1) differing ages, 2) tasks of differing difficulty, 3) instructions of differing information value, and 4) reinforcers of differing types.

Basic to this program is the assumption, based on research by this and other investigators, that effective learning techniques cannot be established clearly without first knowing how basic learning parameters interact with the characteristics of the child -- in this case, his age, his sex, the patterns of parental (and teacher) discipline to which he has learned to respond, and type of reinforcement. The purpose of the research program, then, was to systematically explore the relationship between parameters of reinforcement and individual characteristics of the child.

It was anticipated that such a systematic exploration should help determine and clarify the conditions of reinforcement under which the child learns best and help to clarify the relationship between the age of the child and the learning process.

### III. Procedures

#### a. Overview

The specific tasks employed varied somewhat with the nature of the question under investigation, but the basic task was a two choice discrimination learning task in which the subject was presented with two 4" x 4" squares equally divided into two black and white triangles. The discriminanda were presented to the subject on a modified Wisconsin General Test Apparatus with a lazy-susan turntable mounted in the center and the subject was to learn to choose the block with the base of the white triangle down and facing the child. In the visual discrimination task described, the subject was asked to point to the correct discriminanda

and the experimenter reinforced the subject with either a verbal or material reinforcement or did not respond, depending upon the condition of the experiment. Subjects were ordinarily given between 50 and 100 training trials with the left-right position of the correct choice being randomly determined. The subject was given ten seconds to make his choice and there was a ten second intertrial interval during which the experimenter recorded the subject's response and prepared the apparatus for the next trial. Subjects were asked to leave the classroom only once for a period of from twenty minutes to half an hour, since the entire learning procedure was conducted during one session.

At the end of the training session, each subject was thanked for his participation, and told he had done well (independent of his performance). The experimenter then asked the subject not to talk with his classmates about the task until they each had a chance to play, and he was then returned to his classroom.

#### b. Research Designs

The specific research questions to be asked were a continuation of the research on-going in this laboratory and were guided both by developments in the literature and by data gathered in the current program. However, the literature on discrimination learning in children is sufficient to reveal significant gaps in our knowledge and to suggest multiple questions relating to the broad parameters of age of subject, sex of subject, cultural background, parental and teacher discipline and related child rearing practices, complexity of task, and type of reinforcement.

The specific research strategy with which these problem areas were approached was an extension of the levels x levels strategy proposed by Gollin (1965), in which both individual characteristics (e.g., age of

subject) and task characteristics (e.g., complexity) were simultaneously manipulated in order to map and to describe the process under study. In all, six studies were run during the project period with the first three studies representing an effort to explicate task variables and the last three studies representing an effort to explicate both task and organismic variables. In general the progression of the studies was from material reinforcement and task variables to social reinforcement and organismic variables. Thus the overall purpose of the research program was to explore systematically the relationship between parameters of reinforcement, task variables, and organismic variables related both to experimenter and to subject.

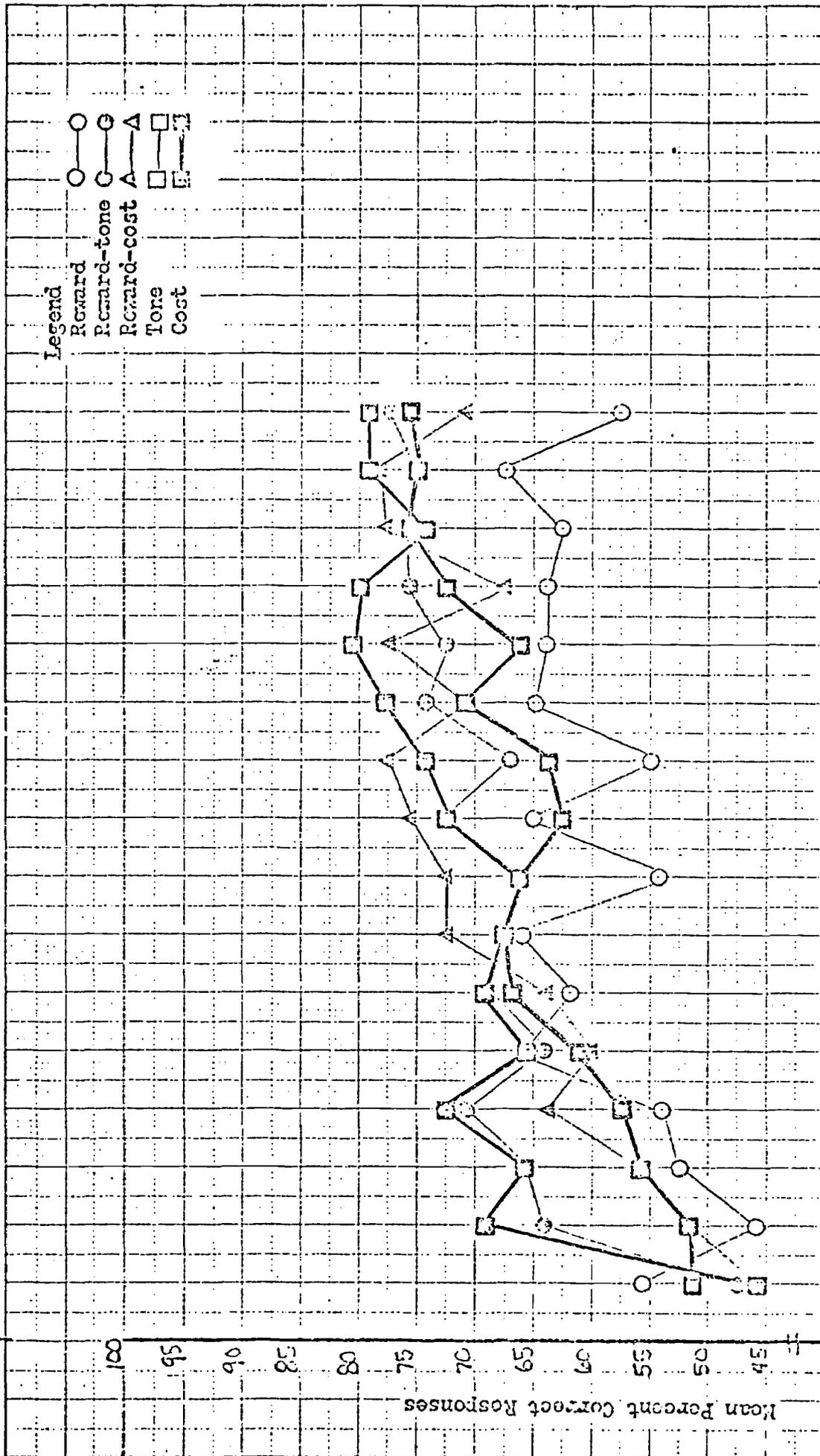
1. Study I. Study I was a two-choice discrimination learning task employing 160 fourth grade students, four experimenters (two male and two female), and five reinforcement conditions. The reinforcement conditions were reinforcement (1 token) for correct responses (Group R), 75 db, .1 sec. duration tone for each incorrect response (Group P), 75 db, .1 sec. duration tone for each incorrect response and one token for each correct response (Group RP), confiscation of one token for each incorrect response (Group C), and confiscation of one token for incorrect responses and reinforcement (1 token) for correct responses (Group RC). Equal numbers of male subjects were run by each male and female experimenter and each subject was given 80 acquisition trials. The final design, therefore, was a 4 x 5 x 80 factorial design combining four experimenters and five reinforcement conditions with repeated measures across eighty trials.

The purpose of Study I was to determine whether the previous observation that the superior performance of groups punished for incorrect responses was a function of punishment modality.

Results. The total number of correct responses in each of 16 blocks of five trials was submitted to a 2 x 5 repeated measures analysis of variance involving two experimenter teams, five levels of reinforcement and 16 repeated measures. The significant main effect of this analysis was the main effect of trials [ $F(15,2250) = 18.26, p < .01$ ] while the main effects of teams and reinforcement condition were not significant. However, the two-way interaction of reinforcement x teams [ $F(4,150) = 3.93, p < .01$ ], trials x teams [ $F(15,2250) = 1.96, p < .01$ ], and trials x reinforcement [ $F(60,2250) = 1.55$ ] were also significant, as was the three way interaction of trials x reinforcement x teams [ $F(60,2250) = 1.48, p < .05$ ]. The overall results of this study are presented in Figure 1.

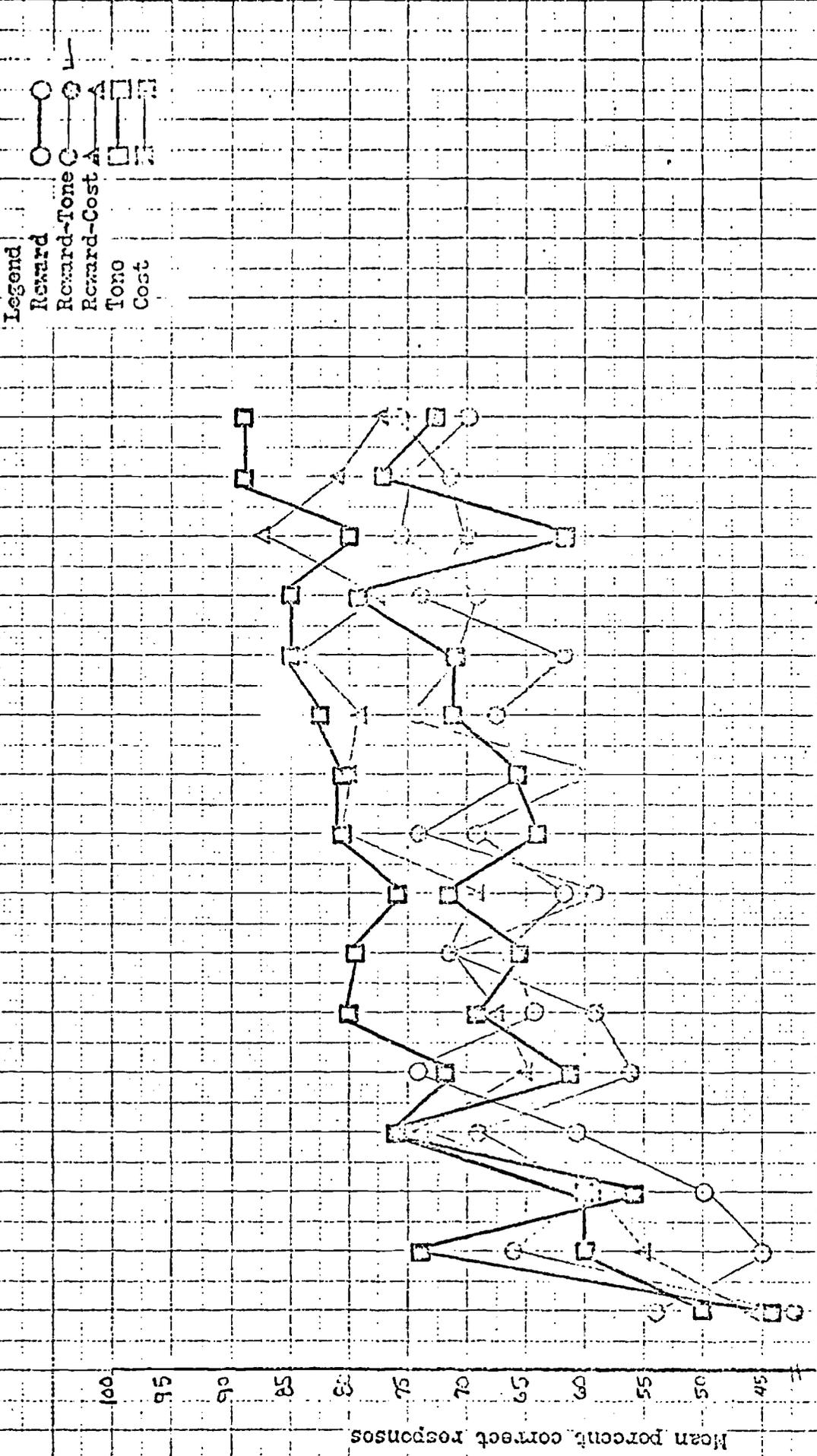
Inspection of Figure 1 reveals that the performance of the response cost group was superior to the tone group while both were superior to the performance of the reinforcement group. The performance of the reinforcement-tone and reinforcement-response cost group was intermediate to that of the tone and cost groups alone. Thus, overall groups punished for incorrect responses performed better than groups rewarded for correct responses. Within the punishment group, response cost groups performed better than tone groups. The results involving teams, which are depicted in Figures 2 and 3, are that the performance of team 2 differed from that of team 1 both in that the performance of subjects run by team 2 was highly variable, and in that the performance of the reward-tone group was reversed. With team 1 the reward-tone group showed performance gains late in the acquisition series and reached a peak of approximately 70 per cent correct responding whereas with team 2 the performance of the reward-tone group improved early in the series and reached a peak performance of 80 per cent correct responding.

Legend  
 Reward ○—○  
 Reward-tone ○—○  
 Reward-cost A—A  
 Tone □—□  
 Cost □—□



Blocks of Five Trials

Figure 1. Mean Percent Correct Responses as a Function of Blocks of Five Trials for Five Conditions.



Blocks of Five trials

Figure 1. Mean percent correct responses for Reward, Reward-Tone, Reward-Cost, Tono, and Cost conditions.

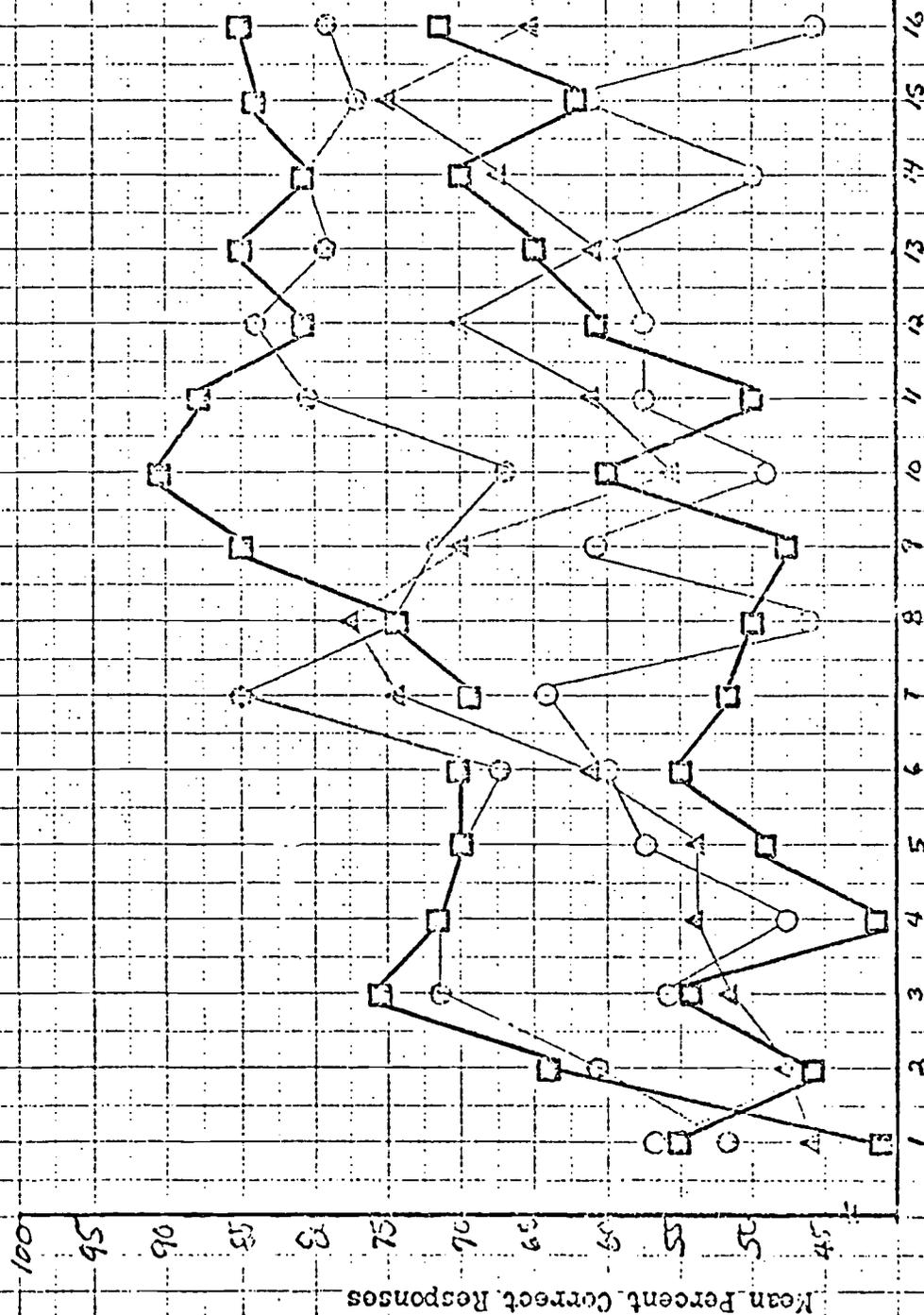
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Legend

- Reward
- Reward-Tone
- Reward-Cost
- Tone
- Cost



Blocks of Five trials

Effect of reinforcement conditions for tone 2.

2. Study II. Study II (Ratliff, 1972) was an extension of Study I which again compared the effects of punishment presented in the same and in different sensory modalities as the reinforcement (i.e., response cost and tone) on a two-choice discrimination task (identical to that used by Whitehurst, 1969) in which one half of the 160 third grade male subjects were given full instructions as to the meaning of the non-reinforced trial and one half received no information about the meaning of the non-reinforced trial. The final design was a 2 x 2 x 5 factorial combining two experimenters, two levels of information, and the same five reinforcement conditions employed in Study I, with repeated measures on the trials variable. Each subject was given 60 training trials. The task, which differed from Study I, was adopted from Whitehurst (1969) to assess whether previous results obtained in this laboratory were peculiar to the discrimination task typically employed by the Principal Investigator and his co-workers.

Results. The total number of correct responses in each of 12 blocks of five trials was submitted to a 2 x 2 x 5 repeated measures analysis of variance. This analysis revealed a significant main effect of reinforcement condition [ $F(4,140) = 3.59, p < .01$ ] and a significant main effect of trials [ $F(11,1540) = 44.62, p < .001$ ]. No other main effects or interactions were significant. Of special interest was the failure to find either a significant main effect of instructions or a significant interaction involving instructions.

The results of Study II are depicted in Figure 4 where the graph reveals that the performance for reward cost was superior to the performance for tone alone or for reward alone. Interestingly, there were no significant performance differences between the response cost, reinfor-

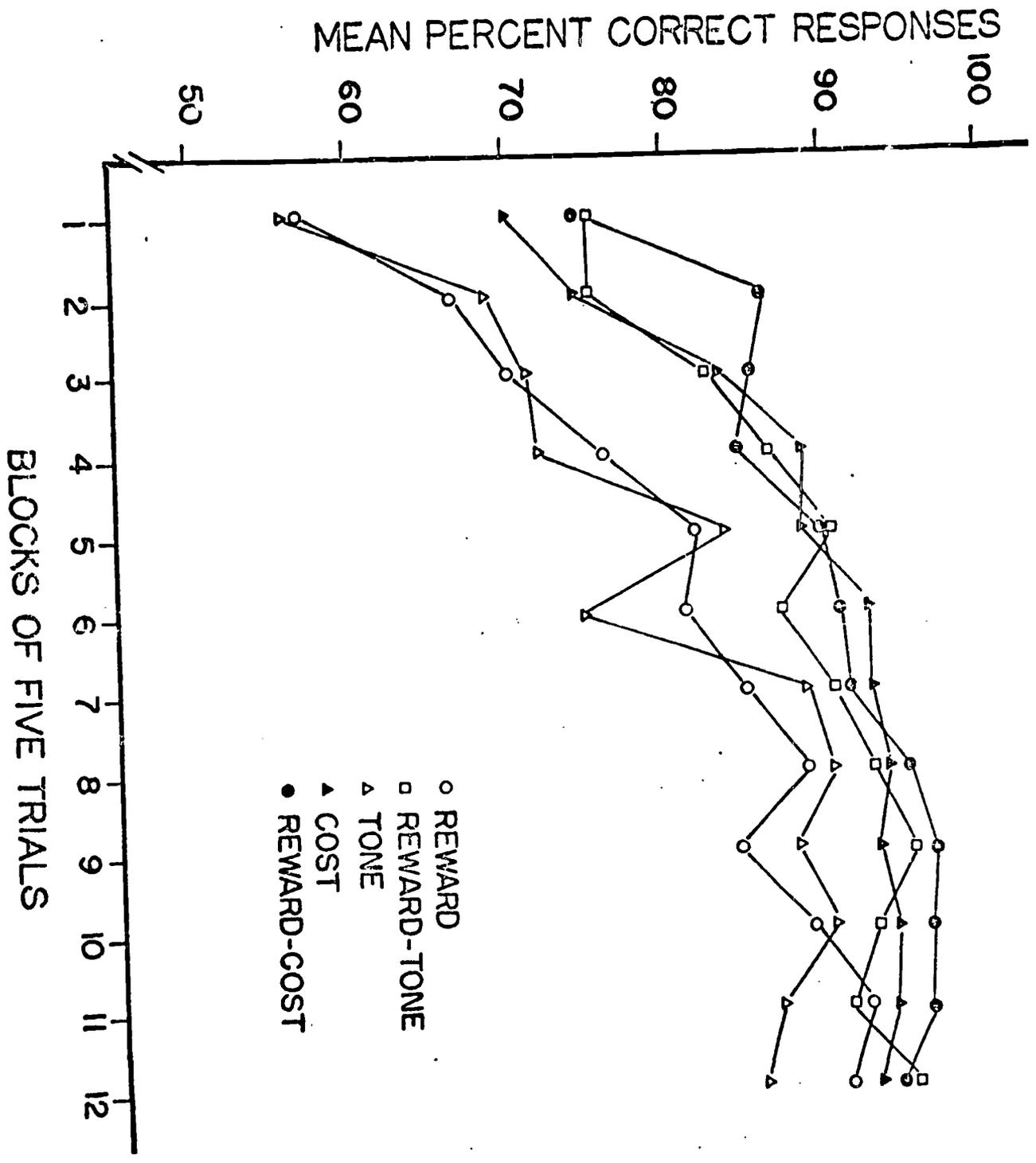


Figure 4

(35)

cement-response cost, nor the reinforcement-tone groups, nor were there any significant performance differences between the reinforcement and tone groups.

3. Study III. Study III was designed as a pilot study to assess the possible relationship between sex of subject and experimenter and delay of reinforcement. The design was a 2 x 2 x 2 factorial involving two experimenters (one male and one female), immediate or delayed reinforcement (0 seconds delay versus 30 seconds delay), and equal numbers of male and female subjects in each group for a total of 40 subjects. Each subject was run a total of 65 training trials.

Results. The total number of correct responses in each of 13 blocks of five trials was submitted to a 2 x 2 x 2 factorial analysis of variance with repeated measures on the trials variables.

The results of the analysis of variance were a significant main effect of trials [ $F(12,432) = 4.39, p < .001$ ] indicating that all subjects learned irrespective of reinforcement condition. No other effects were significant but inspection of Figure 5 reveals that across trials subjects performed better for immediate reinforcement than for delayed reinforcement although the effect was not statistically significant. Of interest was the failure of the major independent variables to produce significant results. No obvious explanations are available to account for these negative results but one possibility is that subjects shared information about the nature of the task. Since the subjects were all drawn from an open space classroom, this possibility cannot be discounted. Further, the discriminanda were presented on a rear projection screen mounted in a Lehigh Valley Human Test System apparatus which may have heightened subjects' attention to the task and increased rate of acquisition.

4. Study IV. Study IV was designed as a pilot investigation to

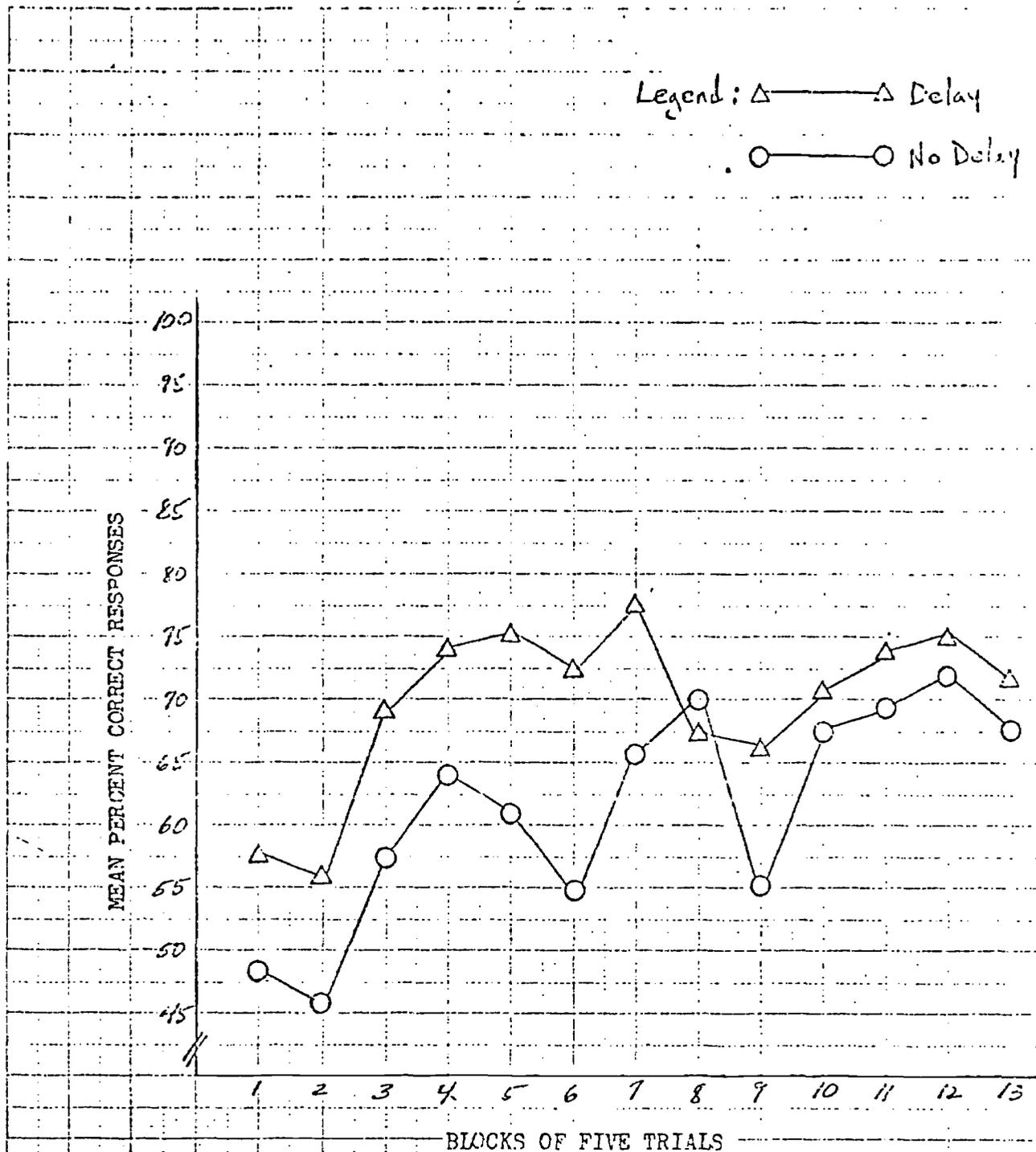


Fig. 5 Mean Performance Score as a Function of Delay of Reinforcement Condition and Five-Trial Block.

10 Millimeter to the Centimeter

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determine the responsivity of sixth grade children to social reinforcement. The study was a  $2 \times 2 \times 3$  repeated measures design in which male and female experimenters ran equal numbers of male and female sixth grade subjects on a two-choice discrimination learning task, for either verbal reinforcement ("right") for correct responses, verbal punishment ("wrong") for incorrect choices, or a combination of verbal reinforcement and verbal punishment for correct and incorrect responses. Each of the 96 subjects were run a total of fifty trials.

Results. The total number of correct responses in each of five blocks of ten trials were submitted to a  $2 \times 2 \times 3$  repeated measures analysis of variance. The results were a significant main effect of reinforcement contingency [ $F(2,84) = 4.58, p < .025$ ], a significant main effect of trials [ $F(4,336) = 43.05, p < .001$ ], and a significant trials  $\times$  sex of subject  $\times$  sex of experimenter  $\times$  reinforcement contingency interaction [ $F(8,336) = 2.20, p < .025$ ]. The results of this study are presented in Figures <sup>6, 7, 8.</sup> 5, 6, and 7.

Multiple contrasts between group means revealed that with a male experimenter male subjects performed best for the verbal reinforcement-verbal punishment combination whereas with female subjects no significant differences were observed between the performance of the three reinforcement groups. With a female experimenter, male subjects performed best for the verbal reinforcement and verbal reinforcement-verbal punishment combination whereas females performed best with the verbal reinforcement-verbal punishment combination.

Thus the complex interaction of the experimental variables with trials suggests that social reinforcement effects are contingent, in part, on both the sex of the subject and the sex of the experimenter.

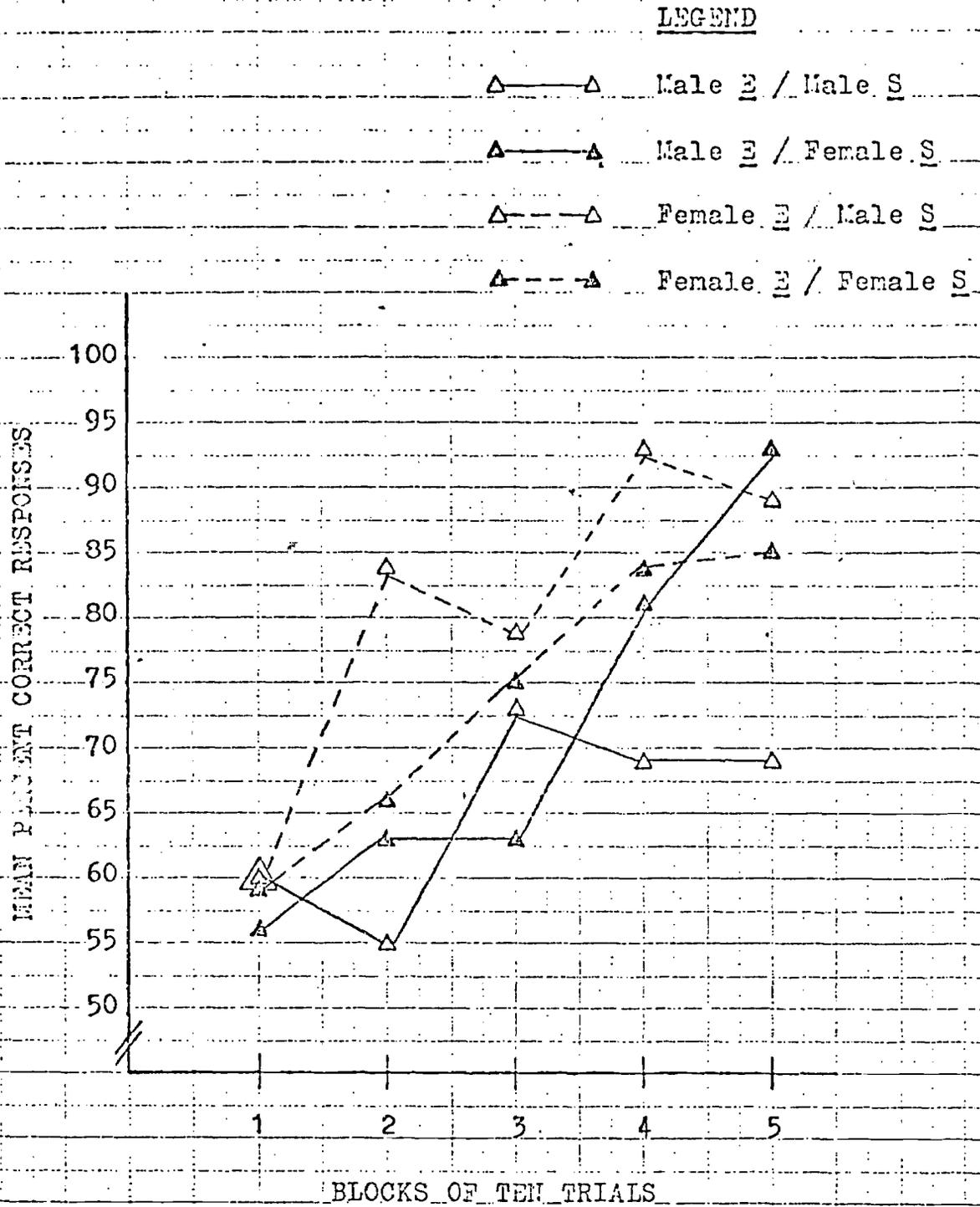


Figure 6, Mean Performance Score for Sixth Grade Subjects as a Function of Verbal Reinforcement Contingency, Sex of <sup>Subject</sup> ~~Experimenter~~, Sex of <sup>Experimenter</sup> ~~Subject~~, and Ten Trial Blocks

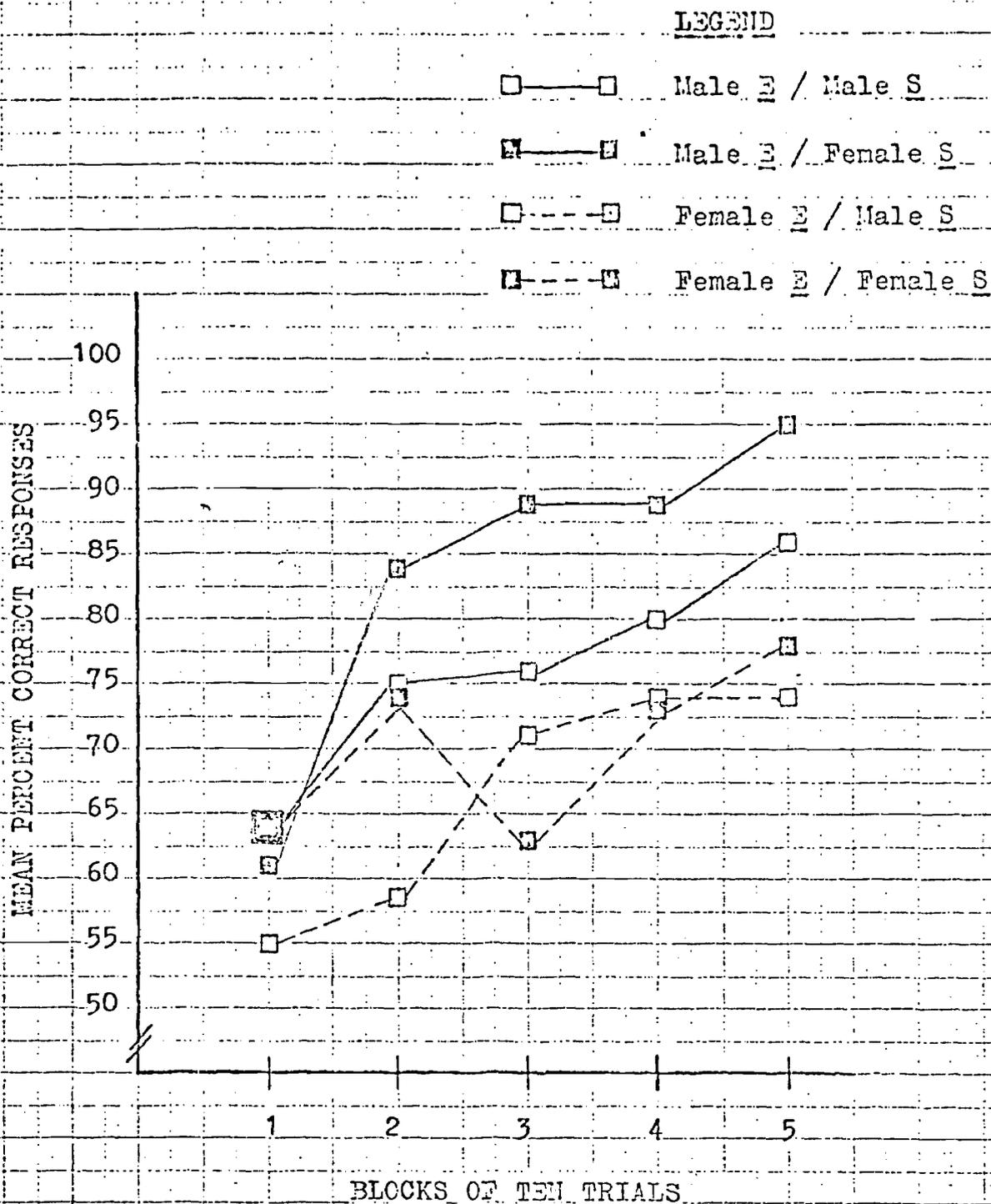


Figure 7. Mean Performance Score for Sixth Grade Subjects as a Function of Verbal Punishment Contingency, Sex of Experiment<sup>er</sup> and Sex of Subject, and Ten Trial Blocks

LEGEND

- Male E / Male S
- Male E / Female S
- - -○ Female E / Male S
- - -● Female E / Female S

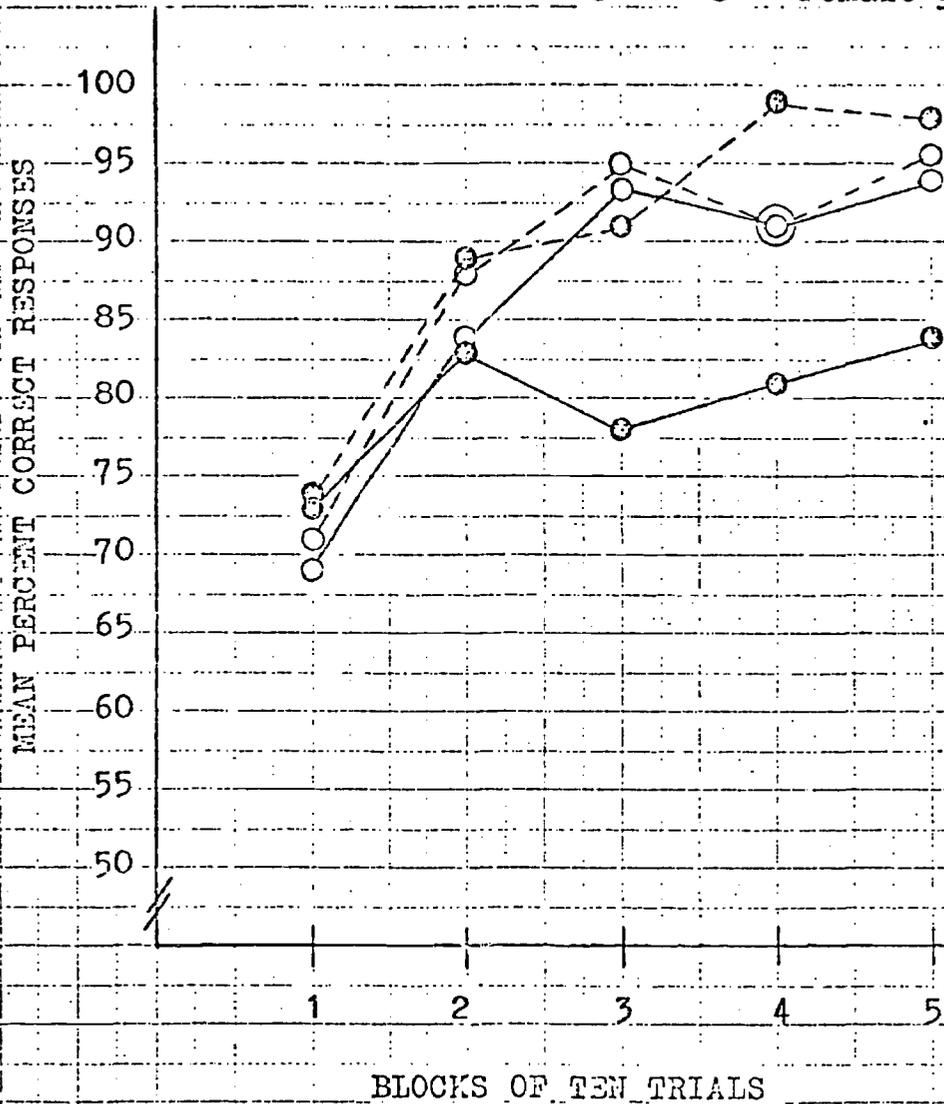


Figure 8.

Mean Performance Score for Sixth Grade Subjects as a Function of Verbal Reinforcement-Verbal Punishment Contingency, Sex of Experimenter, Sex of Subject, and Ten-Trial-Blocks

Further, the results suggest that the complex interaction observed in adult subjects by Ratliff *et al.* (1973) may be observed at a much earlier date and may be dependent, in part, on developmental variables reflected by the child's age.

5. Study V. Study V was designed to assess developmental trends in discrimination learning. Accordingly, subjects from the fourth and eighth grades were run on the same two-choice discrimination learning task previously employed with male and female experimenters (two male, two female) running equal numbers of male and female subjects from each grade level for a total of 197 subjects. The final design was a  $2 \times 2 \times 3 \times 3$  factorial design manipulating sex of subject, sex of experimenter, two grade levels, and three types of social reinforcement. The latter condition again was "right" for correct responses, "wrong" for incorrect responses, and a combination of "right" and "wrong" for correct and incorrect responses. Each subject was run a total of fifty trials.

Results. Since the procedures of Study IV were identical to those of Study V, the total number of correct responses from the sixth grade subjects run in Study IV were combined in five blocks of 10 trials with the total number of correct responses from the fourth and eighth grades and were submitted to a  $2 \times 2 \times 3 \times 3$  repeated measures analysis of variance. The results were a significant main effect of grade [ $F(2,252) = 6.97$ ,  $p < .001$ ], a significant main effect of trials [ $F(4,1008) = 115.38$ ,  $p < .001$ ], and a significant third order interaction of sex of experimenter  $\times$  sex of subject  $\times$  reinforcement contingency  $\times$  trials [ $F(8,1008) = 1.97$ ,  $p < .05$ ].

The main effect of grade reflected that performance on the discrimination task used in this study steadily improved with age such

that each older age group performed better than each younger age group.

The significant third order interaction was observed with fourth grade subjects, but disappeared with eighth grade subjects as revealed by separate analysis of variance performed on each age group. Figures 9, 10, and 11 present this relationship.

Multiple contrasts between group means for each age group revealed that with male experimenters, fourth grade male subjects did not differ in performance for each of the contingencies whereas female subjects performed well for either verbal reinforcement or the combination of verbal reinforcement and verbal punishment, but not as well for verbal punishment. With female experimenters fourth grade male subjects performed equally well for each of the reinforcement contingencies whereas fourth grade female subjects performed best for verbal punishment with verbal reinforcement and the verbal reinforcement-verbal punishment groups not differing significantly. With sixth grade subjects the results were that with a male experimenter male subjects performed equally well for verbal reinforcement and verbal punishment with both groups performing better than the verbal reinforcement-verbal punishment combination, whereas female subjects performed best for verbal reinforcement and the verbal reinforcement-verbal punishment combination. With a female experimenter, male subjects performed equally well for each of the three reinforcement contingencies whereas female subjects performed best for the verbal reinforcement-verbal punishment combination with performance for the other two contingencies not differing significantly. Finally, with eighth grade subjects, there were no significant sex differences with all subjects performing equally well for each contingency.

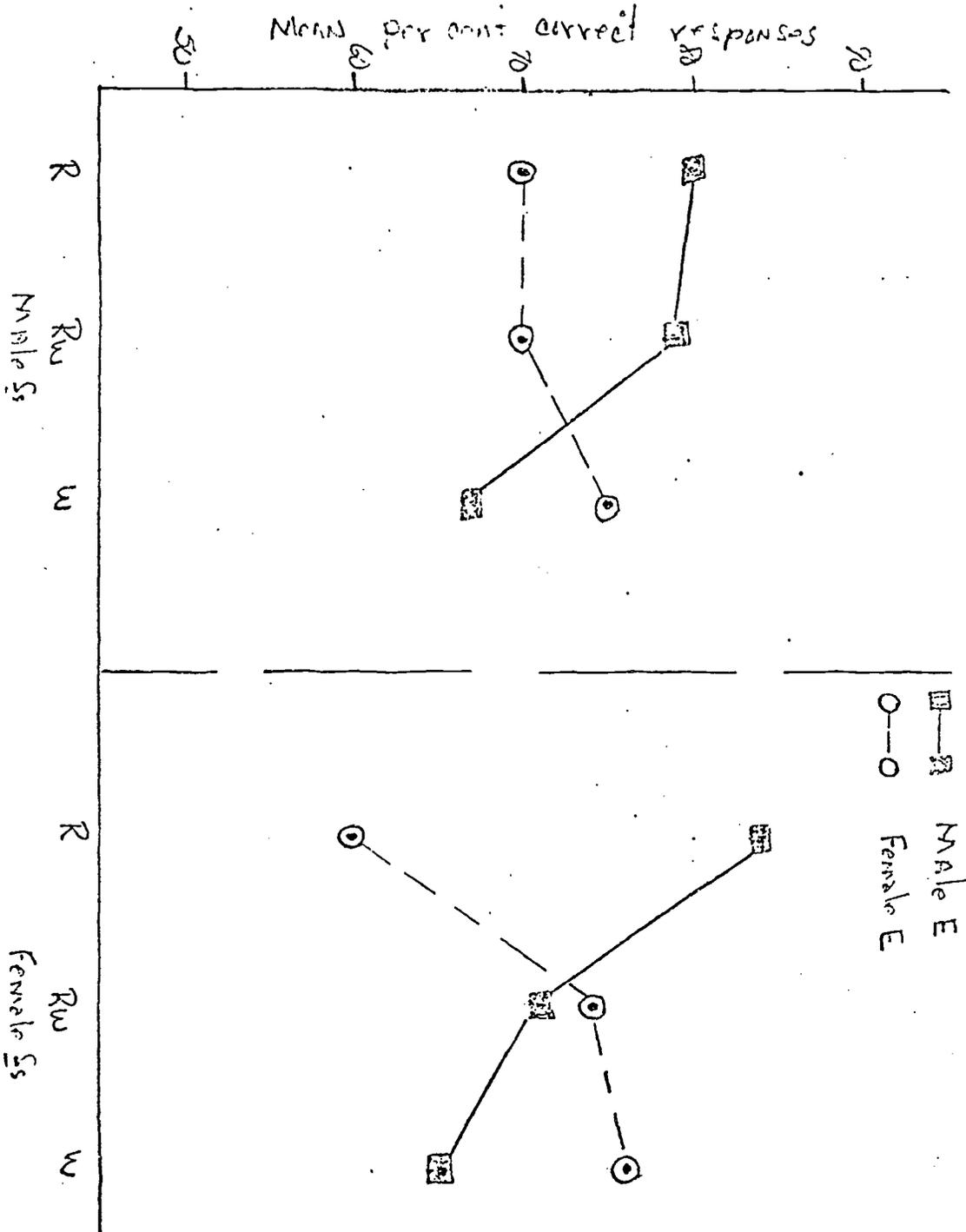


Figure 9 Mean percent correct responses for fourth grade subjects in a function of sex of E, sex of S, and reinforcement condition.

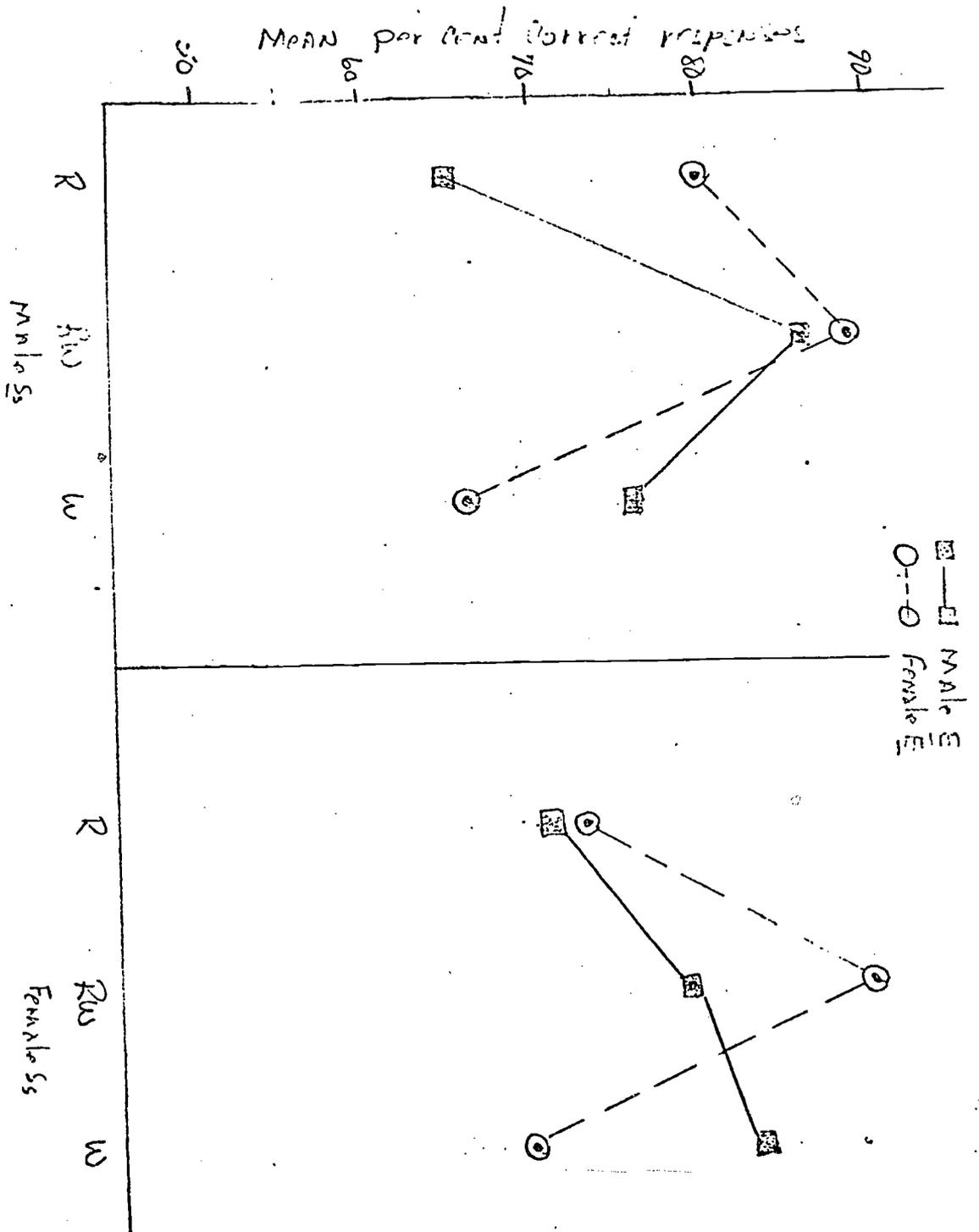


Figure 10 MEAN per cent correct responses of sixth grade subjects as a function of sex of E, Sex of S, and reinforcement condition

Mean percent correct responses

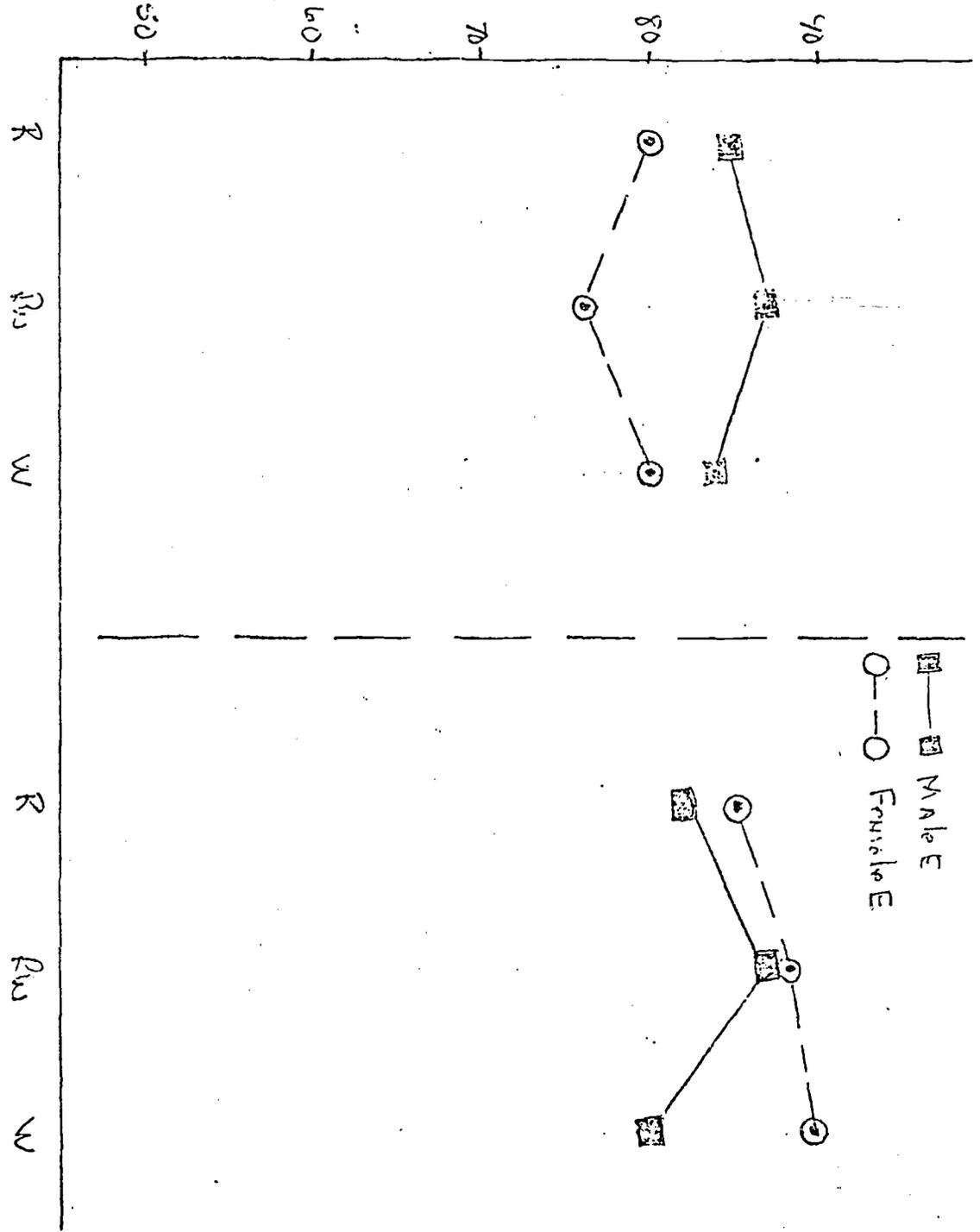


Figure 11. Mean percent correct responses for eighth grade subjects as a function of sex of E, sex of S, and reinforcement condition.

6. Study VI. Study VI was designed to assess the relationship of parental discipline to discrimination learning for social reinforcement. Each S from the fourth and eighth grade who participated in Study V was given a perceived parental discipline test prior to being run on the discrimination task. For the perceived parental discipline measure groups of five children were shown a series of 35 mm slides picturing a mother, father, boy, and girl in different situations (cf., Kagan, 1961). A series of questions were asked the child about the slides to ascertain which parent is perceived by the child as being most nurturant, strongest, and so on. Following participation in this portion of the research, children were then assigned to groups in a 2 x 2 x 3 factorial design manipulating sex of experimenter, sex of subject, and three social reinforcement conditions (i.e., "right" for correct responses, "wrong" for incorrect responses, and "right"- "wrong" for correct and incorrect responses).

Results. The results of Study VI were analyzed in two separate components. First, the scores the children received on the perceived parental discipline measure were scored such that the child's perception of the mother and father as being either punitive or nurturant could be coded. These results were submitted to separate analyses of variance for both the punitive and nurturant factors for each parent. On the punitive scale, fourth and eighth grade subjects, whether male or female, rated the mother as being low on punitiveness and rated the father as being high on punitiveness. On the nurturance scale the mother was seen by fourth grade subjects as being more nurturant than the father, whereas eighth grade subjects rated both parents as being equally nurturant.

Secondly, subjects were separated into groups in accordance with their perceptions of parental discipline and their discrimination task scores were submitted to a 2 x 2 x 3 analysis of variance with sex of subject, parental nurturance (or parental punitiveness), and reinforcement contingency being the three variables on which subjects were stratified. No significant relationships between parental discipline and reinforcement contingency were observed.

#### IV. Conclusions

The results of the present series of investigations suggest that, overall, punishment for incorrect responses produces superior performance to reinforcement for correct responses. However, a number of factors limit this generalization with the effects of type of punishment seeming to vary with the nature of the task. In Study I both the tone and response cost punishment groups performed better than the reinforcement group whereas in Study II only the response cost group performed better than the reinforcement group. One crucial difference between the studies was the nature of the task. In Study I, the task typically employed in this laboratory was employed and the modality of presentation of the punishment was varied. In Study II, a different task was employed while varying the modality of presentation of the punishment. The difference appeared to be in the difficulty of the task with Study I employing a difficult task and Study II a less difficult task. In Study II all groups learned quickly and reached an asymptote of roughly 90% correct responding whereas in Study I the groups were more diverse both with rate and asymptote of performance. Thus, the effects of punishment appear to vary both with the modality of the punishment and the nature of the task.

In addition to conclusions regarding punishment, the effects of

social reinforcement and punishment were shown to vary with sex of subject and experimenter and age of subject. Thus, the complex interaction of sex of subject, sex of experimenter, and reinforcement was observed with the fourth and sixth grade subjects but disappeared with the eighth grade subjects. Such results suggest a strong developmental influence in the results. However, in looking at the data and speculating as to why there was no significant interaction of sex variables and social reinforcement for eighth grade subjects, one must not overlook the possibility that for this age group the task was so easy as to obscure relationships between the independent variables.

The results of the research with perceived parental discipline provide support for the earlier research on parental discipline (cf., Kagan, 1961; Emmerich, 1959). In addition, the results of this research extend the findings of earlier research (cf., Kagan, 1961) by describing perceived parental discipline in subjects considerably older than those employed in previous research. Of particular interest was the finding that differences in perceptions of mother and father as being either predominantly nurturant or punitive tend to disappear.

## References

- Bissett, B. M., & Rieber, M. The effects of age and incentive value on discrimination learning. Journal of Experimental Child Psychology, 1966, 6, 199-206.
- Becker, W. C. Consequences of different kinds of parental discipline. In M.L. Hoffman & L.W. Hoffman (Eds.), Review of Child Development Research. Vol. 1, New York: Russell Sage Foundation, 1964, pp. 169-208.
- Brackbill, Y., & O'Hara, J. The relative effectiveness of reward and punishment for discrimination learning in children. Journal of Comparative and Physiological Psychology, 1958, 51, 747-751.
- Buchwald, A. M. Extinction after acquisition under different verbal reinforcement combinations. Journal of Experimental Psychology, 1959, 57, 43-48.
- Buss, A. H., & Buss, E. H. The effect of verbal reinforcement combinations on conceptual learning. Journal of Experimental Psychology, 1956, 52, 283-287.
- Cameron, A., & Storm, T. Achievement motivation in Canadian Indians, middle- and working-class children. Psychological Reports, 1965, 16, 459-463.
- Cradler, J. D., & Goodwin, B. L. Conditioning of verbal behavior as a function of age, social class, and type of reinforcement. Educational Psychology, 1971, 62, 279-284.
- Curry, C. The effects of verbal reinforcement combinations on learning in children. Journal of Experimental Psychology, 1960, 59, 434.
- Douvan, E. Social status and success striving. Journal of Abnormal and Social Psychology, 1956, 52, 219-223.
- Emmerich, W. Parental identification in young children. Genetic Psychology Monographs, 1959, 50, 257-308.
- Emmerich, W. Variations in the parent role as a function of the parent's sex and the child's sex and age. Merrill-Palmer Quarterly, 1962, 8, 1-11.
- Gollin, E. S. A developmental approach to learning and cognition. In L.P. Lipsett & C.C. Spiker (Eds.), Advances in Child Development and Behavior; Vol. 2., New York: Academic Press, 1965.
- Hamilton, M.L. Discrimination learning in children as a function of verbal-reinforcement combination and information. Journal of Genetic Psychology, 1969, 114, 283-290.
- Havighurst, R.J. Minority subcultures and the law of effect. American Psychologist, 1970, 25, 313-322.

- Kagan, J. & Lemkin, J. The child's differential perception of parental attributes. Journal of Abnormal and Social Psychology, 1960, 61, 440-447.
- Katz, I. Review of evidence related to the effects of desegregation on the intellectual performance of negroes. American Psychologist, 1964, 19, 381-399.
- Marshall, H. H. Learning as a function of task interest, reinforcement, and social class variables. Journal of Educational Psychology, 1969, 60, 133-137.
- Meyer, W. J., & Offenbach, S. I. Effectiveness of reward and punishment as a function of task complexity. Journal of Comparative and Physiological Psychology, 1962, 55, 532-534.
- Meyer, W. J., & Seidman, S. B. Age differences in the effectiveness of different reinforcement conditions on the acquisition and extinction of a simple concept learning problem. Child Development, 1960, 31, 419-429.
- Murphy, J. V., & Miller, R. E. Spatial contiguity of cue, reward, and response in discrimination learning by children. Journal of Experimental Psychology, 1959, 58, 485-489.
- Penney, R. K. Effect of reward and punishment on children's orientation and discrimination learning. Journal of Experimental Psychology, 1967, 75, 140-142.
- Penney, R. K., & Lupton, A. A. Children's discrimination learning as a function of reward and punishment. Journal of Comparative and Physiological Psychology, 1961, 54, 449-451.
- Postman, L. Rewards and punishments in human learning. In L. Postman (Ed.), Psychology in the Making. New York: Knopf, 1962.
- Ratliff, R. G. Two-choice discrimination learning in children as a function of punishment modality and reinforcement combinations. Journal of Experimental Child Psychology, 1972, 3, 365-371.
- Ratliff, R. G. & Bashore, T. Discrimination learning as a joint function of delay of reinforcement and delinquent sub-type. In preparation for submission to Journal of Research in Crime and Delinquency.
- Ratliff, R. G., & Donohue, B. The effects of reward, punishment, and knowledge of results on children's discrimination learning. In preparation for submission to Journal of Experimental Child Psychology.
- Ratliff, R. G., & Garcia, R. J. Perceived parental discipline and discrimination learning in children. In progress.
- Ratliff, R. G., & Gutierrez, A. The effects of social reinforcement and punishment on a two-choice discrimination task as influenced by ethnic background of experimenter and ethnic background and age of subject. In progress.

- Ratliff, R. G., Morganstern, K. P., & Ratliff, A. R. Patterns of learning in verbal discrimination as an interaction of social reinforcement and sex combinations. Under review, Journal of Personality.
- Ratliff, R. G., & Root, K. J. Two-choice discrimination learning in children as a joint function of incentive level and punishment. Journal of Genetic Psychology, in press.
- Ratliff, R. G., & Shoulders, D. I. Delay of reinforcement and two-choice discrimination learning in delinquent and non-delinquent boys. Under review, Journal of Personality.
- Ratliff, R. G., & Tindall, R. C. Interaction of reward, punishment, and sex in a two-choice discrimination task with children. Developmental Psychology, 1970, 3, 150.
- Schlicter, K. J., & Ratliff, R. G. Discrimination learning in juvenile delinquents. Journal of Abnormal Psychology, 1971, 77, 46-48.
- Spence, J. T. Effects of verbal reinforcement combination and instructional condition on performance of a problem-solving task. Journal of Personality and Social Psychology, 1966, 3, 163-170. (a)
- Spence, J. T. The effects of verbal reinforcement combination on the performance of a four-alternative discrimination task. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 421-428. (b)
- Spence, J. T. Verbal discrimination performance as a function of instructions and verbal-reinforcement combinations in normal and retarded children. Child Development, 1966, 37, 269-281. (c)
- Spence, J. T. Distracting effects of material reinforcement in the discrimination learning of lower and middle-class children. Child Development, 1970, 41, 103-112.
- Spence, J. T. Do material rewards enhance the performance of lower class children? Child Development, 1971, 42, 1461-1470.
- Spence, J. T. Verbal and nonverbal rewards and punishments in the discrimination learning of children of varying socioeconomic status. Developmental Psychology, 1972, 6, 381-384.
- Spence, J. T., & Denton, M. C. The influence of verbal and nonverbal reinforcement combinations in the discrimination learning of middle- and lower-class preschool children. Child Development, 1967, 38, 1177-1186.
- Spence, J. T., & Segner, L. L. Verbal versus nonverbal reinforcement combinations in the discrimination of middle- and lower-middle class children. Child Development, 1967, 38, 29-38.

- Stevenson, H. W. Social reinforcement with children as a function of CA, sex of E, and sex of S. Journal of Abnormal and Social Psychology, 1961, 63, 147-154.
- Stevenson, H. W. Social reinforcement of children's behavior. In L.L. Lipsett and C.C. Spiker (Eds.), Advances in Child Development, Vol. 2, New York: Academic Press, 1965, pp. 97-126.
- Stevenson, H. W., & Allen, S. Adult performance as a function of sex of experimenter and sex of subject. Journal of Abnormal and Social Psychology, 1964, 68, 214-216.
- Strain, G. S., Unikel, I. P., & Adams, H. E. Alternation behavior by children from lower socioeconomic groups. Developmental Psychology, 1969, 1, 131-133.
- Terrell, G., Jr. The role of incentive in discrimination learning in children. Child Development, 1958, 29, 231-236.
- Tindall, R. C., & Ratliff, R. G. Interaction of reinforcement conditions and developmental level in a two-choice discrimination task with children. Under review, Journal of Experimental Child Psychology, 1973.
- Turner, Charles. Effects of tester and need for approval on children's learning. Educational Psychology, 1971, 62, 240-244.
- Whitehurst, G. J. Discrimination learning in children as a function of reinforcement condition, task complexity, and chronological age. Journal of Experimental Child Psychology, 1969, 7, (2), 314-325.
- Winer, B. J. Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.
- Witryol, S. M., & Fischer, W. F. Scaling children's incentives by a method of paired comparisons. Psychological Reports, 1960, 7, 471-474.
- Zigler, E., & deLabry, J. Concept-switching in middle-class, lower-class, and retarded children. Journal of Abnormal and Social Psychology, 1962, 65, 267-272.
- Zigler, E., & Kanzer, T. The effectiveness of two classes of verbal reinforcers on the performance of middle and lower class children. Journal of Personality, 1962, 30, 157-163.