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EFFECTS OF CONTINGENT AND NONCONTINGENT SOCIAL REINFORCEMENT ON PERFORMANCE OF CHILDREN IN A BALL-STRIKING SKILL

by

Nancy Jo Bailey

A Dissertation Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
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Approved by

E. Doris McKinney
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APPROVAL PAGE

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The study was conducted to determine effects of contingent and noncontingent social reinforcement on preschool children performing a ball-striking skill. Answers to the following questions were sought: (1) Do the performance results of practice accompanied by contingent social reinforcement differ from the results of practice accompanied by noncontingent social reinforcement? (2) Do levels of performance, as measured by the number of target hits, the distance at which the target is hit, and form consistency scores, increase with practice? (3) Do children who are high achievers in hitting the target differ from low achievers in form consistency?

Twelve preschool children, enrolled in the Experimental Kindergarten at the Institute for Child and Family Development at The University of North Carolina at Greensboro, served as subjects for the study. The nine boys and three girls were matched for age, sex, and pretest scores, and then randomly assigned to one of three groups. Subjects in two groups practiced the skill individually with praise given contingently or noncontingently in a counterbalanced order. Subjects in the third group served as a no-practice control. Practice periods were distributed over four weeks. All subjects were tested at the end of the second and the fourth week.

The task consisted of striking a ball toward a target with a table tennis paddle. The ball was projected down a trough which was adjustable for height. The target was adjustable for height

and distance. All testing was filmed at 32 frames per second with a Kodak Instamatic M8 camera.

The Friedman rank-order analysis of variance was used for comparing performances among the treatment conditions and for comparing performances among the three test periods. The Walsh test was used to analyze the difference between the number of target hits during practice under contingent or noncontingent social reinforcement. The Walsh test was also used to analyze differences between groups and between test periods when performance differences were first found as a result of the analysis of variance.

The major findings were: (1) During practice, children hit the target more often when social reinforcement was given immediately upon hitting the target than when social reinforcement was given without regard to accomplishment. (2) Children who practiced increased their number of target hits, while children who did not practice did not increase target hits. No differences were found in the distance at which the target was hit or in form consistency scores between children who practiced and children who did not practice. (3) High achievers in hitting the target did not increase their form consistency as practice proceeded, while low achievers displayed increased consistency in selected aspects of form.

On the basis of the findings, the following conclusions were made: (1) contingent social reinforcement, when compared with noncontingent social reinforcement, aids children in the performance of physical skills; (2) levels of skill performance of preschool children can be increased by practice; (3) high achievers

tend to be versatile in form, while low achievers tend to display increasingly similar responses as practice proceeds.

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CHAPTER I

INTRODUCTION

Methods of instruction in physical education have been influenced in their development over the years by educational priorities of the times. Early in this century, pragmatic educational philosophers attempted to eliminate the mind-body dualistic concept of man from educational thinking, and to base upon the logic of the experimental method a modern concept of the learning-teaching process. The prime educational priority shifted from training the mind and the body to teaching students how to learn, so that they could continue to learn after their formal schooling ended. Physical educators advocated increased student control in planning instructional activities. Problem solving was advocated as an instructional method designed to foster the student's taking initiative for his own learning. Contemporary writers retain the idea that methods of instruction should promote independent learning on the part of the student, but are more explicit in describing the kind of behavior the student should show as a result of schooling. They advocate the development of methods of instruction that contribute to the acquisition of technical skills, but at the same time contribute to the student's ability to acquire on his own the new skills required by our rapidly changing culture (Rubin, 1969). The application of a behavior technology

to education is one approach among many suggested for meeting today's educational priorities.

Behavior technology consists of the extrapolation to applied settings the principles of behavior and concepts of learning derived from controlled laboratory research (Bandura, 1969). Interest in applying behavior technology to physical education is illustrated by several recent articles describing the principles of behavior and their applications to teaching (Siedentop and Rushall, 1972), and by several recent investigations in which the effect of reinforcement on the learning of gross motor skills has been the general problem area.

The present investigation examined the effects of verbal praise, used as social reinforcement, on the learning of a striking skill by preschool children. The investigation included two unique features. First, dependent variables were employed that have not been studied previously by physical educators investigating the effects of social reinforcement. These included two measures of accuracy of performance and a measure of individual consistency of form. Several writers (Higgens and Spaeth, 1972; Grose, 1967) have suggested that studies of the acquisition of skills should give more attention to the consistency of movement displayed by the student during learning. The other distinguishing feature of the present study was that the treatment included a uniform procedure for gradually increasing the level of performance required for reinforcement. Previous studies in the physical education literature, which reported the application of social reinforcement to be

ineffective in learning gross motor skills, applied reinforcement without gradually altering the criterion for reinforcement as instruction proceeded.

Comparisons of recent studies reflect an unresolved issue concerning the effects of social reinforcement upon motor skill learning and performance. Several studies reported positive effects of verbal praise while others reported either no effects or inconsistent effects of social reinforcement. Explanations for the differential findings implicated the extent of the variation in the subject's movement over repeated attempts to perform the task. Martens (1971) reasoned that novice performers seldom possess the motor control necessary to vary responses even though incentives for improved performance are present. He hypothesized that social reinforcement has greater potential to affect performance of well-learned motor responses than the initial acquisition of skills because novice performers do not possess volitional motor control. The basis for an alternative explanation does not require the concept of volitional motor control, but acknowledges that all behavior fluctuates. Millenson (1967) suggested that when trial-to-trial performances vary, those responses that are more effective are differentially reinforced and tend to increase in frequency while ineffective responses decrease in frequency, and the net result is improved performance. One might hypothesize that when repeated attempts to perform a task are highly consistent, although ineffective, there is little opportunity for reinforcement of improved responses and so little

improvement is observed. Social reinforcement should be effective in the initial acquisition of skills if performance fluctuates, and if reinforcement can be applied to those responses that are more effective.

Few studies have been concerned with the variability or consistency of the individual's performance in skill acquisition. Investigations concerning the consistency of performance have been limited primarily to the accuracy of college-age subjects performing coincidence timing tasks. Form consistency during skill acquisition has been studied infrequently. Investigations of the conditions under which reinforcement affects form are needed.

Statement of the Problem

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking task by preschool children. The study which employed two experimental and one control group sought to determine if performance is differentially affected by contingent and noncontingent praise. The dependent measures were the number of times the ball hit the target, the distance at which the target was hit, and trial-to-trial consistency in selected aspects of form. Specific subquestions concerned both treatment and practice effects.

Questions related to treatment effects were:

1. Does the number of target hits during practice periods accompanied by contingent praise differ from the number of target hits during practice accompanied by noncontingent praise?

2. Are there differences among test performances as measured by target hits, target distance, and form consistency scores that follow practice accompanied by contingent verbal praise, noncontingent verbal praise, and a period of time with no practice or praise?

Questions related to practice effects were:

3. Do the number of target hits, target distances, and form consistency scores of subjects who practice increase across the three test periods?

4. Do the number of target hits, target distances, and form consistency scores of subjects who do not practice increase across the three test periods?

Other questions not directly related to practice or treatment effects but still of interest were:

5. Do the experimental subjects who score above the median in target hits during practice periods increase their form consistency scores across test periods?

6. Do the experimental subjects who score below the median in target hits during practice periods increase their form consistency scores across test periods?

Assumptions

It is assumed that the variables of age, sex, and pretest scores, employed for equating the groups, are pertinent to the level of performance and to estimation of future success on the task.

It is assumed that the dependent variables can be accurately observed, recorded, and filmed by trained assistants.

It is assumed that the level of measurement achieved by the testing procedure is appropriate to the statistical model on which the Friedman two-way analysis by ranks and the Walsh test are based.

It is assumed that verbal praise functions as a reinforcer.

Null Hypotheses

Null hypothesis related to treatment effects was:

1. There are no significant differences among practice accompanied by contingent praise, practice accompanied by noncontingent praise, and a period of time with no practice or praise as measured by the number of target hits, distance at which the target is hit, and form consistency scores during the midtest and posttest.

Null hypotheses related to practice effects were:

2. There are no significant differences among the pretest, midtest, and posttest scores in the number of target hits, distance at which the target is hit, and form consistency scores of the subjects who practice the task.

3. There are no significant differences among the pretest, midtest, and posttest scores in the number of target hits, distance at which the target is hit, and form consistency scores of subjects who do not practice the task.

Other null hypotheses not directly related to practice or treatment effects, but of interest in the study were:

4. There are no significant differences in form consistency scores among the pretest, midtest, and posttest for the subjects who score above the median in target hitting during the practice periods.

5. There are no significant differences in form consistency scores among the pretest, midtest, and posttest for the subjects who score below the median in target hitting during the practice periods.

Directional Hypotheses

All but the first of the following directional hypotheses were subject to analysis by the Walsh test on the condition that the null hypotheses concerning differences among the three samples were rejected first. The three-sample statistical test was not applied to the first hypothesis prior to the application of the Walsh test because the data were obtained from the two treatment conditions of practice only.

Directional hypotheses related to treatment effects were:

1. Practice with contingent praise will be superior to practice with noncontingent praise in the number of target hits achieved in the practice periods.

2. Test performance which follows practice with contingent praise will be superior to test performance which follows practice with noncontingent praise.

3. Test performance which follows practice with noncontingent praise will be superior to test performance which follows a period of no practice.

4. Test performance which follows practice with contingent praise will be superior to test performance which follows a period of no practice.

Directional hypotheses related to practice effects were:

5. The number of target hits accomplished, the distance at which the target is hit, and consistency of form will increase from the pretest to the midtest, and from the midtest to the post-test for subjects who practice.

6. The number of target hits accomplished, the distance at which the target is hit, and consistency of form will increase from the pretest to the midtest, and from the midtest to the post-test for subjects who do not practice.

Directional hypotheses related to achievement and form consistency were:

7. Consistency scores will increase from the pretest to the midtest, and from the midtest to the posttest for the subjects who score above the median in target hitting during the practice periods.

8. Consistency scores will increase from the pretest to the midtest, and from the midtest to the posttest for the subjects who score below the median in target hitting during the practice periods.

Definition of Terms

The terms which follow are defined in a manner to relate the experimental procedures to the principles of behavior. The terms are defined in a technical manner in order to assist the reader in designing similar procedures based upon the same

principles, and to facilitate comparisons among studies concerning the effects of social reinforcement in motor skill learning.

Reinforcement is a process of applying a stimulus consequence that increases the probability of the response it follows.

Social reinforcement is a process in which a stimulus consequence that increases the probability of the response it follows is applied by an individual or individuals to one another. In the present investigation, praise delivered by the experimenter is social reinforcement.

Contingency management is a process of arranging reinforcement to follow the occurrence of some amount of specified behavior. In this study, striking the ball in a manner to cause the ball to hit the target is the performance upon which reinforcement is dependent.

Noncontingent reinforcement is a process in which a stimulus consequence that increases the probability of the response it follows is applied in the absence of a response requirement. In this study, verbal praise given after a specified number of trials is noncontingent reinforcement.

Shaping is a process of teaching a specified performance by selectively reinforcing successive approximations to the behavioral goal. In this study, the level of performance required for reinforcement is gradually altered by increasing the target distance each time the target is hit.

Form is the specific movement of a response that refers to the joint and muscle action used in a response. Velocity, force,

joint angle, direction, and position are common dimensions used to describe the joint and muscle action involved in a response. In this study, only dimensions of position are used to represent the joint and muscle action involved in the response. The positions are represented by traced sequences of filmed performances.

The following terms are defined uniquely as they are used in this investigation. The meaning of the following terms used in this study may differ from their conventional usage.

Consistency of form is a concept referring to the amount of similarity in movement among several responses. In this study, consistency of form refers to selected aspects of the relative location of the striking implement at crucial points in the swing. Crucial points are: (1) the finish of the backswing, (2) the estimated point of contact in relation to the ball dispenser, and (3) the line traced from the tip of the paddle from the finish of the backswing to the finish of the forward swing.

Consistency score is the numerical expression of the degree of similarity among the first five swings in a test period. The score reflecting the degree of similarity among swings is based upon selected aspects of form. The score is computed by making comparisons among each of the five swings on three aspects of form. Each comparison is scored as "similar" or "different" based upon predetermined classification of three aspects of form. Arbitrary points of division are used to set the limits of each classification. Comparisons scored as "similar" are assigned one point. Thirty points is the maximum score for the five swings.[1]

[1]For further details see Procedures chapter, page 30.

Procedures

Three groups composed of four subjects were equated on age, sex, and pretest scores. The method of study employed an incomplete rotation design with two groups practicing under both contingent and noncontingent praise, and a third group serving as a control group with no practice and no praise. The order of treatment was counterbalanced for the two practice groups. The treatment time period spanned four weeks and two days. Instrumentation included a ball dispenser, a target, a table tennis paddle, 35 tennis balls, a Kodak Instamatic M8 camera operated at 32 frames per second, an adjustable camera tripod, canvas measuring tapes, a rear-lighted screen, and a Kodak Super Eight slow motion projector. Measures of performance included the number of target hits, distance at which the target was hit, and form consistency. Form consistency scores were based upon selected aspects of paddle position during the swing and reflected the degree of similarity among the first five swings made in a test period.

Delimitations

The study included 12 children, ranging in age from 4 years to 5 years 10 months, with 4 children in each of the 3 groups. The subjects were 12 of 16 children enrolled in an experimental kindergarten at The University of North Carolina at Greensboro.

The experimental treatment consisted of practice periods in which one subject at a time participated. The treatment included

practice accompanied by contingent praise, practice accompanied by noncontingent praise, and test performance without practice or praise.

Reinforcement, analyzed for differential effects, included praise earned by hitting the target with the ball and praise given without regard to success in hitting the target during practice periods.

Measurement of performance included: (1) accuracy scores based upon the number of target hits, (2) accuracy scores based upon the distance at which the target was hit, and (3) consistency scores based upon the number of similarities among trials on selected aspects of form.

The period of time of the investigation was four weeks and two days for practice on the task and one week for testing.

Limitations

The size of the sample was limited to four subjects in each of two experimental groups that practiced, and four subjects in a no-practice control group. The size of the sample was small because of the time limitations caused by individual subject treatment.

The period of time involved in the investigation was limited to four weeks and two days in which subjects practiced. Practice periods were limited to four under contingent social reinforcement and four under noncontingent social reinforcement with 30 trials in each period, making a total of 120 trials in each condition.

The subjects' play activities outside of the experimental setting were not monitored directly by the investigator; however,

estimates of the amount and kind of play activities related to ball striking were made from telephone interviews with the children's parents or guardians. No attempt was made to control the activities in which the subjects participated while away from the kindergarten. However, balls and paddles were made unavailable to the children at the kindergarten during this study.

Social reinforcement was limited to verbal praise. Tangible reinforcers such as food or prizes might have functioned as equally strong or stronger as reinforcers. Verbal praise given by the experimenter was chosen as the reinforcer because it was naturally available in the typical skill-learning situation. Verbal praise was under the control of the experimenter and could be delivered according to schedule with a high degree of accuracy. The number of errors made in delivering verbal praise was recorded.

The two treatments administered consecutively to the subjects who practiced the task may have affected the performance levels achieved. However, the order of the treatments was counterbalanced.

Summary

The primary problem of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking skill by preschool children. Form consistency as a dependent measure and a uniform procedure for gradually increasing the level of performance required for reinforcement were distinguishing features of the study. The

investigation rested upon several assumptions. Verbal praise was assumed to function as a reinforcer. Variables selected to equate groups were assumed to be pertinent to the level of performance and probability of subject success on the task.

The main hypothesis tested was that there was no difference in task performance between practice with contingent and noncontingent verbal praise. Related hypotheses tested were: (1) there were no performance differences across three test periods for control subjects exposed to test performance only; (2) there were no performance differences across three test periods for subjects exposed to test performance with interpolated practice; and (3) there was no increase in form consistency across test periods for subjects scoring above and below the median in target hitting during practice sessions. Null hypotheses concerning comparisons among the two practice conditions and the control condition, and among the three test periods, were tested first. If a null hypothesis was rejected, directional hypotheses concerning two-sample comparisons were tested.

While generalizations are limited to the sample employed in the present investigation, the findings of the study may contribute to knowledge of applications of behavior technology to teaching motor skills. Other applications may be found in the data which indicate levels of accomplishment exhibited by preschool children on a ball striking task.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking task by preschool children. The dependent measures were the number of target hits, the distance at which the target was hit, and consistency in selected aspects of form. Effects of verbal praise, given only after successful trials, were compared with effects of verbal praise given noncontingently. The two practice conditions were compared with a control condition in which subjects did not practice.

Investigations reported in this chapter contained findings related to the present study and contributed to the rationale and instrumentation for the present study. A search of the literature revealed few studies directly related to the present investigation. Studies selected for review were limited to three categories: (1) application of social reinforcement to the acquisition and performance of gross motor skills, or in increasing persistence and accuracy of motor performance in applied and nonapplied research, (2) assessment of ball-striking tasks performed by young children, and (3) assessment of accuracy and consistency of performance on tasks of coincident timing.

Application of Social Reinforcement to Motor Skill Performance

Studies concerning the application of social reinforcement to motor skill learning and performance include both applied and nonapplied research. The distinction (Baer and others, 1968) is based upon the researcher's focus of interest. Applied research focuses upon problems of social significance and employs subjects who display behavioral problems of social significance. The nonapplied research focuses upon problems of theoretical importance and employs subjects who are representative of some general population rather than subjects who display a behavioral problem.

Applied research. Several studies have demonstrated the effectiveness of social reinforcement applied by adults to increase specific kinds of gross motor performance that were of social importance for young children. Johnston and others (1966) applied social reinforcement contingently to induce a three-year-old boy to engage in vigorous play activities on climbing apparatus. Observational records showed that the boy seldom played with other children in the laboratory school. Adult social reinforcement was applied contingently upon the use of climbing equipment. Reinforcement consisted of standing within 10 feet of the boy, watching him, speaking to him, touching him, and taking equipment to him to be used in climbing on the apparatus. Social reinforcement was withdrawn when the child was not touching the climbing equipment.

To evoke the climbing behavior initially, so that it could be reinforced, the teacher stood near the equipment and reinforced

approach behavior. The criterion for reinforcement was narrowed gradually until reinforcement was contingent upon touching the equipment. Climbing increased from less than one percent of the playtime to over 60 percent of the time. A reversal of contingencies demonstrated that social reinforcement was the controlling factor in climbing. The child's verbal behavior and social interactions with other children increased as well. The writers hypothesized that these activities were reinforced when they occurred simultaneously with the reinforced climbing behavior.

Harris (1964) reported the same kind of increase in verbal behavior when a three-year-old girl's posture in an upright position was reinforced. This child had walked previously, but had reacquired crawling behavior and spent most of the time in the preschool on the floor or ground. After contingent social reinforcement, the walking behavior was reinstated. Talking and initiating play with other children also appeared to increase in frequency. A reversal of contingencies demonstrated that social reinforcement was a controlling variable in reinstating the girl's walking behavior.

In working with a six-year-old boy and girl, categorized as low trainable retarded, Linford and Duthrie (1968) used praise and pats on the back as social reinforcers and food as another reinforcer to induce a sustained high level of physical exertion. They taught and chained three exercise items into a routine. The children received food for running part of a 20-yard shuttle run. The distance criterion for reinforcement was gradually increased until they made eight trips before being reinforced with food. Running

faster was socially reinforced. Running an agility course was then taught in the same manner and performed after the shuttle run. After the two items were put together, lifting a 10 pound ball and placing it in a chute was added as a third task. When food was withdrawn as a reinforcer, the boy continued to perform the complete routine, but at a slower rate of speed. He stopped running on the second day after social reinforcement was also withdrawn. The other child continued to perform for 16 days after both food and verbal praise were withdrawn. When the experimenter removed himself from the girl's presence, and communicated with her remotely, running the course was extinguished. When reinforcement was reinstated for both subjects, they approximated their performance made during the first reinforcement phase of the study.

Bensburg (1965) trained a staff member in a school for the retarded to shape self-help activities and play skills in 8-to-15 year olds. In 15 and 30 minute instructional periods, with one subject at a time, the staff member gave simple verbal directions and gestures. She reinforced successive approximations of the desired behavior in a manner similar to that described by Johnston (1966), Harris (1964), and Linford and Duthrie (1968). Cereal, cookies and candy were initially used as reinforcers and were paired with verbal praise. After five months, food was dropped as a reinforcer and only social reinforcement was used. The responses were maintained for two months after the termination of the study.

Bensburg believed that three factors contributed to success in shaping new motor behavior. First, effective reinforcers were

found and used. Second, the subject's attention was focused on the desired task. And, finally, the tasks were divided into manageable units. Simple components were taught first and the difficulty of the task was increased gradually.

The investigations reviewed as applied research included several procedures which distinguish them from the other studies reported. Data on individual subjects were reported and they indicated improvement in the behavior under study. The reversal experimental design was characteristically employed to determine and demonstrate the controlling variables. Statistical analyses of the data were primarily nonparametric and were applied to individual subjects. The variables selected for study were related to behavior that was causing social or physical problems for the subject.

Nonapplied research. McManis (1965) compared accuracy and persistence on a pursuit rotor task under four verbal incentive conditions. His subjects were 48 normal and 48 retarded boys and girls. The verbal incentive conditions were neutral, reproof, praise, and competition. He reported that all the children were more persistent under neutral, praise or competition conditions than under reproof. Accuracy was better for the retarded children under competition and praise conditions than in the reproof and neutral conditions. For the normal children, there were no differences in accuracy among the treatments. McManis (1965) did not speculate on the causes for the differences between accuracy and persistence, but noted that the normal children were more accurate in their pretest and posttest performances than the retarded children.

Roberts and Martens (1970) predicted that positive social reinforcement would be superior to uncomplimentary statements or no social reinforcement in performing a coincident timing task. Although this study employed a coincident timing task as the procedure for obtaining a dependent measure, the focus of the study was the effects of social reinforcement in increasing accuracy on the task. The dependent measures were analyzed for differential effects of four social reinforcement conditions. Sixty male college subjects were randomly assigned to one of four treatment conditions in which confederates were used to induce subjects to perform on coincident timing apparatus under the guise of testing the apparatus for malfunctions. In one condition, complimentary statements were made after each block of five trials and after randomly selected trials. In the second condition, statements that were uncomplimentary were given in the same distribution. In the remaining conditions, no statements were made and confederates were either absent or remained in the experimental setting. All subjects received knowledge of results after each trial.

Findings of the study indicated no significant differences among the four conditions. The data were analyzed parametrically by a random block design and indicated that all subjects improved their performance on the task over 30 trials. Roberts and Martens (1970) gave two explanations for their findings. The subtlety of the reinforcers may have caused them to be ineffective, that is, the subjects may not have been aware of the reinforcement contingencies. The other explanation implicated the knowledge of results

given and the clarity of the task. Subjects in all four conditions received equal information about their responses. Roberts and Martens suggested that when intrinsic knowledge of results are withheld, or when subjects do not have a clear idea of what they are to do, negative comments are usually superior to positive because they prompt adjustments in performance. Positive comments given noncontingently suggest that incorrect responses are correct, so fewer movement adjustments are likely to be made.

In another study, Martens (1970) compared the effects among five verbal incentive treatments on a motor task with accuracy scores as the response measured. The task was rolling a ball up an inclined plane. Verbal praise was given when the subject improved his performance over the previous trial. Negative comments were given randomly to another group of subjects. A third group received praise and reproof contingent upon increasing or decreasing accuracy over the previous trial. The other treatment conditions consisted of no comments by the experimenter and the subject. The 50 subjects were 3 to 5 years old. All subjects improved their performance over 40 trials. There were no significant differences reported among the five treatments.

Martens (1970) suggested that social reinforcement increases performance in the quantitative dimension. Speed and frequency of a task are affected by social reinforcement, but not accuracy. His explanation is that subjects have too little control over their own motor performance to vary it. This explanation suggests that when subjects possess little motor control, there are few opportunities to reinforce improved responses, and reinforcement is ineffective.

In still another study, Martens (1971) looked for differential effects of social reinforcement on boys with either high internal control or high external control as a personality factor. The Bailer Locus and Control Scale was used to determine the particular personality characteristics. Those characterized by the test as having high internal control were thought to perceive positive and negative events as consequences of their own actions. The high external control individuals were thought to perceive events as unrelated to their own behavior and beyond their control.

Martens (1971) used rolling a ball up an inclined plane as the task and accuracy scores as the response measure. His 172 subjects were all boys in grades 4, 5, and 6. Again, he found no significant differences between the treatment conditions, when praise and reproof were given contingent upon increasing or decreasing accuracy over the previous trial. He concluded that social reinforcement has greater potential to affect performance of well-learned motor responses than the initial acquisition of skills.

Although Roberts and Martens (1970) found no effects of social reinforcement on the learning of a gross motor skill, in an earlier study Hefferline and Keenan (1963) demonstrated effectiveness of a reinforcement contingency to evoke an individuated muscle twitch in the thumb. They demonstrated the effectiveness of reinforcement under conditions in which subjects were unable to report observing their own movement or to verbalize the reinforcement contingency. They used contingent reinforcement and the withdrawal of reinforcement to increase and then decrease the frequency of a

muscle twitch in the range of 25 to 30 microvolts on an electromyographic record. An electrode was placed on the thumb to record evoked muscle potentials. Non-functioning electrodes were placed on other parts of the body to distract attention from the thumb response. The experimenters informed subjects that they would receive a nickle for each increment that might occur on a counter that was placed near the subject. Subjects were not told how to produce points on the counter. The experimenters reinforced a muscle twitch by incrementing the counter for each twitch that generated potentials within a given range. Muscle twitches falling within the reinforced range of potentials increased in frequency. When reinforcement was withheld, the frequency of the response diminished. When reinforcement was again applied, the frequency of the muscle twitch increased. The results of the study showed that inability to verbalize the reinforcement contingency did not render the contingency ineffective.

Harney and Parker (1972), investigating effects of social reinforcement on children's motor performance, employed the same task and accuracy measures as those employed by Martens (1970). Ninety-six first-grade children practiced the task under three conditions that included positive comments, negative comments, and conversation with the experimenters. Comments were given following every trial. Findings indicated that male subjects in the positive and negative comment conditions performed significantly better than males in the conversation control condition. There were no differences among the three conditions of practice for

female subjects. The experimenters speculated that the interaction of the sex of the subject and the treatment occurred because boys of the subjects' age were more competitive on motor performance tasks. All subjects improved in accuracy on the task as determined by a parametric randomized block statistic.

Nonapplied research concerning the effects of social reinforcement on motor performance presented somewhat variable findings. Martens (1970) found no differential effects among various social reinforcement conditions and a control condition. Other investigations reported differential effects when the results were analyzed for interactions among several variables. McManis (1965) reported both praise and competition conditions to be superior to reproof and neutral conditions for retarded children but found no differences among normal children. Hefferline and Keenan (1963) demonstrated the control of a monetary reinforcement contingency over motor performance by strengthening and extinguishing a muscle twitch in the thumb.

Assessment of Children's Motor Performance

Seils (1951) administered a battery of gross motor performance tests, including a ball-striking task, to 510 children ranging in age from 71 to 106 months. The delivery of the ball was controlled by the pendular movement of a cord to which the ball was attached. Average performance measured by the number of hits increased at successive grade levels, but did not increase during three-month intervals.

In a longitudinal study, Halverson and Roberton (1960) observed a variety of effects produced by environmental conditions designed to evoke or influence motor performances in children. The investigators video taped and filmed six boys and girls periodically from age three to age six. The data for one boy and one girl were reported to age six. While social reinforcement was not manipulated, simple verbal instructions specifying a goal for the child were manipulated. Corresponding changes in the child's motor responses were filmed and analyzed. Tentative findings were that children reverted to an earlier pattern of movement when the goal that was set increased the difficulty of the task. In the case of four-year-olds doing a sidearm striking skill, the verbal prompt, "really hit it hard," evoked "better movement" but resulted in a missed contact with the ball. The children subsequently returned to an earlier pattern of poking the ball or making short jerky swings at the ball. This return to an earlier movement pattern occurred immediately after failure to contact the ball when the difficulty of the task was increased by bouncing rather than tossing an aerial ball to be hit. Halverson and Roberton (1960) inferred that children perform best when the motor task is challenging, but not so difficult as to encourage overcaution.

Johnson (1962) administered a battery of tests to over 4,000 children in grades 1 through 6. A ball-striking task was included in which the ball was controlled by the circular movement of a cord attached to the ball and powered by a machine. The average number of hits increased at successive grade levels. For

subjects in the first grade, 95 percent of the boys' scores fell below 5 hits out of 10 trials, and 50 percent of the scores fell below 2 hits for 10 trials. Girls scored slightly lower than boys.

Wickstrom (1968) filmed children performing a sidearm striking task with a bat and a paddle. Ages of the subjects ranged from 21 to 60 months. Children younger than 30 months persisted in using an overarm striking pattern, while children beyond 30 months used a sidearm motion in a horizontal plane when encouraged to perform the task in that manner. Changes observed at successive age levels in the striking pattern were described.

The studies assessing children's motor performance suggested a general trend toward improvement in ball-striking skills during the elementary school period. Performance changes were reported in form used to accomplish striking skills and in accuracy and distance measures of performance.

Assessment of Accuracy and Consistency in Coincident Timing Tasks

Many writers have suggested that the components of striking skills are analogous to components of coincident timing tasks studied in the laboratory. Both types of tasks require coordinated movements at exactly the right instant. Total time available for the task is usually divided into three periods: (1) premovement, (2) movement time, and (3) conclusion of the movement. Subjects vary their responses by employing varying amounts of time among the three periods. The point of coincidence in the laboratory setting is often predetermined and constant. Striking skills outside the laboratory setting usually involve a varying point of coincidence.

Grose (1967a) measured 51 college males for the ability to time the completion of a motor response to coincide with the moveing target's reaching a predetermined point. The motor responses tested included total body movement over a nine foot distance, a finger button pressing, and arm movement over a two foot distance. Simple reaction time was also measured. The task in all three conditions was to complete the response at the same time a laterally moving target reached a fixed point. Each subject performed 25 trials of each task. A rotation treatment design was employed to control for practice effects on the three tasks. Knowledge of results was withheld in each of the three conditions. Findings revealed little correlation between the quickness of reaction time and coincidence timing ability. Most subjects completed the task prematurely and failed to improve in accuracy on the tasks.

In a subsequent study, Grose (1967b) investigated variability among and within subjects. Movement tasks and procedures employed were the same as those employed in the earlier investigation. Repeated trials failed to result in individuals becoming more alike or less alike in performing the coincident timing task. Intra-individual variability decreased by 27 percent in the arm and the whole body responses. Estimates of variation of responses within an individual's scores were achieved by finding the difference scores between the means of the even and odd numbered responses. The standard deviation of the difference scores was divided by two and served as the within subject variance on accuracy in performing the coincident timing task.

In a third study, Grose (1969) investigated the relationship of the timing of the movements and accomplishment. The arm movement and total body movement tasks used in the previous studies were employed. Timing was defined as the regulation of the speed of motion to reach a predetermined destination at a specified moment. Findings indicated that the time pattern of the movement was unrelated to success on the tasks. When performing the arm movement task, some subjects varied the premovement time unit and some varied the speed of the moving arm to increase accuracy. When performing the whole body movement, adjustment appeared to occur in the last step of the movement, and the premovement time period did not result in increased accuracy.

The several studies by Grose investigating within-subject variability in performing coincident timing tasks suggest that an increase in consistency occurs with repeated trials on the task. The degree of consistency in all cases was based upon accuracy scores. Estimates of variation of responses within an individual's scores were achieved by using difference scores of the means of odd and even numbered responses. The standard deviation of the difference scores was divided by two and served as an estimate of an individual's trial-to-trial variability. When the coincident timing task was studied to determine how the subject varied his performance from trial to trial to increase accuracy, the premovement period of the task appeared to have little importance in arm motion or total body movement tasks. When knowledge of results

was withheld subjects failed to increase accuracy with practice although individual variability decreased.

Summary

The review of literature included investigations which were reported under three headings: (1) application of social reinforcement to acquiring gross motor skills or increasing persistence and accuracy of motor performance in applied and nonapplied research, (2) assessment of ball-striking tasks by young children, and (3) assessment of accuracy and consistency on tasks of coincident timing.

Findings summarized from the literature indicated the effectiveness of social reinforcement in changing a variety of gross motor skills when procedures for gradually increasing the level of performance required for reinforcement were used. The nonapplied research presented mixed findings when verbal praise was compared with reproof, neutral and conversational control conditions. The experimental treatments used fixed levels of performance required for reinforcement. Praise was characteristically given after fixed trials and not systematically paired with improved responses. The assessment studies suggested a general trend toward improvement in ball-striking skills during the elementary school period. Performance in coincident timing studies indicated that intraindividual variability decreased with repeated trials.

CHAPTER III

PROCEDURES

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking task by preschool children. The dependent measures were the number of target hits, the distance at which the target was hit, and consistency in selected aspects of form. Effects of verbal praise given on successful trials were compared with effects of verbal praise given without regard to accomplishment. The two practice conditions were compared with a control condition in which subjects were exposed only to test performance.

Procedures used to develop and conduct the study are reported in this chapter. They include, first, a detailed description of a preliminary study conducted to design a suitable striking task and an appropriate procedure to be applied in the main investigation. In the second section of the chapter, the procedures employed in the main investigation are reported.

PRELIMINARY STUDY

A preliminary study was conducted in order to design a suitable task and an appropriate procedure to be applied in the main investigation. Procedures for and outcomes of designing the task and refining experimental methods are described. They include:

(1) identifying the subject population, (2) developing a rationale for the striking task, (3) designing the task, (4) filming and quantifying aspects of topography for consistency scores, and (5) determining objectivity in dispensing verbal praise contingently and noncontingently. Results of the preliminary study were used to design several of the procedures employed in the main investigation.

Subjects

Twenty-one four and five year old children enrolled in the School of Home Economics Nursery School at The University of North Carolina at Greensboro in 1971 and 1972 were selected for the preliminary study. There were 10 boys and 11 girls comprising the preliminary study group. The major determinants in the selection of the preliminary study subjects were the accessibility of the location, the similarity of the subjects to the group to be included in the main study, and the similarity of the facilities and equipment used by these children to those to be employed in the main study.

The subjects participated in the preliminary study over a period of three months. Time limitations and availability of the children made it necessary to work with 11 subjects during April and May, 1972 and 10 subjects in September, 1972. The details of the subjects' involvement will be described following a discussion of the rationale for procedures used in designing the task.

Rationale for Procedures in Designing the Task

It was recognized that motor tasks other than striking could be suitable for studying the effects of verbal praise on learning a motor task. A ball-striking task was selected because outcomes of performance could be scored objectively and gross aspects of form could be filmed and quantified. Procedures for designing the striking task were guided by six criteria: (1) the task had to be one in which the children would persist, both on repeated trials and over a four-week period; (2) task accomplishment had to be observable and quantifiable; (3) the task had to allow for increased accomplishment to be observed with practice; (4) the task had to permit the subjects to demonstrate some accomplishment during early trials to permit reinforcement to be applied; (5) the task had to be one that could be taught by uniform procedures; and (6) task performance had to produce gross aspects of form that could be filmed and quantified.

Performing the task with persistence. A task on which four and five year old children would persist over a period of repeated trials within one practice session and over several practice sessions had to be developed. A task of high intrinsic reinforcement value was desirable because during the test periods the children would receive no verbal reinforcement. The task had to be one in which children would continue to perform without coaxing or urging by the investigator. This control would prevent coercion and urging from interfering with the contingent and noncontingent verbal praise applied in the practice periods.

Observing and quantifying accomplishment. The task selected for the main study had to be one in which the presence or absence of change in a subject's performance could be readily detected. This specification required a task movement which could be recognized quickly enough for the application of reinforcement, and one which could be reliably and objectively observed, recorded, and quantified.

Testing the effects of verbal praise on learning. The task had to discriminate among increasing amounts of accomplishment which might occur in practice. This criterion permitted study of the effects of reinforcement on learning. If subjects mastered the task completely in the early sessions, the presence or absence of change following the experimental treatment could not be observed; therefore, the task had to be designed so that initial attempts resulted only in partial mastery and increased accomplishment required repeated performance of the task.

Reinforcing early accomplishment. The fourth criterion was that some early accomplishment on the task be observed. An early measure of accomplishment was a prerequisite for the procedure of reinforcing successive approximations to final accomplishment. A response had to occur before it could be reinforced. A procedure for reinforcing increasing amounts of accomplishment had to be built into the task or the reinforcement procedure.

Standardizing teaching instructions. Another criterion for task suitability was that the task could be taught by applying uniform instructional procedures. If differences in accomplishment were to be studied in relationship to the application of

contingent and noncontingent reinforcement, all subjects had to receive the same content and amount of instruction. If the level of initial proficiency in understanding the task varied from subject to subject, uniform instructions effective for all levels had to be developed.

Selecting aspects of form for analysis. The final criterion for task suitability was that the task performance could be observed, recorded, and quantified. This criterion was necessary to determine if reinforcement affected consistency of form. The aspects of form selected for analysis were subject to the following limitations. First, aspects of form that were deemed a necessary component of the striking task would be selected. This limitation insured that an opportunity to observe each form aspect would be present in every trial. Second, aspects of form which could be filmed with a Kodak Instamatic M8 camera at 32 frames per second would be selected. Third, aspects of form that could be filmed from a side view of the subject would be selected. A side view of the subject was filmed because that position appeared to be least distracting to the subjects, and afforded an unobstructed view of the subject. Finally, aspects of form that were suitable for analysis by point and line tracings made from a sequence of frames of the filmed performance would be selected.

The Task

A striking task which met the six criteria outlined above was designed for use in the main investigation. Twenty-one

preliminary study subjects performed the striking task individually in at least one 15-minute period. Based upon observations of subject performance, the task was altered and subsequent performance was observed. In this manner, the task conditions were altered until the task appeared suitable for use in the main investigation.

The procedures for investigating specific task conditions for suitability included: (1) selecting the instruments, (2) selecting conditions to enhance persistence, (3) specifying accomplishment, and (4) designing verbal and other instructional prompts.

Selecting the instruments. A striking implement and projectile were selected by observing subjects' choices from among those made available. The task, which was presented as a hitting game, consisted of striking a ball with a paddle after it rolled off a ball dispenser. The ball, propelled by gravity, rolled down a Plexiglas chute that was five feet in length and mounted on two supports with the back support three inches higher than the front. A target two feet by two and one-half feet in dimensions was placed several feet from the subject. Figure 1, page 36, shows the positions of the ball dispenser, target, subject and camera.

Various sizes of paddles and balls were presented to eight subjects in the first two days of the preliminary study. Observations of the subjects' choices were made in a situation where three varieties of paddles were placed before the child and the direction was given to "pick out a paddle and we'll play this hitting game." After it was observed which paddle was selected

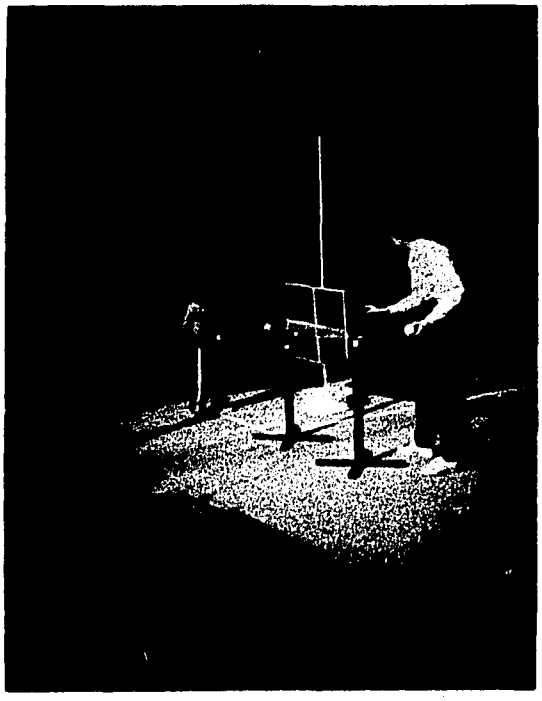

Figure 1. Positions of Ball Dispenser, Target, Subject, and Camera

most often, four varieties of balls were presented in the same manner. Of the paddles made available, the table tennis paddle was consistently selected. Other selections were made but always were exchanged for the table tennis paddle. The tennis ball was consistently selected by the subjects over larger or smaller balls of various colors and weights. Based on the above observations, the instruments selected were the table tennis paddle and the tennis ball.

Selecting task conditions to enhance persistence. Procedures for and outcomes of testing the subjects' persistence on the task followed. Repeated trials of the ball-striking task were presented to four children under various social reinforcement contingencies. Two of the subjects were given continuous verbal praise contingent upon hitting the ball in one practice session and contingent upon hitting the target in another session. Two subjects were given noncontingent verbal praise following alternate trials. In two practice periods no verbal praise was given and verbal interaction with the subject was avoided during trials. Under the four reinforcement conditions described, subjects were given as many trials as they would tolerate. Trials were presented repeatedly until the child expressed verbally that he did not want to perform or he failed to attend to the task. Evidence of inattention to the task was walking away from the practice area or behavior other than swinging at the ball as it came off the ball dispenser. The children persisted in repeated trials of the task under all reinforcement contingencies tested. Thirty-two were the fewest consecutive trials performed.

Persistence in performing the task appeared to be affected by the presence or absence of the target and the arrangement of heights and distances of the ball dispenser and target. To discover under which conditions the children would persist for the greatest number of trials, repeated trials were given to those subjects who had not participated under the various reinforcement contingencies tested earlier. The target distance and ball dispenser heights were increased by varying amounts, and on some trials the target was eliminated from the task. Observations of performance on the task without a target suggested that the presence of the target increased the number of consecutive trials the children attempted. Without the target, the subjects stopped performing after 32 to 45 trials. When a target was added to the task, most subjects continued at the task for at least 50 trials. After 50 trials most sessions were terminated because of time limitations.

In several practice sessions, the target distance was increased from one and a half to 14 feet. The increments were made by six inches for some subjects and by two feet for others. The height of the ball dispenser was increased by one inch increments for some subjects and by three inches for others. The children continued to perform the task in all conditions. However, when the target distance was increased by as much as two feet, the subjects sometimes complained that the target was too far away.

On the basis of these observations, 30 trials were selected as the number of trials to be given in each of the test and practice

periods. It was estimated that all children in the experiment would persist at the task for as many as 30 trials with or without social reinforcement. The target was included in the task because it appeared to increase the intrinsic reinforcement value of the task. It was estimated that all children in the experiment would persist at the task under conditions in which the target distance was increased by as much as 18 inches, and the ball dispenser height by as much as 3 inches. Therefore, increasing the target distance and height of the ball dispenser was retained for further study as the procedure for teaching the subjects to hit a free-falling ball.

Specifying accomplishment. The task, under several different arrangements of the equipment, was presented to the subjects in order to select the specific performance that would demonstrate accomplishment. The first arrangement of the equipment was with the target distance at 7 feet and the ball dispenser at 44 inches. The equipment remained stationary and the requirements for reinforcement were gradually increased. Initial hits were praised without regard to their direction or force. After several consecutive hits were accomplished and praised, only those hits that were toward the target were praised. After several hits toward the target were accomplished, a distance requirement was added to the performance that demonstrated accomplishment. These procedures were discarded for two reasons: (1) subjects complained that the target was too far away even though hitting the target was not required for reinforcement, and (2) when the requirements for task accomplishment continually changed, the experimenter was unable to identify

accomplishment quickly enough to permit immediate reinforcement. Hitting the ball without an accuracy requirement was rejected as the behavior that demonstrated accomplishment because the subject performance level was very high initially. Some subjects hit the ball on 82 percent of the trials in the early practice periods.

Hitting the target with the ball was selected as the behavior that demonstrated accomplishment. Target hits appeared to be easily identified as a signal for reinforcement. The greatest number of hits occurred when the target was as close as arm's distance from the ball dispenser plus 6 inches and the ball dispenser was set at a height of 29 inches. This arrangement of the equipment was chosen for the initial practice condition in the teaching procedure because of the success demonstrated by the preliminary subjects.

The number of target hits accomplished in the first 30 trials by 7 subjects ranged from 3 to 12. When all of the trials were scored, the number of target hits ranged from 7 to 27. The number of trials varied among subjects as a result of the procedure discussed earlier for testing persistence on the task. The percentage of trials on which target hits were accomplished in the first 30 trials ranged from 10 percent to 40 percent. The percentage of target hits accomplished for all trials attempted ranged from 14 percent to 54 percent. The number of trials attempted ranged from 32 to 60.

Based upon the number of target hits accomplished, the task appeared to meet the criteria concerning accomplishment that were

set for task suitability. Accomplishment on the task was observed and quantified. The task appeared to discriminate among increasing amounts of accomplishment which might occur in practice. This was indicated by the increase in scores with additional practice. Early accomplishment on the task was observed. The range of target hits accomplished in the first 30 trials demonstrated that the subjects were able to perform the task.

Designing verbal and other instructional prompts. A variety of verbal instructions and instructional prompts used in the Spring of 1972 were tested with 10 pilot subjects in September of 1972. The following procedures were used to discover which instructions appeared to result in successful performance by all subjects. The equipment was arranged with the ball dispenser set at a height of 29 inches and the target distance at the subject's arm length plus 6 inches from the ball dispenser. Instructions were given to a subject and his subsequent performance observed. If the child hit the target, or came close to hitting the target, the instructions were judged to be adequate. The least successful subjects were retested on two successive days using those instructions that appeared most effective.

The following prompts were given in various combinations: physical guidance in hitting the ball, modeling the hit, marks on the ground to indicate where to stand, and a variety of verbal instructions. Verbal instructions included statements designed to convey the general idea of the task and how to perform the task. Examples of the first kind of verbal instructions given were: "Hit

the ball before it touches the ground," "Hit the target," "Stand behind the line," or "Stand in the circle." Examples of verbal instructions that informed the subject how to hit the ball were: "Watch the ball," "Hold the paddle up," "Swing sooner," or "Swing faster." When only verbal instructions were given, the subjects appeared to be least successful. They appeared to hit the target less than subjects who were given any other combination of instructions. Verbal prompts that directed attention to what the subject was asked to do appeared effective when combined with modeling the task or physical assistance in hitting the ball. All but one subject was successful when the task was first modeled and then followed by physical assistance in hitting the ball. Modeling and physical assistance were combined with verbal instructions on where to stand to watch the demonstration, when it was the subject's turn to hit, and similar procedural directions. Most of the subjects were successful without physical guidance but some children did not hit the ball without that guidance.

Based upon results of the above procedures, the following instructions were designed for use in the study. The subject was told, "Stand here and watch. I'll show you how to do this." Two hits were modeled by the experimenter. Then the subject was told, "Now I'll help you hit a couple. Stand behind this line." A restraining line made of a two-foot strip of cardboard two inches wide was placed on the ground at a distance from the ball dispenser that equaled the subject's arm length. The experimenter assisted the subject in making two hits. Assistance was given by placing

one hand over the subject's hand that gripped the paddle and guiding the swing so that the ball was hit onto the target. Following two hits the subject was told, "Now it is your turn." The prompts, "Ready," and "Here comes another one," were given prior to the delivery of the ball in the ball dispenser.

Filming and Selecting Aspects of Form for Analysis

Four of the September preliminary study subjects were filmed with a Kodak Instamatic M8 camera at 32 frames per second and at a distance of 19 feet from the subject. The camera was positioned for a side view of the subject with the subject's striking arm nearest the camera.

The films were first projected in slow motion using a rear-lighted screen 36 inches in front of the projector. Aspects of form that were visible for each of the subjects and in each of the swings were identified and tentatively selected for analysis. Each aspect of form was traced by point and line drawings made from a sequence of frames showing the forward arm motion of the swing. Figure 2, page 44, shows tracings of selected aspects of form. Tracings were made as the film was advanced through the projector manually, one frame at a time. Dots were marked at each point where a change in position or location of the part in question was observed. The points marked were then joined together by connecting a line from the first point in the movement to the last. Verification of accuracy was achieved by repeating tracings. If the two tracings varied

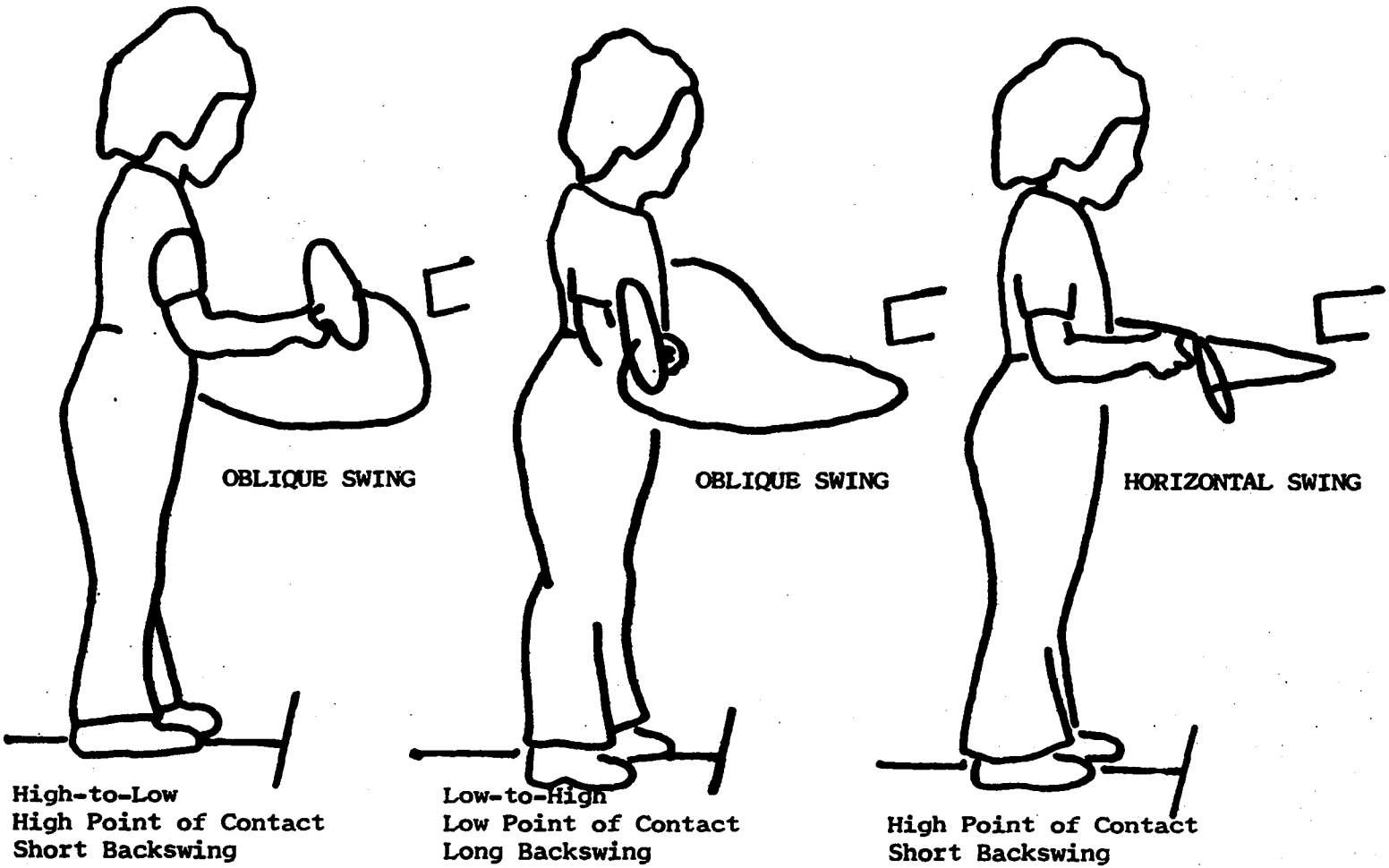

Figure 2. Tracings of Selected Aspects of Form

by more than one-tenth of an inch, a third tracing was completed.[1]

The following aspects of form were traced from five swings of two pilot subjects. (1) the plane of the swing, (2) the foot movement during the swing, (3) the inclination of the trunk during the forward swing, (4) the relative height at which the ball was hit, and (5) the relative length of the backswing. The aspects retained for analysis were the plane of the swing, the relative length of the backswing, and the relative height at which the ball was hit. These aspects of form met the specifications for selection and were traced onto a composite tracing for each swing. The other aspects of form, foot movements during the swing and the inclination of the trunk, were rejected because they were not present in every swing filmed.

Quantifying the tracings. The aspects of form retained for analysis were the plane of the swing, the relative length of the backswing, and the relative height at which the ball was hit. Quantification of the tracings was achieved by the following procedures. Each form aspect was divided into two categories. Categories for the plane of the swing were oblique and horizontal. Categories for the relative length of the backswing were long and short. Categories for the relative height at which the ball was hit were low or high point of contact. An oblique swing was classified as low-to-high or high-to-low in the direction of the swing.

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[1]The procedure used for varifying accuracy of tracings was adopted from the literature reporting cinematographic analyses in which angles measured were retraced. Studies reported by Roy (1971) and Teeple (1968) exemplify this procedure.

Arbitrary points of division were used to set the limits of each category or classification. The relative length of a backswing was categorized by the position of the paddle at the finish of the backswing. A backswing was categorized as "long" when at least a portion of the paddle appeared superimposed upon the leg or trunk of the body at the finish of the backswing. A backswing was categorized as "short" when the paddle was not extended far enough to appear superimposed upon the leg or trunk of the body at the finish of the backswing.

The plane of the swing was judged to be horizontal or oblique. A swing plane was categorized as horizontal if less than the width of the paddle separated the beginning of the forward swing to any other point in the tracing. The swing was categorized as oblique if at least the width of the paddle separated the forward swing path from the backswing at any point in the tracing.

Swings in an oblique plane were judged to be either from a relatively high position to a lower position or from a low to a higher position. The start and finish points for the forward swing tracings were used for this judgement, and the tip of the paddle at a point directly opposite the grip was used as the landmark for the tracing. When the finish point was higher than the start of the swing, the swing was categorized as low-to-high. When the finish point was lower than the start of the forward swing, the swing was categorized as high-to-low.

The relative height at which the ball was hit was the third aspect of form analyzed. A ball that was hit after dropping from

the ball dispenser a distance more than the diameter of the ball was categorized as a "low" hit. A ball that was hit before dropping a distance more than the diameter of the ball was categorized as a "high" hit. When the ball was missed, the "point of contact" was considered to be that point where the paddle appeared largest and approximately in front of the ball dispenser. The tip of the paddle was used as the landmark for these tracings.

Selection of these particular aspects of form and procedure for quantifying them were influenced by the writings of many who have described performance of striking skills (Wickstrom, 1970; Espenschade and Eckert, 1967). Aspects of form selected and procedures used to quantify form were related to factors often considered in describing mechanics of striking skills. However, form analysis was limited to the study of change in trial-to-trial consistency of form, and aspects of form were selected and quantified for that purpose.

Consistency score. A consistency score reflecting the degree of similarity among a subject's first five swings in the test period was derived from the tracings after each aspect of form was categorized. Ten paired comparisons in each category were made among the five swings traced. Each comparison was scored as "similar" or "different" on the three aspects of form selected. One point was scored for each comparison that was judged "similar," and 30 points was the maximum score for the five swings.

Objectivity in Dispensing Verbal Praise

To determine objectivity in giving verbal praise, three observers were trained to record subject performance in hitting the target and experimenter performance in giving verbal praise contingently and noncontingently. The procedure for dispensing praise was first described and demonstrated to the observers. Observers then practiced recording performance in two separate 30-minute periods. The procedure followed by the observers was to record on a score sheet a target hit or a miss for each trial and whether the trial was followed by praise or no praise.

The procedures for dispensing praise were as follows. Contingent verbal praise was given by the experimenter immediately following each target hit. The statements of praise included the child's name and a personal compliment. Statements used were, "_____, you're a very good hitter; _____, aren't you smart; _____, you're terrific." That praise was paired with the statement, "You're so (good, smart, terrific) that I'm going to raise this a little." The ball dispenser and target were raised and the target distance was increased by six inches following each target hit. The same statements of praise were given in the noncontingent condition without regard to accomplishment in hitting the target. Subjects in the noncontingent condition received the same amount of praise as those in the contingent reinforcement condition, but praise was given following fixed trials without regard to accomplishment in hitting the target.

Six separate test periods were observed. Three were under contingent and three under noncontingent reinforcement conditions. Inspection of the records showed 100 percent agreement by the observers in recording their independent observations. Further inspection showed that verbal praise was given with 100 percent accuracy in the contingent reinforcement condition, indicating that each target hit in the contingent reinforcement condition was followed by praise. In the noncontingent reinforcement condition, 97 percent accuracy was achieved in giving verbal praise.

Percentage of accuracy was determined by the ratio between chances for errors and the number of appropriate responses made. Thirty trials produced 90 chances for incorrect responses. Omitting verbal praise when it should have been given, giving praise when it should have been omitted, and using phrases other than those selected were scored as errors. Three errors were committed. Two of the errors were of the first type, and one error was scored when the verbal praise was given twice following one trial.

Limitations of the Preliminary Study

Conclusions based upon the results of the preliminary study were limited by the following:

No statistical analysis was applied to the data obtained from the preliminary subjects. Outcomes of the subject performance were judged against criteria set for suitability of the task and the experimental procedures. The task and the procedures were altered until performance appeared to meet the criteria.

Time limitations and availability of subjects required a three-month intervention between the first two months and the third month of the study. One subject was dropped from the study due to illness.

Windows in the kindergarten room adjacent to the practice area permitted some of the subjects to observe others performing the task. This observation may have affected their performance.

Outside observers occasionally present in the experimental setting may have distracted or otherwise affected subject performance.

Landmarks used in the procedure for tracing the filmed performance introduced subjective error. No marks were placed upon the paddle or the subject prior to filming. However, procedures for verifying accuracy of the tracings insured that any errors which occurred were systematic.

Summary

A preliminary study with 21 4 and 5 year old subjects was conducted over a 3-month period to design a suitable striking task and an appropriate procedure to be applied in the main investigation. A rationale for the procedures used in designing the task was developed and rested upon six criteria for task suitability. The six criteria were: (1) the task had to be one in which the children would persist, both on repeated trials and over a four-week period; (2) task accomplishment had to be observed and quantified; (3) the task had to allow for increased accomplishment to be

observed with practice; (4) the task had to permit some accomplishment during early trials; (5) the task had to be taught by uniform procedures; and (6) task performance had to produce gross aspects of topography that could be filmed and quantified.

A striking task which met the six criteria outlined was designed for use in the main investigation. The instruments selected for use in the task were a regulation table tennis paddle and a regulation tennis ball. The task designed was hitting the target by striking the ball with the paddle after the ball rolled off a ball dispenser.

Persistence in performing repeated trials of the task was tested under a variety of conditions including various social reinforcement contingencies, the presence or absence of the target, various increments in the distance of the target, and various increments in the height of the ball dispenser and target. Based upon the number of consecutive trials attempted, 30 trials were selected as the number to be given in each of the test and practice periods in the main investigation. The target was retained for use in the task because it appeared to increase the intrinsic reinforcement value of the task and provided a suitable means for identifying and reinforcing accomplishment. Increasing the distance of the target and height of the target and ball dispenser as accomplishment was demonstrated at previous heights and distances was selected as one of the procedures for teaching subjects to hit a free falling ball. Hitting the target with the ball was selected as the behavior demonstrating accomplishment. Verbal instructions were

designed and included procedural directions and prompts for looking at the ball when it was placed in the ball dispenser. Modeling the task and physical assistance were combined with the verbal instructions as another procedure to be employed in the teaching of the task.

Four subjects were filmed and aspects of form were selected from the films for determining each subject's trial-to-trial consistency. The aspects of form selected included: (1) the plane of the swing and its general direction, (2) the relative length of the backswing, and (3) the relative height at which the ball was hit. Point and line tracings of these three aspects of form were made from a sequence of frames showing the backswing and forward arm motion of the swing. The tracings of each swing were quantified by classifying the aspects of form into one of two categories. Arbitrary points of division were used to set the limits of the categories which included: (1) horizontal or oblique plane of the swing, (2) long or short backswing, and (3) high or low point of contact. Oblique swings were classified as high-to-low or low-to-high in the direction of the swing. A consistency score, reflecting the degree of similarity among each subject's first five swings, was determined by comparing each swing with every other swing in the set of five trials filmed. Thirty points was the maximum score for the five swings and indicated the highest degree of consistency that could be measured by this procedure.

Objectivity in giving verbal praise contingently and non-contingently was determined from records of three trained

independent observers. Observers recorded a target hit or a miss for each trial and praise or no praise following each trial. Failing to give praise when it was scheduled or using phrases other than those selected were scored as errors. Observers reached 100 percent agreement in recording this data in six separate text periods. Contingent verbal praise was given without committing errors, and noncontingent praise was given with 97 percent accuracy. It was concluded that the procedure for delivering verbal praise was sufficiently objective to be employed as the reinforcement procedure in the main investigation.

THE STUDY

Procedures used to conduct the study are reported in this section. Procedures developed in the preliminary study include: (1) selecting and describing the subjects, (2) describing the equipment, (3) describing the task, (4) dispensing praise, (5) recording practice performance, and (6) recording and scoring test performance. Additional procedures used to conduct the study include equating the groups, counterbalancing the treatment, and analyzing the data.

Subjects

The subjects were 12 children enrolled in the Experimental Kindergarten operated by The Institute for Child and Family Development at The University of North Carolina at Greensboro during the Fall of 1972. They were selected from a pool of 16 children enrolled in the kindergarten. The 16 children ranged in age from 4 years to

5 years 10 months. None of the subjects was involved in the preliminary study. The 12 subjects retained for the study ranged in age from 4 years 7 months to 5 years 10 months, and included 9 boys and 3 girls. The subjects had participated in other experiments involving academic skills in which reinforcement contingencies were manipulated; however, none of these experiments involved gross motor skill learning or performance.

Equating Groups

Three equated groups composed of four subjects were obtained. Two were designated as experimental groups and one as a control group. From the group of 16 children enrolled in the kindergarten, 15 were pretested on the striking task. One child was lost to the study because of absence from school during the week scheduled for the pretest. Of the 15, 3 subjects were dropped from the study for the following reasons. One subject had a partial hearing disability that might have interferred with learning. Another subject was dropped for lack of further subjects to achieve age matches within the groups. The third subject was dropped for lack of further subjects to achieve gender matches within the groups.

The 12 children were randomly assigned to one of 3 groups. The groups were equated on pretest performance, age, and gender. The groups were equated by obtaining three sets of three matched subjects and then randomly assigning one subject in each set to one of three groups. The sets were first matched on gender, and then, as nearly as possible, on age and pretest scores. Pretest scores

were the number of target hits and the number of times the subject hit the ball without regard to success in hitting the target.

Each group was composed of three boys and one girl. Mean ages in months of the groups were 60.7, 62, and 64.2 The mean number of target hits for the groups were 3.2, 2.8, and 2.5. The mean number of hits without an accuracy requirement for the groups were 16, 14.5, and 16.8. No statistical analysis was applied to test the equality of the groups because the differences among the groups were small enough to be of no practical difference. The difference between the means of the highest scoring group and the lowest was .8 for target hits and 2.3 for the total number of times the ball was hit. The greatest difference among the groups in mean age in months was 3.5. Differences that occurred on the three variables were not systematic and did not appear to favor any group. The oldest group ranked third among the groups in target hits and first in the number of times the ball was hit. The group that ranked first in target hits had the youngest mean age and ranked second in the number of times the ball was hit.

Equipment

The equipment employed in the study consisted of a ball dispenser, a target, a table tennis paddle, 35 tennis balls, a cardboard restraining line, canvas measuring tapes, a Kodak Instamatic M8 camera, an adjustable camera tripod, a rear-lighted screen, and a Kodak Super Eight projector.

The ball dispenser was made of two pieces of clear Plexiglas that were one-fourth inch thick and five feet long. One piece

was three-fourths inches wide, and the other four inches wide. They were cemented together to form a right angle. The inside measurement of each side of the angle was three and three-fourths inches. The ball dispenser was supported by two metal telescoping standards. The rear standard was 3 inches higher than the front, and each was adjustable in height from 26 inches to 49 inches.

The target was constructed of two pieces of heavy cardboard mounted on the front and back of a wooden frame. The frame was 1¼ inches deep, 30 inches wide, and 24 inches high. The target was attached to a telescoping standard with the face of the target parallel to the length of the ball dispenser. The top of the target was one foot higher than the top front edge of the ball dispenser.[2] The target face was painted green.

A regulation tennis ball served as the projectile. When placed on the rear of the ball dispenser, the ball rolled down the incline at a speed that projected the ball to the ground at approximately 11 to 13 inches from the front edge of the ball dispenser. A standard size table tennis paddle was used as the striking implement.

A line was placed on the ground at a right angle to the target face prompting the subject to stand facing the ball as it rolled off the ball dispenser. The line was placed at a distance from the ball dispenser that equalled the length of the subject's

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[2]The relative positions of the ball dispenser, target, and subject are shown in Figure 1, page 36.

arm. This distance was used because it had appeared effective for subjects in the preliminary study.

A Kodak Instamatic M8 camera was used to photograph the subjects at 32 frames per second during test periods. The camera was set on a tripod with the lens 36 inches from the ground and 19 feet from the ball dispenser. The camera was set at a right angle to the length of the ball dispenser to photograph a side view of the subject with the striking arm nearest the camera on the backswing.

Task

The task involved hitting the ball with the paddle after the ball rolled off the ball dispenser. The subject demonstrated accomplishment of the task by striking the ball in a manner that caused the ball to hit the target. The ball dispenser was placed so that the ball rolled at a right angle to the target direction. Procedures used in the training periods were developed in the preliminary study. Training periods on the task consisted of 30 trials and were always begun with the target and the ball dispenser at their lowest and closest positions. The front of the ball dispenser was set at 29 inches above the ground. The target was placed to the side at a distance equal to the length of the subject's arm plus six inches. The height of the ball dispenser and the target were increased by one inch and the target distance by six inches as accomplishment was demonstrated at each setting.

Counterbalancing Treatment

Two experimental groups practiced under both contingent and noncontingent reinforcement. The sequence in which they received each treatment was counterbalanced. In the first four training periods, the subjects in one group received contingent praise while subjects in the other group received noncontingent praise. In the second four training periods, the contingencies for reinforcement were reversed. A third group served as a control and was exposed only to the pretest, midtest and posttest. All subjects were tested for accomplishment or change in performance at the end of the first phase of the study before the contingencies for reinforcement were reversed. After the second phase of the study, subjects were retested.

Practice for the two experimental groups was distributed between alternate days of the week. Half of the experimental subjects from each group practiced the task on a Monday-Wednesday schedule and half on a Tuesday-Thursday schedule. The schedule was altered to accommodate subjects who were absent from the kindergarten on a practice day. When a subject was absent on the day he was scheduled for practice, his yoked partner did not practice, and both he and his yoked partner from the other experimental group practiced on two consecutive days following his return to the kindergarten. Distribution of practice over days varied for individuals within the groups due to absences; however, the amount of practice and the interval between training periods were the same for both groups. Practice for both groups was distributed over four weeks and two days.

Dispensing Praise

The two groups designated as experimental groups were exposed to practice under both contingent and noncontingent praise as reinforcement. Noncontingent praise was the control procedure used as an alternative to withholding reinforcement. Noncontingent praise was used to avoid a radical change in the experimental environment when the subject moved from one experimental condition to the other. A warm relationship between the experimenter and the child could be hypothesized as a cause for performance changes observed. Applying praise noncontingently permitted a warm experimenter-child relationship to remain, but changed the temporal relation between the successful performance of the task and the praise.

Contingent reinforcement was verbal praise delivered by the experimenter immediately following each target hit. The statements of praise included the child's name and a personal compliment. Statements used were: "_____, you're a very good hitter," "_____, aren't you smart," and "_____, you're terrific." That praise was followed by the statement, "You're so (good, smart, terrific) that I'm going to raise this a little." The height of the target and the ball dispenser was increased by an inch following each target hit, and the target distance was increased by six inches.

In the noncontingent reinforcement condition, the statements of praise were delivered without regard to the subject's success in hitting the target. Each subject was praised the same

number of times as his yoked counterpart in the contingent reinforcement condition. Praise was distributed evenly over 30 trials without regard to the subject's success in hitting the ball or the target. To equate the amount of verbal praise received by the two experimental groups, matched subjects from the two groups were yoked on the amount of praise given. Training periods for subjects in the contingent reinforcement condition always preceded those for subjects in the noncontingent condition. This procedure was used for determining the amount of praise given in the noncontingent condition. A subject in the noncontingent condition received the same amount of praise as his yoked counterpart earned in the contingent praise condition. Rotating the three statements of praise in a consistent order insured that the content of praise was the same for both experimental groups.

Recording and Scoring Practice Performance

The experimenter was assisted by a trained observer who recorded on a score sheet a target hit or miss for each trial.[3] The observer also recorded the trial number that was followed by verbal praise. Target hits were totaled for each practice period. The number of target hits achieved was used for comparing the two practice conditions.

To assess objectivity in dispensing praise contingently and noncontingently, the number of errors made in giving praise was determined from the score sheet. Three types of errors were possible on each trial: (1) praise given when it should not have

[3]Sample score sheets are found in the Appendix.

been, (2) praise omitted when it should have been given, and (3) praise given with content that varied from the selected phrases. The percentage of accurate praise given in each condition of practice was determined.

Recording and Scoring Test Performance

All subjects, including the no-practice controls, were tested three times in a pretest, a midtest and a posttest. The pretest was given prior to the first practice phase. The midtest followed the four practice periods of the first practice phase. The posttest followed the four practice periods of the second practice phase. Five test trials were given at each of six different settings of the ball dispenser and target, making a total of 30 trials in each test period. The height settings for the ball dispenser and distances for the target progressed from the shortest distances in the first five trials to the longest in the last five trials. The target height and the height of the ball dispenser were increased by three inches following every fifth trial. The ball dispenser was first set at 29 inches. The target distance was first set at a distance equal to the subject's arm length plus 6 inches and was increased by 18 inches following every fifth trial.

In the pretest the task was first modeled by the experimenter. Then two practice trials by the subject were manually assisted by the experimenter's placing one hand over the child's hand and guiding the swing to cause the ball to hit the target.

All subjects received the same verbal instructions designed in the preliminary study. The subject was told, "Stand here and watch. I'll show you how to do this." Two hits were modeled by the experimenter. Then the subject was told, "Now I'll help you hit a couple. Stand behind this line." A restraining line made of a two-foot strip of cardboard two inches wide was placed on the ground at a distance from the ball dispenser that equaled the subject's arm length. The experimenter assisted the subject in making two hits. Following two hits, the subject was told, "Now it's your turn." The prompts, "Ready," and "Here comes another one," were given prior to the delivery of the ball in the ball dispenser. No verbal praise was given during testing. The midtest and posttest were conducted in the same manner except that modeling and manual assistance were omitted to minimize learning that might occur in the test periods.

Scoring target hits and target distance. The number of target hits and the distance from the target at which the task was accomplished were recorded by the trained observer. These scores were used for analyzing differences among the pretest, midtest, and posttest performances. They were also used for analyzing differences among the two conditions of practice and the control condition. The number of times the subject contacted the ball with the paddle was scored only in the pretest, and was used as one of the matching variables in equating the groups.

Filming and quantifying tracings of form. All test performances were filmed at 32 frames per second with a Kodak Instamatic M8 camera. Procedures described in the preliminary study

were used to quantify form consistency. A consistency score reflecting the degree of similarity among a subject's first five swings in the test period was derived from the tracings after selected aspects of form were categorized. The aspects of form selected for analysis were the plane of the swing, the relative length of the backswing, and the relative height at which the ball was hit. Quantification of the tracings was achieved by the following procedures. Each form aspect was divided into two categories. Categories for the plane of the swing were an oblique or horizontal swing. Categories for the relative length of the backswing were a long or short backswing. Categories for the relative height at which the ball was hit were a low or high point of contact. An oblique swing was classified as low-to-high or high-to-low in the direction of the swing.

Arbitrary points of division were used to set the limits of the categories. The relative length of the backswing was classified as long or short by the position of the paddle at the finish of the backswing. A backswing was categorized as "long" when it was long enough to cause at least a portion of the paddle to appear superimposed upon the leg or trunk of the body. A backswing was categorized as "short" when it failed to extend far enough for the paddle to appear superimposed upon the leg or trunk of the body. The plane of the swing was classified horizontal or oblique. A swing plane was classified horizontal if less than the width of the paddle separated the beginning of the forward swing from any other point in the tracing. The swing was oblique if at

least the width of the paddle separated the forward swing path from the backswing at any point in the tracing. Swings in an oblique plane were classified as either a low-to-high swing or a high-to-low swing. The start and finish points for the forward swing tracings were used for this judgment, and the tip of the paddle at a point directly opposite from the grip was used as the landmark for these tracings. When the finish point was higher than the start of the swing, the swing was classified as low-to-high. When the finish point was lower than the start of the forward swing, the swing was classified high-to-low. The third aspect of form was the relative height at which the ball was hit. A ball that was hit after dropping from the ball dispenser a distance greater than the diameter of the ball was a "low" hit. A ball that was hit before dropping more than the diameter of the ball was classified as a "high" hit. When the ball was missed, the "point of contact" was considered to be that point where the paddle appeared largest and approximately in front of the ball dispenser.

Consistency scores were derived from comparisons among the five traced swings. Each of the first five swings was compared with each of the others on the three dimensions, yielding 10 comparisons for each form dimension, or 30 comparisons in all, for each subject on each test. Each comparison was scored as "similar" or "different" on each of the three aspects of form selected. One point was scored for each comparison that was judged as "similar," and 30 points was the maximum score for the 5 swings. The maximum score indicated the highest possible degree of trial-to-trial

consistency in form as measured by these procedures. Consistency scores were used to determine differences among pretest, midtest, and posttest performance and differences among the two practice conditions and the control condition.

Analyzing the Data

The data, obtained from practice periods and a pretest, a midtest and posttest, were analyzed nonparametrically for practice and treatment effects. Dependent measures of the tests were the number of target hits, the greatest distance at which the target was hit, and form consistency. The dependent measure of the practice periods was the number of target hits. Form consistency data of four subjects scoring above the median and of four subjects scoring below the median in the number of target hits during practice, were analyzed for increased consistency with practice.

The Friedman two-way analysis of variance by ranks was employed for testing differences among the three test periods and among the three experimental conditions. When significant differences were found among the three sample comparisons, the Walsh test was employed to determine differences between each pair of test periods or each pair of experimental conditions. Target hit data obtained from the practice periods were analyzed by application of the Walsh test.

The data were analyzed nonparametrically because the size of the sample was small. The individual subject treatment, the counterbalanced control procedure, and time limitations prohibited

a larger sample. The Friedman two-way analysis of variance by ranks was used to test differences among the three test periods for practice effects. The Friedman test also was used to analyze differences among the three treatment conditions of practice accompanied by contingent praise, practice accompanied by noncontingent praise, and a no-practice or praise control on the midtest and posttest for treatment effects. These data were analyzed with the alpha set at .20. Following applications of the Friedman test in which significant differences were found, the Walsh test was applied to analyze differences between each successive pair of test periods and each pair of treatment conditions. Differences between contingent and noncontingent praise in the number of target hits in the eight practice periods also were analyzed by the application of the Walsh test. The alpha level was set at .05 when the data were analyzed by the Walsh test.

The unconventional alpha level of .20 was employed when the data were analyzed by the Friedman test because power of the Friedman was estimated to be very low when few subjects were employed. Seigel (1956) reported that the Friedman rank-order analysis of variance and the analogous parametric F test are nearly equal in power when the assumptions required for parametric analyses are met. Cohen (1962) estimated the F test to have a power of .41 when 3 groups and 23 subjects, or observations, are employed. Three-sample comparisons in the present study employed only four subjects or observations. In a further discussion of statistical power, Seigel (1956) suggested the appropriateness of using a less stringent

alpha level than the conventional .01 or .05 for exploratory research, or for investigation in which potential inaccuracy of conclusions does not have dangerous or harmful consequences. In the present study, falsely rejecting hypotheses would not have dangerous or harmful effects. Methods described by Cohen (1969) for increasing power of the statistical test are to increase sample size, increase the effectiveness of the experimental control procedures, or increase the alpha level at which the data are analyzed. In the present study, the size of the sample was small and necessarily fixed. Experimental procedures for maintaining internal validity were applied. Setting the alpha level at .20 appeared to be the most feasible of the alternatives available for increasing power of the Friedman test used in the present investigation.

Gains resulting from testing or from unknown extraneous variables were analyzed by determining differences among the three test periods for the control subjects who did not practice. Gains in performance resulting from practice plus testing were analyzed by determining differences among the three test periods for subjects who practiced. Treatment effects were determined by two methods. First, the number of target hits in the practice periods was compared for differences between practice with contingent and noncontingent praise. Second, midtest and posttest data of the three matched groups were analyzed for differences among practice with contingent praise, practice with noncontingent praise, and no practice. Form consistency data for two groups of subjects were analyzed for increased consistency with practice. Form

consistency of four subjects scoring above the median, and of four subjects scoring below the median in hitting the target during practice periods, were analyzed for within-subject differences among the three test periods.

SUMMARY

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking task by preschool children who ranged in age from 4 years to 5 years 10 months. Verbal praise was used as a social reinforcer. The dependent measures analyzed for differential effects were the number of target hits, the distance from the target at which the task was accomplished, and trial-to-trial consistency in selected aspects of form. A preliminary study was conducted to determine appropriate procedures to be employed in the main investigation.

Three groups of four subjects were equated on pretest scores, age, and gender. A counterbalance design was used in which two groups were given practice under both contingent and noncontingent praise. The order of the treatment was reversed for the groups. One group received contingent praise in the first four practice periods while the other received noncontingent praise. Following the first four practice periods, a test for accomplishment or change was administered and the contingencies of praise were reversed. Following the second four practice periods, a posttest was administered. A control group was tested on a time

schedule that coincided with the test periods for the two practice groups. No praise was given during test periods. All test performance was filmed and selected aspects of form were quantified for determining trial-to-trial consistency among the first five swings of each test.

CHAPTER IV

FINDINGS AND DISCUSSION

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking task by preschool children. Twelve children, ranging in age from 4 years to 5 years 10 months, were selected from 17 potential subjects to serve as subjects for the investigation. Twelve children were divided into three groups equated on age, sex, and pretest scores, with two groups designated as experimental, and one group as a control. Subjects in the experimental groups practiced a hitting task individually, and they were given contingent and noncontingent verbal praise in a counterbalanced order. Four subjects in one experimental group were given contingent praise in the first four practice periods, while four subjects in the second experimental group were given noncontingent praise. A test was administered following the first four practice periods. The contingencies of praise for the two groups were reversed in the second four practice periods. A posttest was administered following the second four practice periods. The four no-practice control subjects were tested on a time schedule that coincided with the test periods for the subjects who practiced. Verbal praise was withheld for all subjects during the test periods.

Dependent measures obtained from the test performance included the number of target hits, the distance at which the target

was hit, and consistency in selected aspects of form. The dependent measure obtained from practice periods was the number of target hits. Test performance was filmed and selected aspects of form were quantified for determining trial-to-trial consistency among the first five swings of a test period.

In this chapter, the findings of the investigation are first presented and then discussed. The findings and discussion are presented in separate sections, both of which include: (1) treatment effects, (2) practice effects, and (3) achievement and form consistency. Data concerning objectivity of verbal praise are presented in the findings section following the presentation concerning achievement and form consistency.

FINDINGS

The findings related to treatment effects are reported first. They include target hit data for the eight practice periods analyzed for differences between practice accompanied by contingent praise and practice accompanied by noncontingent praise. Midtest and posttest data are presented for group comparisons among practice with contingent praise, practice with noncontingent praise, and repeated testing without interpolated practice or praise. The findings related to practice effects are reported second. They include comparisons among the pretest, midtest, and posttest data. These data are reported for subjects who practiced under contingent and noncontingent praise, and for subjects who did not practice and received no praise. Finally, form consistency data for subjects

scoring above and below the median in target hits during practice are presented and analyzed for differences across test periods.

Treatment Effects

The first question related to treatment effects was: Does the number of target hits during practice accompanied by contingent praise differ from the number of target hits during practice accompanied by noncontingent praise? Target hits during practice arrayed in Table 1 followed a counterbalanced order in which subjects received contingent or noncontingent verbal praise as shown:

	Practice Periods							
	1	2	3	4	5	6	7	8
Subjects 1 - 4	C	C	C	C	NC	NC	NC	NC
Subjects 5 - 8	NC	NC	NC	NC	C	C	C	C

When the order in which subjects received contingent and noncontingent verbal praise was examined, the number of target hits by subjects who received noncontingent praise in the first four practice periods tended to decrease across those periods. The decrease is clearly represented for subjects 7 and 8, and to a lesser extent for Subject 6. On the other hand, subjects who received noncontingent verbal praise in the second four practice periods either increased target hits or showed relatively little change in target hits during practice accompanied by noncontingent verbal praise. For example, Subject 1 showed relatively little change in target hits during practice accompanied by noncontingent verbal praise, while Subject 4 showed an increase in target hits during practice accompanied by noncontingent verbal praise.

Table 1. Target Hits in Four Practice Periods Accompanied by Contingent Verbal Praise and Four Practice Periods Accompanied by Noncontingent Verbal Praise

Order of Treatment	Subject	Practice Periods 1	2	3	4	5	6	7	8
Contingent to noncontingent	1	7	5	6	7	7	9	9	8
	2	4	5	6	7	5	5	6	2
	3	3	5	8	8	6	4	3	4
	4	1	2	4	2	5	11	12	8
Noncontingent to contingent	5	4	7	9	4	8	6	8	11
	6	9	6	4	6	6	8	14	11
	7	5	0	0	1	0	0	3	11
	8	12	9	12	5	7	9	10	7

Table 2 presents the total target hits and difference scores between the four practice periods under contingent verbal praise and the four practice periods under noncontingent verbal praise.[1] Five of the eight subjects scored more target hits during practice accompanied by contingent verbal praise than during practice accompanied by noncontingent verbal praise. Application of the Walsh test indicated that this difference was significant at the .04 level, with subjects hitting the target significantly more often during practice accompanied by contingent verbal praise than during

[1]Raw scores of the three dependent measures for all test periods and all subjects and for target hits in the eight practice periods are located in the Appendix.

practice accompanied by noncontingent verbal praise. Therefore, the directional hypothesis that practice accompanied by contingent verbal praise is superior to practice accompanied by noncontingent verbal praise in the number of target hits achieved during practice periods was supported.

Table 2. Total Target Hits and Difference Scores of Four Practice Periods Under Contingent and Four Under Noncontingent Verbal Praise

Subject	Contingent Praise	Noncontingent Praise	Difference
1	25	33	8
2	22	18	-4
3	24	17	-7
4	9	36	27
5	33	24	-11
6	39	25	-14
7	14	6	-8
8	33	38	5

The second question related to treatment effects was: Are there differences among test performances as measured by target hits, target distance, and form consistency scores that follow practice accompanied by contingent verbal praise, noncontingent verbal praise, and a period of time with no practice or praise? Differences among the three conditions were analyzed at the midtest and posttest for target hits, target distance and form consistency scores.

Table 3 presents midtest target hits and rank order following four practice periods accompanied by contingent verbal praise (E-1), four practice periods accompanied by noncontingent verbal praise (E-2), and a period of time with no practice or praise (C). The number of target hits are ranked across the rows by treatments, with the rank of 1 assigned to the highest score. Three of the four control subjects (9, 10, 11) received the rank of 1 for target hits during the midtest. However, one control subject (12) failed to hit the target during the midtest.

Table 3. Midtest Target Hits Following P tice Accompanied by Contingent Verbal Praise (E-1), Noncontingent Verbal Praise (E-2), and No Practice or Praise (Control)

Matched Subjects	E-1 Contingent Praise		E-2 Noncontingent Praise		Control	
	Hits	Rank	Hits	Rank	Hits	Rank
1-5-9	6	2.5	6	2.5	12	1
2-6-10	9	2	5	3	12	1
3-7-11	3	2	0	3	5	1
4-8-12	1	2	7	1	0	3

Table 4 presents posttest target hits and rank order following the second four practice periods accompanied by noncontingent verbal praise (E-1), contingent verbal praise (E-2), and a period of time with no practice or praise (C). The experimental group that received contingent verbal praise during the first four

practice periods (E-1), received noncontingent verbal praise during the second four practice periods. The experimental group that received noncontingent verbal praise during the first four practice periods (E-2), received contingent verbal praise during the second four practice periods. Inspection of the ranks indicates that the group practicing under contingent verbal praise during the four practice periods prior to the posttest (E-2) had the greatest number of target hits among the three groups during the posttest. One control subject and two subjects who practiced under noncontingent verbal praise during the four practice periods prior to the posttest failed to hit the target during the posttest.

Table 4. Posttest Target Hits Following Practice Accompanied by Contingent Verbal Praise (E-2), Noncontingent Verbal Praise (E-1), and No Practice or Praise (Control)

Matched Subjects	E-2 Contingent Praise		E-1 Noncontingent Praise		Control	
	Hits	Rank	Hits	Rank	Hits	Rank
1-5-9	10	2	14	1	9	3
2-6-10	9	2	0	3	11	1
3-7-11	7	1	0	3	5	2
4-8-12	8	2	12	1	0	3

Two Friedman Analyses of Variance for target hits among the three groups at the midtest and posttest are presented in Table 5. No further group comparisons for target hits were made

because differences among the groups failed to reach significance at the .20 level of confidence. The null hypothesis that there are no significant differences among practice accompanied by contingent verbal praise, noncontingent verbal praise, and no practice or praise as measured by target hits during the midtest and posttest was supported.

Table 5. Friedman Analyses of Variance of Midtest and Posttest Target Hits Following Practice Accompanied by Contingent Verbal Praise, Noncontingent Verbal Praise, and No Practice or Praise.

Source	SR^2	df	Xr^2
Midtest	198.5	2	1.62
Posttest	192.0	2	0.00

Table 6 presents midtest target distances and rank order following practice periods accompanied by contingent verbal praise (E-1), noncontingent verbal praise (E-2), and a period of time with no practice or praise (C). Inspection of target distances displayed in Table 6 indicates that one subject who practiced under noncontingent verbal praise prior to the midtest, and one control subject, failed to hit the target during the midtest.

Table 7 presents posttest target distances and rank order following practice periods accompanied by noncontingent verbal praise (E-1), contingent verbal praise (E-2), and a period of time with no practice or praise (C). Half of the subjects who practiced

Table 6. Midtest Target Distances in Feet, and Rank Order Following Practice Accompanied by Contingent Verbal Praise (E-1), Noncontingent Verbal Praise (E-2), and No Practice or Praise (Control)

Matched Subjects	E-1 Contingent Praise		E-2 Noncontingent Praise		Control	
	Distance	Rank	Distance	Rank	Distance	Rank
1-5-9	7.5	1.5	4.5	3	7.5	1.5
2-6-10	3.0	2.5	3.0	2.5	4.5	1
3-7-11	3.0	2	0.0	3	6.0	1
4-8-12	1.5	2	4.5	1	0.0	3

under noncontingent verbal praise in the four practice periods prior to the posttest failed to hit the target during the post-test.

Table 7. Posttest Target Distances in Feet and Rank Order Following Practice Accompanied by Noncontingent Verbal Praise (E-1), Contingent Verbal Praise (E-2), and No Practice or Praise (Control)

Subjects	E-1 Contingent Praise		E-2 Noncontingent Praise		Control	
	Distance	Rank	Distance	Rank	Distance	Rank
1-5-9	4.5	2	6.0	1	3.0	3
2-6-10	3.0	2	0.0	3	7.5	1
3-7-11	7.5	1	0.0	3	3.0	2
4-8-12	4.5	1.5	4.5	1.5	0.0	3

Friedman Analyses of Variance of target distances among the three groups at the midtest and posttest are displayed in Table 8, and indicate nonsignificant differences at both the midtest and posttest. The null hypothesis that there are no significant differences among practice accompanied by contingent verbal praise, noncontingent verbal praise, and no practice or praise as measured by the target distance during the midtest and posttest was supported.

Table 8. Friedman Analyses of Variance of Midtest and Posttest Target Distances Following Practice Accompanied by Contingent Verbal Praise, Noncontingent Verbal Praise, and No Practice or Praise

Source	SR^2	df	Xr^2
Midtest	196.5	2	1.12
Posttest	195.0	2	0.88

Table 9 presents midtest form consistency scores and rank order following practice periods accompanied by contingent verbal praise (E-1), noncontingent verbal praise (E-2), and a period of time with no practice or praise (C). Ranges of consistency scores for control subjects and subjects practicing under noncontingent verbal praise prior to the midtest were greater than the range of scores for subjects practicing under contingent verbal praise. Consistency scores of subjects practicing under contingent verbal praise prior to the midtest ranged from 20 to 30, a range of 10

points. Consistency scores of subjects practicing under noncontingent verbal praise prior to the midtest ranged from 12 to 26, a range of 14 points. For control subjects consistency scores ranged from 14 to 30, a range of 16 points.

Table 9. Midtest Form Consistency Scores and Rank Order Following Practice Periods Accompanied by Contingent Verbal Praise (E-1), Noncontingent Verbal Praise (E-2), and No Practice or Praise (Control)

Matched Subjects	E-1 Contingent Praise		E-2 Noncontingent Praise		Control	
	Score	Rank	Score	Rank	Score	Rank
1-5-9	20	3	26	1.5	26	1.5
2-6-10	30	1	26	2	14	3
3-7-11	22	2.5	26	1	22	2.5
4-8-12	30	1.5	12	3	30	1.5

Table 10 presents posttest form consistency scores and rank order following practice periods accompanied by noncontingent verbal praise (E-1), contingent verbal praise (E-2), and a period of time with no practice or praise (C). Consistency scores of control subjects ranged from 14 to 30, a range of 16 points which was identical to control subjects' range at the midtest. Scores of subjects practicing under contingent verbal praise prior to the posttest also ranged from 14 to 30 at the posttest. For subjects practicing under noncontingent verbal praise prior to the posttest, consistency scores ranged from 23 to 26, a range of only 3 points.

Table 10. Posttest Form Consistency Scores and Rank Order Following Practice Accompanied by Contingent Verbal Praise (E-2), Noncontingent Verbal Praise (E-1), and No Practice or Praise (Control)

Matched Subjects	E-2 Contingent Praise		E-1 Noncontingent Praise		Control	
	Score	Rank	Score	Rank	Score	Rank
1	30	1	26	2.5	26	2.5
2	26	1	23	2	22	3
3	14	2.5	26	1	14	2.5
4	19	3	26	2	30	1

Friedman Analyses of Variance of form consistency scores among the three groups at the midtest and posttest are displayed in Table 11, and indicate nonsignificant differences at both the midtest and posttest. The null hypothesis that there are no significant differences among practice accompanied by contingent verbal praise, noncontingent verbal praise, and no practice or praise as measured by form consistency scores obtained during the midtest and posttest was supported.

Table 11. Friedman Analyses of Variance of Midtest and Posttest Form Consistency Scores Following Practice Accompanied by Contingent Verbal Praise, Noncontingent Verbal Praise, and No Practice or Praise

Source	SR^2	df	Xr^2
Midtest	198.5	2	1.62
Posttest	193	2	0.44

Nonsignificant differences were found among the three conditions at both the midtest and the posttest for target hits, target distances, and form consistency scores. The null hypothesis that there are no significant differences among practice accompanied by contingent verbal praise, practice accompanied by noncontingent verbal praise, and a period of time with no practice or praise as measured by midtest and posttest scores of form consistency, the number of target hits, and distance at which the target is hit was supported.

Practice Effects

The first question related to practice effects was: Do the number of target hits, target distances and form consistency scores of subjects who practice increase across the three test periods. Table 12 presents target hits and rank order across three test periods for subjects who practiced. The rank of number 1 represents the most target hits and the rank of number 3 represents the least target hits for each subject in each test period. Six of eight practiced subjects scored their greatest number of target hits during the posttest, while two scored their greatest number during the midtest.

Table 13 presents the Friedman Analysis of Variance of pretest, midtest, and posttest target hits of practiced subjects, and indicates significant differences among the three test periods at the alpha level of .20. The null hypothesis that there are no significant differences among pretest, midtest, and posttest target

Table 12. Target Hits and Rank Order Across Three Test Periods of Practiced Subjects

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
1	10	2	6	3	14	1
2	1	2	9	1	0	3
3	2	2	3	1	0	3
4	0	3	1	2	12	1
5	6	2.5	6	2.5	10	1
6	4	3	5	2	9	1
7	3	2	0	3	7	1
8	0	3	7	2	8	1

hits of subjects who practiced was rejected. Subsequent application of the Walsh test to the target hit data of practiced subjects indicated midtest target hits to be significantly greater than pretest target hits, and posttest target hits to be significantly greater than midtest target hits. Differences were significant at the alpha level of .04. The directional hypothesis that the number of target hits will increase from the pretest to the midtest and from the midtest to the posttest for practiced subjects was supported.

Table 13. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Target Hits of Practiced Subjects

Source	SR^2	df	Xr^2
Target hits	798.5	2	3.56[a]

[a]Difference significant at the .20 level.

Table 14 presents target distances in feet, and rank order across three test periods of practiced subjects. Two practiced subjects hit the target at the maximum distance of 7.5 feet during the pretest.

Table 14. Target Distances in Feet and Rank Order Across Test Periods of Practiced Subjects

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
1	2.5	3	7.5	1	6.0	2
2	.5	2	3.0	1	0.0	3
3	.5	2	3.0	1	0.0	3
4	0.0	3	1.5	2	4.5	1
5	7.5	1	4.5	2.5	4.5	2.5
6	1.5	3	3.0	1.5	3.0	1.5
7	7.5	1.5	0.0	3	7.5	1.5
8	0.0	3	4.5	1.5	4.5	1.5

Table 15 presents the Friedman Analysis of Variance of pretest, midtest, and posttest target distances of subjects who practiced, and indicates no significant differences among the three test periods for target distance. The null hypothesis that there are no significant differences among pretest, midtest, and post-test target distances of subjects who practiced was supported; therefore, directional hypotheses were not tested.

Table 16 presents form consistency scores and rank order across three test periods of subjects who practiced. Five of eight practiced subjects were least consistent during the pretest. Ranks

Table 15. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Target Distances of Practiced Subjects

Source	SR^2	df	Xr^2
Target distance	780.5	2	1.56

of consistency scores were almost evenly distributed between the midtest and posttest.

Table 16. Form Consistency Scores and Rank Order Across Test Periods of Practiced Subjects

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
1	26	1.5	20	3	26	1.5
2	16	3	30	1	23	2
3	10	3	22	2	26	1
4	20	3	30	1	26	2
5	13	3	26	2	30	1
6	24	3	26	1.5	26	1.5
7	23	2	26	1	14	3
8	22	1	12	3	19	2

Table 17 presents the Friedman Analysis of Variance of pretest, midtest, and posttest form consistency scores of subjects who practiced, and indicates nonsignificant differences among the three test periods for consistency scores. The null hypothesis

that there are no significant differences among pretest, midtest, and posttest consistency scores of subjects who practiced was supported. Therefore, directional hypotheses were not tested.

Table 17. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Form Consistency Scores of Practiced Subjects

Source	SR^2	df	Xr^2
Form consistency	786.5	2	2.30

The second question related to treatment effects was: Do the number of target hits, target distances, and form consistency scores of subjects who do not practice increase across three test periods? Table 18 presents target hits and rank order across three test periods for subjects who did not practice. Three of four control subjects scored their fewest target hits during the pretest, and one subject failed to hit the target in all test periods.

Table 18. Target Hits and Rank Order Across Three Test Periods for Subjects Who Did Not Practice

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
9	6	3	12	1	9	2
10	2	3	12	1	11	2
11	2	3	5	1.5	5	1.5
12	0	2	0	2	0	2

Table 19 presents the Friedman Analysis of Variance of pretest, midtest, and posttest target hits of subjects who did not practice, and indicates significant differences among the test periods for target hits. The null hypothesis that there are no significant differences among the pretest, midtest, and posttest target hits of subjects who do not practice was rejected at the alpha level of .20. Subsequent applications of the Walsh test to the target hit data of subjects who did not practice indicated nonsignificant differences between the pretest and the midtest, and between the midtest and the posttest. Therefore, the directional hypothesis that the number of target hits will increase from the pretest to the midtest and from the midtest to the posttest for subjects who do not practice was not supported.

Table 19. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Target Hits of Subjects Who Did Not Practice

Source	SR^2	df	Xr^2
Target hits	207.5	2	3.88[a]

[a]Difference significant at the .20 level.

Table 20 presents target distances and rank order across three test periods of subjects who did not practice. Three of four control subjects hit the target from a greater distance during the midtest than they did during the pretest. The fourth control subject failed to hit the target in all three test periods.

Table 20. Target Distances in Feet, and Rank Order Across Three Test Periods of Subjects Who Did Not Practice

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
9	6.0	2	7.5	1	3.0	3
10	.5	3	4.5	2	7.5	1
11	.5	3	6.0	1	3.0	2
12	0.0	2	0.0	2	0.0	2

Application of the Friedman Analysis of Variance displayed in Table 21 indicates nonsignificant differences among the three test periods for target distances of subjects who did not practice. The null hypothesis that there are no significant differences among the three test periods for target distance of subjects who do not practice was supported.

Table 21. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Target Distances of Subjects Who Did Not Practice

Source	SR^2	df	Xr^2
Target distance	200	2	2.00

Table 22 presents form consistency scores and rank order across test periods of subjects who did not practice. Subject 12, who never hit the target during testing, scored maximum points in form consistency across the three test periods.

Table 22. Form Consistency Scores and Rank Order Across Three Test Periods of Subjects Who Did Not Practice

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
9	20	3	26	1.5	26	1.5
10	13	3	14	2	22	1
11	22	1.5	22	1.5	14	3
12	30	2	30	2	30	2

Application of the Friedman Analysis of Variance displayed in Table 23 indicates nonsignificant differences among the three test periods for form consistency scores of subjects who did not practice. The null hypothesis that there are no significant differences among pretest, midtest, and posttest form consistency scores of subjects who do not practice was supported. Directional hypotheses were not tested.

Table 23. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Form Consistency Scores of Subjects Who Did Not Practice

Source	SR^2	df	Xr^2
Form consistency	195	2	.88

Achievement and Form Consistency

The first question related to achievement and form consistency was: Do the experimental subjects who score above the

median in target hits during practice increase their consistency of form across test periods? Table 24 presents form consistency scores and rank order across three tests for subjects scoring above the median in target hitting during practice.

Table 24. Form Consistency Scores and Rank Order Across Three Tests of Subjects Scoring Above the Median in Target Hits During Practice Periods

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
1	26	1.5	20	3	26	1.5
5	13	3	26	2	30	1
6	24	3	26	1.5	26	1.5
8	22	2	12	3	19	1

Application of the Friedman Analysis of Variance displayed in Table 25 indicates nonsignificant differences among the three test periods for form consistency scores of subjects scoring above the median in target hitting during practice periods. The null hypothesis that there are no significant differences in consistency scores among the pretest, midtest, and posttest for subjects scoring above the median was supported.

Table 25. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Form Consistency Scores of Subjects Scoring Above the Median in Target Hits During Practice Periods

Source	SR^2	df	Xr^2
Tests	198.5	2	1.6

The second question related to achievement and form consistency was: Do the experimental subjects who score below the median in target hitting during practice increase their consistency of form across test periods? Table 26 presents form consistency scores and rank order across three test periods for subjects scoring below the median in target hitting during practice. All four subjects had higher consistency scores on the midtest than on the pretest.

Table 26. Form Consistency Scores and Rank Order Across Three Tests for Subjects Scoring Below the Median in Target Hits During Practice Periods

Subject	Pretest	Rank	Midtest	Rank	Posttest	Rank
2	16	3	30	1	23	2
3	10	3	22	2	26	1
4	20	3	30	1	26	2
7	23	2	26	1	14	3

The Friedman Analysis of Variance displayed in Table 27 indicates significant differences among the three test periods for consistency scores of subjects scoring below the median in target hits during practice. Subsequent applications of the Walsh test to form consistency scores of subjects below the median in target hitting during practice showed midtest consistency to be significantly greater than the pretest consistency scores, and no significant difference between the midtest and posttest

consistency scores. The null hypothesis that there are no significant differences in consistency scores among the pretest, midtest, and posttest for subjects scoring below the median in target hitting during practice was rejected at the .20 level of confidence. The directional hypothesis that form consistency scores of subjects scoring below the median in target hitting during practice will increase from pretest to the midtest was supported. The directional hypothesis was not supported for an increase from the midtest to the posttest.

Table 27. Friedman Analysis of Variance of Pretest, Midtest, and Posttest Form Consistency Scores of Subjects Scoring Below the Median in Target Hits During Practice Periods

Source	SR^2	df	Xr^2
Tests	210	2	4.5^a

[a]Difference significant at the .20 level.

Objectivity of Praise

To determine objectivity in giving verbal praise during the practice periods, a trained observer recorded on a score sheet a target hit or a miss for each trial, and whether the trial was followed by praise or no praise.[2] Percentage of accuracy in delivering praise was determined by the ratio between chances for errors and the number of appropriate responses made. Thirty trials per subject produced 90 chances for errors in

[2]Sample score sheets are located in the Appendix.

giving verbal praise. Failing to give praise following the preselected trial, giving praise when it should have been withheld, and using phrases other than those selected were scored as errors. Inspection of the records showed that verbal praise was given with 100 percent accuracy in the contingent praise condition. In the noncontingent praise condition, the lowest percentage of accuracy attained was 80 percent for each of two subjects. The mean for accuracy of praise given each subject was 89 percent and the median was 90 percent.

DISCUSSION

The findings of the present investigation are discussed in the following section. Speculations concerning observations of subject performance for which no data were recorded are offered. In addition, form consistency data for subjects above and below the median target hitting score are discussed in relation to the kinds of form displayed. The discussion of the findings is divided into three parts: (1) the effects of treatment conditions upon task performance; (2) the effects of practice upon task performance, and (3) the form consistency of subjects scoring above and below the median in target hitting during practice.

Treatment Effects

The number of target hits by subjects during practice with contingent praise was significantly greater than the number of target hits by the same subjects during practice with noncontingent praise. While only five out of eight subjects scored more target

hits under contingent praise than under noncontingent praise, the difference was significant. There were no data to indicate whether contingent praise enhanced accomplishment or noncontingent praise interfered with performance. However, observation of subject behavior, for which no statistical data were obtained, appeared to contribute to the superiority of contingent praise over noncontingent praise in the number of target hits. During practice with noncontingent praise subjects demonstrated a wide range of behavior between and during trials which may have interfered with performance of the task. Some examples of this behavior in the noncontingent praise condition were exhibited while the ball rolled down the ball dispenser. Subjects often balanced on one foot, stood in a crouched position, or kneeled while waiting for the ball to arrive. One subject stood 5 to 10 feet away from the ball dispenser as the ball was presented for the trial. As the ball rolled down the ball dispenser, this subject ran forward, sometimes whirling around on both feet, and arrived in front of the ball dispenser in time to hit the ball. Subjects usually swung at the ball as it rolled off the ball dispenser, but occasionally they balanced the ball on the paddle instead of striking the ball. Subjects sometimes held the paddle at the end of the ball dispenser and prevented the ball from rolling off the ball dispenser. Following a trial, subjects often ran after the ball and sometimes picked up the ball and threw it toward the experimenter or away from the practice area.

Under practice with contingent reinforcement, subjects stood relatively still and faced the ball dispenser while the ball for the trial was presented. Subjects almost always swung at the ball as it left the ball dispenser. After each trial, subjects usually watched the ball roll away and then looked toward the experimenter as the prompt for the next trial was given.

When the reinforcement contingencies were reversed for the two groups, subjects who displayed the variety of behavior described above during noncontingent praise appeared to adopt the more workman-like behavior exhibited by the subjects under contingent reinforcement. Subjects who displayed this workman-like behavior in the first phase of the study under practice with contingent praise gradually adopted a wider variety of behavior when they began to practice under noncontingent praise. Although no data were obtained concerning the frequency or amount of time subjects engaged in the varieties of behavior described, observations made by the experimenter and a trained assistant suggested that extraneous behavior exhibited under noncontingent reinforcement interfered with accomplishment. The workman-like behavior exhibited by subjects during practice with contingent praise may or may not have enhanced accomplishment in hitting the target, but in any case, the workman-like behavior did not appear to interfere with accomplishment.

Target hits by the two groups that practiced suggested an interaction of level of performance and the order in which

contingent or noncontingent reinforcement was given. The group that received noncontingent praise in the first four practice periods decreased the number of target hits across the first four practice periods. The group that received noncontingent praise after a period of practice accompanied by contingent praise showed no comparable decrease in target hits. The findings suggest that when contingent praise is given first, gains made in the first practice periods may be maintained. However, when noncontingent praise is given first, performance deteriorates. One explanation for these findings suggests an interaction between level of performance and noncontingent reinforcement. In the initial stages of practice more unsuccessful than successful responses are likely to occur. Therefore, when noncontingent reinforcement is given in the initial practice periods, unsuccessful responses are reinforced at a higher rate than successful responses. When noncontingent reinforcement is given after a period of practice, proportionally more successful responses will be emitted and, therefore, reinforced. Martens (1970, 1971) suggested an interaction between reinforcement and performance level when he concluded that social reinforcement has greater potential for affecting performance of well-learned motor responses than the initial acquisition of skills. Social reinforcement had no effect upon the performance of his subjects. He reasoned that in the initial stages of practice, subjects have little control over their own motor responses. An alternative explanation (Millenson, 1967) suggested that when trial-to-trial

performances vary, those responses that are more effective are differentially reinforced and tend to increase in frequency while ineffective responses decrease in frequency, and the net result is improved performance. If initial performances are more variable than well-learned performance, one might expect reinforcement to be effective in the initial acquisition of skills when reinforcement is applied to improved performance. Comparisons among studies in the literature are difficult to make because shaping procedures are not fully described or are omitted. Findings of the present study suggest that the contingency of reinforcement interacts with the level of performance and favors contingent reinforcement over noncontingent reinforcement in the first stages of practice.

Although significant differences were found between contingent and noncontingent praise in the number of target hits during practice, nonsignificant differences were found at the midtest and posttest for the group comparisons among practice with contingent praise, practice with noncontingent praise, and no practice or praise. The reasons for finding nonsignificant effects of verbal praise on target hitting, target distance, and form consistency in the testing conditions of the midtest and posttest, but finding significant effects on target hitting during practice is unknown. Comparisons of contingent and noncontingent praise conditions in practice periods were based upon target hits by the same subjects under both conditions, and revealed a significant difference favoring contingent praise.

When differences among the three conditions were analyzed by group comparisons, there were nonsignificant differences. From the data it is impossible to determine if practice with contingent praise caused performance to improve, if practice with noncontingent praise caused performance to deteriorate, or if both effects occurred in combination. If extraneous behavior displayed under practice accompanied by noncontingent praise interfered with effective practice, one might speculate that differences among the three groups might have appeared at the midtest and posttest had the treatment been extended over a longer period of time.

Additional explanation for finding nondifferential effects in the testing and differential effects during practice lies in the differences between conditions of practice and test periods. Reinforcement was withheld during testing as a control procedure. Therefore, control subjects were accustomed to performing without praise during the experiment, while practiced subjects were not. Another difference between practice and test conditions was that tests were made at six different target distances. The target distance was increased by 18 inches without regard to subject success. In the practice condition, the target was increased by six inches, and only when the subject hit the target. Having to make an adjustment to these changes in the experimental setting may have interfered with test performance of practiced students. The final difference was observed by the trained assistant who brought the children to the experiment from the kindergarten. She reported that the control subjects appeared more eager to go to

the experiment than the practiced subjects. Early in the study, most children asked to go to the experiment every day, and ran to the experiment when they were told it was time. During the post-test, the control subjects appeared more eager than the subjects who had practiced. These observations suggested habituation effects in practiced subjects and no habituation effects in control subjects.

Practice accompanied by contingent praise and practice accompanied by noncontingent praise had nondifferential effects on the within-subject form consistency on three dimensions of form during testing. The form dimensions involved a sequence of movements displayed from the finish of the backswing to the follow-through, and included the plane of the swing, the direction of the swing, and the relative height at which the ball was hit. One explanation of the nondifferential effects of contingent and non-contingent reinforcement concerns the time interval between the movement and the reinforcement. Reinforcement is most effective when it immediately follows the behavior to be reinforced. The effectiveness of reinforcement generally decreases as the delay between a response and reinforcement increases (Bandura, 1969). Effects of reinforcement might have been found by studying changes in form consistency on dimensions of form appearing in closer temporal relation to the reinforcement. For example, in the present study, comparisons among thirty swings on the point of contact might have revealed effects of reinforcement on form consistency. When the swing is a well-learned unified response one

might expect reinforcement to affect the swing as a whole. But when the movement is relatively unpracticed and not well integrated, extrinsic reinforcement may have more control over those points along the sequential movement involved in the response that are closer in time to reinforcement. An alternative procedure that might have produced differential effects is reinforcing form directly. Although form was not directly reinforced in the present investigation, several writers (Johnston and others, 1966; Harris, 1964) have reported an increase in behavior that was associated in time with the behavior being reinforced. However, reinforcing target hits in the present study did not reinforce particular forms displayed that were most effective in hitting the target. Reinforcing form directly or using different dependent measures might have produced different results.

Practice Effects

Target hits for the three test periods showed significant increases for subjects who practiced and no significant differences across test periods for control subjects who did not practice. The data indicated that repeated testing did not account for the improvement in target hitting exhibited by the subjects who practiced. However, nonsignificant differences at the midtest and the posttest for the three groups and inspection of raw scores indicated that some control subjects hit the target as often as some subjects who practiced. Control subjects showed a trend toward increased target hits from the pretest to the midtest.

Nonsignificant differences across the three test periods for the target-distance data were found for both control and experimental subjects. The target-distance data appeared very similar for control and experimental subjects. Although differences in target distance were nonsignificant, three control and two experimental subjects increased target distance up to 5.5 feet from the pretest to the midtest. There were no comparable increases from the midtest to the posttest in any subject. Significant increases in target distance were expected to accompany increases in the number of target hits because the target distance was increased slightly each time the subject hit the target in both practice conditions. Nonsignificant findings for the target-distance data might be explained by unexpectedly high pretest scores. Two experimental subjects attained the maximum test distance of 7.5 feet in the pretest.

Nonsignificant differences across the three test periods for form consistency were found for both control and experimental subjects. Form consistency scores for the control subjects remained very stable, while scores for the experimental subjects showed greater fluctuation. Control subjects who scored low in form consistency on the pretest also scored low on the posttest. Inspection of the data for experimental subjects suggested some increase in consistency from the pretest to the midtest. Although no significant differences were found among the test periods for the consistency scores, the trend toward increased consistency for some experimental subjects and decreased consistency for other

experimental subjects contrasted with very stable scores for control subjects. The data suggested that repeated practice on the task did affect form consistency, but in different ways for different subjects, some becoming more consistent and some becoming less consistent with practice.

Achievement and Form Consistency

When the data of the four subjects with scores above the median and the four subjects with scores below the median in target hitting during practice were analyzed for changes in form consistency, significant differences among the test periods were found for the low achievers, but not the high achievers. Subjects who were below the median in target hitting increased in form consistency from the pretest to the midtest, but not from the midtest to the posttest. There were nonsignificant differences among the test periods in form consistency for subjects above the median in target hitting.

A brief description of the data for the two groups selected as high and low achievers may demonstrate that differences in levels of accomplishment between high and low achievers was large enough to be of practical importance. Although level of success was determined by the total number of target hits in practice periods, subjects who ranked below the median on target hits in practice periods also ranked below the median on target hits in the test periods. The difference between the poorest total practice score for the high-achievement group and the best total practice score for the

low-achievement group was 13 target hits. The mean target hits in the practice periods was 7.8 for the four high achievers, and 4.6 for the four low achievers, an average difference of 3.2 target hits for each practice period. The difference in target distance at which the target was hit by the high and low groups was 3.0 feet. The high achievement group averaged 4.8 feet in the target distance achieved in each practice period, and the low achievement group averaged 1.8 feet. The differences described appeared great enough to suggest that the distinction between subjects scoring above and below the median in target hits represents a real difference in level of competence on the task. High achievers showed a trend toward increases both in target hits and target distance across test periods, while low achievers showed no comparable increases in either measure. On the other hand, high achievers did not increase in form consistency, while low achievers did.

When aspects of form displayed by high and low achievers were inspected for similarities among the subjects within each of these groups, high achievers appeared to use shorter backswings than the low achievers. On the pretest, all four high achievers used a relatively short backswing while three of the four low achievers used a long backswing on some trials, and a short backswing on other trials. On the midtest all low achievers consistently used either a long or a short backswing. Only one high achiever varied his performance between long and short backswings. The only other form aspect which appeared similar among subjects

within each group was the relative height at which the ball was hit. The relative height at which the ball was hit was variable for both groups on the pretest. Subjects from both high and low groups contacted the ball at a low point on some trials and at a high point on other trials. The relative point of contact remained variable for high achievers across the three test periods, but became highly consistent for low achievers on the midtest. On the midtest, each of the low achievers contacted the ball at either a relatively high point or a relatively low point, and did not vary their performance between a high and low point of contact.

No trends of specific form used were discernable for the plane of the swing or direction of the swing. Subjects from both groups were variable in the plane and the direction of the swing across all three test periods. They used both horizontal and oblique swings. When oblique swings were used, more were classified as low-to-high than were classified as high-to-low, but no difference appeared between the two groups in the direction of the swing.

The data appeared to indicate that, from among the form aspects studied, the specific form employed differed somewhat between the most successful and the least successful subjects in the relative length of the backswing and the relative height at which the ball was hit. The highest achievers tended to use a shorter backswing and were versatile in hitting the ball at a relatively high or low point of contact. Lowest achievers adopted either a long or a short backswing and a high or a low point of

contact, and became increasingly consistent in using one form or the other.

The increased consistency in form for the lowest achievers was comparable to the findings of two studies by Grose (1967a, 1967b), in which all subjects increased consistency in accuracy on a coincident timing task. In conditions where knowledge of results was withheld, subjects failed to increase accuracy but did increase consistency of accuracy scores with repeated trials. Grose (1969) found in a subsequent study that the specific time pattern of movement used was unrelated to success on an arm movement timing task. His subjects varied either the speed of the arm movement or the premovement time unit to increase accuracy. In the present study, the high achievers' variability in hitting the ball at a relatively high or low point of contact appeared comparable to the variability in timing to increase accuracy on the coincident timing task studied by Grose. Hitting the ball at a relatively low point appeared comparable to increasing the premovement time unit and increasing the speed of the arm movement. Hitting the ball at a relatively high point appeared comparable to decreasing the premovement time unit. While Grose's subjects employed one of the two methods for increasing accuracy, the most successful subjects in the present investigation employed both a relative high and low point of contact on various trials, but almost always employed a short backswing.

SUMMARY

The data were analyzed nonparametrically by the Friedman and the Walsh tests. Differences among the three test periods and among the three treatment conditions were tested by applying the Friedman analysis of variance by ranks with the alpha level set at .20. Differences between the pretest and the midtest, and between each treatment condition were analyzed by applying the Walsh test with the alpha level set at .05. Directional hypotheses were tested with the Walsh test.

When the data were analyzed for treatment effects, contingent praise was superior to noncontingent praise in the number of target hits during the practice periods. Comparisons among the groups under the three treatment conditions produced nonsignificant differences on the midtest and the posttest.

Findings related to practice effects indicated significant increases in the number of target hits across test periods for subjects who practiced, and nonsignificant differences across test periods for subjects who did not practice. Nonsignificant differences for the control subjects indicated that testing experience did not cause the significant increases in target hitting found for the experimental subjects. However, control subjects showed a trend toward increased target hits from the pretest to the midtest. Nonsignificant differences across test periods were found for both control and experimental subjects in the target distance at which the target was hit, and form consistency.

When the form consistency data were analyzed for the subjects above and below the median in target hitting during practice, the low achievers significantly increased their form consistency from the pretest to the midtest. Nonsignificant differences were found among the three test periods for high achievers. Inspection of the data for the specific form employed by the high and low achievers indicated that high achievers used a relatively short backswing and were versatile in hitting the ball at a high or a low point of contact. Low achievers did not exhibit versatility in the relative height at which they hit the ball and did not show a preference for either a relatively long or short backswing.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate selected effects of contingent and noncontingent social reinforcement on the performance of a ball-striking skill by preschool children. The main hypothesis investigated was that there was no difference between task performance which resulted from practice with contingent praise and performance which resulted from practice with noncontingent praise. Related hypotheses tested were: (1) there were no performance differences across three test periods for subjects exposed to test performance plus interpolated practice; (2) there were no performance differences across three test periods for control subjects exposed to test performance only; (3) there was no increase across test periods in form consistency for subjects above and below the median in target hitting during practice. Dependent variables included the number of target hits, distance from the target at which the target was hit, and a form consistency score which reflected the degree of similarity among repeated trials of the task. Independent variables that were manipulated were verbal praise given for hitting the target, and verbal praise given without regard for task accomplishment.

The literature concerning the application of social reinforcement to acquiring gross motor skills reported positive effects of social reinforcement when combined with shaping

procedures. Mixed findings were reported when social reinforcement was compared with reproof, neutral, and conversation conditions. Several investigations reported no effects while others indicated positive effects which interacted with subject sex and performance level. The assessment studies of young children on ball-striking tasks suggested a trend toward improvement during the elementary school period at successive grade levels. Investigations concerning the performance of coincident timing tasks showed that individuals decreased variability in accuracy when repeated trials on the task were given. Two unique features of the present investigation were that uniform shaping and reinforcement procedures were employed in the experimental treatment, and a combination of dependent variables seldom studied were employed.

A preliminary study, employing 21 4-and 5-year old subjects, was conducted over a 3 month period to design a suitable striking task and an appropriate procedure to be applied in the main investigation. The task which was developed consisted of striking a projected ball with a paddle, causing the ball to hit a target. The instruments selected for use in the investigation were a ball dispenser, a target, a regulation table tennis paddle, regulation tennis balls, measuring tapes, a Kodak Instamatic M8 camera operated at 32 frames per second, and a camera tripod. The ball dispenser was a five foot Plexiglas trough mounted on standards with the front of the trough three inches lower than the back. The standards supporting the ball dispenser were adjustable in height. The target was 30 inches wide and 24 inches high, and was constructed

of heavy cardboard mounted on the front and back of a wooden frame. The target was attached to a standard which was adjustable in height. The equipment was arranged so that the ball rolled down the ball dispenser at a right angle to the target direction. The height adjustment features of the target and ball dispenser were important in the shaping procedure designed for teaching subjects to hit the free-falling ball with greater force and accuracy. The shaping procedure, which was applied uniformly to all subjects in the practice conditions, was that the target distance was increased six inches each time the subject hit the target. When the target distance was increased, heights of the target and ball dispenser were also increased so that their relative heights remained unchanged. Modeling the task, physical assistance, and verbal instructions were procedures designed for instruction given immediately prior to the pretest. Verbal instructions included only procedural directions of what to do, and prompts for looking at the ball when the ball was placed in the ball dispenser. Physical assistance was given on two practice trials by the experimenter placing one hand over the child's hand and guiding the swing to cause the ball to hit the target.

The study employed three groups of four subjects equated on pretest scores, age, and sex. A counterbalanced design was used in which two groups practiced under contingent or noncontingent verbal praise, with the order of the treatment reversed for the groups. One group received contingent praise in the first four practice periods while the other group received noncontingent praise.

Following the first four practice periods, a test for accomplishment was administered, and the contingencies of praise were reversed. Following the second four practice periods, a posttest was administered. A no-practice control group was tested on a time schedule which coincided with the test periods for the two practice groups to determine practice effects of the testing procedure. All test performance was filmed at 32 frames per second, and selected aspects of form were quantified for determining trial-to-trial consistency among the first five swings of each test. Other measures obtained from tests were the number of target hits and the greatest distance at which the target was hit. The dependent measure obtained from practice periods was the number of target hits.

Practice periods for the two experimental groups were distributed between alternate days of the week on a Monday-Wednesday and Tuesday-Thursday counterbalanced schedule. The schedule was altered to accommodate subjects who were absent on a practice day. Distribution of practice over days varied for individuals within the groups due to absences; however, the amount of practice and the interval between training periods were identical for both practice groups. Practice was distributed over four weeks and two days. Each practice period consisted of 30 trials and always began with the target set at the subject's arm length plus 6 inches, and the ball dispenser set at 29 inches above the ground. The height of the ball dispenser and the target were increased by one inch, and the target distance by six inches, each time the

subject hit the target. Verbal praise, given only in the practice periods, consisted of personal compliments. Contingent reinforcement was praise given by the experimenter immediately following each target hit. Noncontingent reinforcement was praise given following fixed trials without regard to success in hitting the target.

The data were obtained from practice and test periods, each consisting of 30 trials. The experimenter was assisted in the study by a trained observer who recorded a hit or a miss for each trial in both practice and test periods. In practice periods, the observer recorded also that a trial was followed by praise or no praise. Accuracy in delivering praise on schedule for each subject and the number of target hits achieved were obtained from the record made by the observer. Test performance included five trials at six different target distances and was filmed to obtain consistency scores based upon three form aspects. Form aspects selected for study included: (1) the relative length of the backswing, (2) the plane of the swing, and (3) the relative height at which the ball was hit. Each form aspect contained two classifications of form. Classifications for the relative length of the backswing were a long or a short backswing. Classifications for the swing plane were horizontal or oblique. Classifications for the relative height at which the ball was hit were high or low. Oblique swings were classified as high-to-low or low-to-high in their direction. Arbitrary points of division were used to set the limits of each classification. Point and line tracings of paddle positions were

made from the films of the first five swings in each test period. The tracings were made from sequences of frames between the finish of the backswing and the finish of the followthrough. Frames falling between the finish of the backswing and follow through were employed in the tracings when they showed a change in position from the previous position located and were relatively unblurred. Consistency scores were derived from comparisons among the five traced swings. Each of the first five swings was compared with each of the others on three dimensions, yielding 10 comparisons for each dimension, or 30 comparisons in all, for each subject on each test. Each comparison was scored as "similar" or "different." Comparisons which were "similar" were assigned one point. Thirty points was the maximum score attainable and indicated the highest degree of consistency measured by the procedure.

The data were analyzed nonparametrically because the sample was small. Differences among the three test periods and among scores attained by the three groups at the midtest and the posttest were analyzed by the Friedman two-way analysis of variance by ranks, with the alpha level set at .20. When significant differences were found among the three test periods or the three groups, the Walsh test was applied to determine differences between successive test periods and between groups. Target hits achieved in practice with contingent and noncontingent praise were analyzed also by the Walsh test. When the Walsh test was applied, all data were analyzed with the alpha level set at the .05.

The Walsh test, applied to the data obtained in the practice periods, showed significantly more target hits under practice with contingent praise than under practice with noncontingent praise. Applications of the Friedman test to the midtest and posttest data indicated nonsignificant differences among the three groups for target hits, target distance, and form consistency.

Three applications of the Friedman test showed significant differences in target hits achieved across test periods and nonsignificant differences for target distance and form consistency for subjects who practiced. Two applications of the Walsh test showed that subjects who practiced increased significantly the number of target hits achieved from the pretest to the midtest, and from the midtest to the posttest. For the control subjects who did not practice, application of the Friedman test indicated significant differences among the three test periods for target hits, and nonsignificant differences among the three test periods for target distance and form consistency. Subsequent applications of the Walsh test revealed nonsignificant differences from the pretest to the midtest, and from the midtest to the posttest.

Applications of the Friedman test to the form consistency data indicated nonsignificant differences among the three test periods for subjects scoring above the median in target hits during practice, and significant differences among the test periods for subjects scoring below the median in target hits. Applications of the Walsh test to the form consistency data of the subjects

scoring below the median in target hitting indicated a significant increase in form consistency from the pretest to the midtest, but no significant difference between the midtest and the posttest.

The findings were:

1. Practice accompanied by contingent praise yielded significantly more target hits than practice accompanied by noncontingent praise.

2. There were nonsignificant differences among the three groups on test performance which followed practice accompanied by contingent praise, practice accompanied by noncontingent praise, and a period of time with no practice or praise.

3. Eight subjects who practiced the striking skill significantly increased the number of target hits, but did not increase the distance at which the target was hit, and did not increase in form consistency.

4. Subjects who did not practice the striking skill did not change significantly in the number of target hits, the distance at which the target was hit, or their form consistency.

5. Subjects scoring above the median in target hitting during practice did not increase their consistency in form.

6. Subjects scoring below the median in target hitting during practice increased their form consistency from the pretest to the midtest, but did not increase form consistency from the midtest to the posttest.

The conclusions were:

1. Practice accompanied by contingent social reinforcement is superior to practice accompanied by noncontingent social reinforcement for preschool children performing a ball-striking skill.

2. Levels of performance of preschool children on a ball-striking skill increase with practice.

3. Consistency of selected form aspects is not affected by social reinforcement that is given contingently upon the successful outcome of performance.

4. Consistency of selected aspects of form increases with practice for subjects who are relatively low in achievement and relatively inconsistent during initial performance.

Several recommendations for further study of the conditions in which social reinforcement affects motor performance were prompted by the present investigation. The recommendations were:

1. Using the experimental procedures of the present investigation, more subjects should be studied.

2. Extending treatment over a longer period of time, and designing experimental procedures in which control subjects do not increase on the dependent measures are procedures which may be useful in studying social reinforcement effects on motor performance.

3. Reinforcing specific forms versus reinforcing the outcome of performance should be studied.

4. Possible order effects of contingent and noncontingent social reinforcement should be investigated further with special

attention given to interactions between level of performance and reinforcement.

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REFERENCES

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APPENDIXES

APPENDIX A

Data and Score Sheets

Table 28. Master Data Sheet for Tests

Subject[a]	Number of Target Hits			Target Distance (Feet			Form Consistency Score (Number of Matches)		
	Pre-test	Mid-test	Post-test	Pre-test	Mid-test	Post-test	Pre-test	Mid-test	Post-test
1	10	6	14	2.5	7.5	6.0	26	20	26
2	1	9	0	0.5	3.0	0.0	16	30	23
3	2	3	0	0.5	3.0	0.0	10	22	26
4	0	1	12	0.0	1.5	4.5	20	30	26
5	6	6	10	7.5	4.5	4.5	13	26	30
6	4	5	9	1.5	3.0	3.0	24	26	26
7	3	0	7	7.5	0.0	7.5	23	26	14
8	0	7	8	0.0	4.5	4.5	22	12	19
C-9	6	12	9	6.0	7.5	3.0	20	26	26
C-10	2	12	11	0.5	4.5	7.5	13	14	22
C-11	2	5	5	0.5	6.0	3.0	22	22	14
C-12	0	0	0	0.0	0.0	0.0	30	30	30

[a]Subjects 1 through 4 received contingent praise in the first four practice periods, and noncontingent praise in the second four practice periods. Subjects 5 through 8 received noncontingent praise first and contingent praise second.

Table 29. Target Hits During Practice Periods in Order of Occurrence

Subject	Treatment	Day	Trials 1 through 30[a]			Total
1	Contingent praise	1	OXOXXOOXOX	OOOXOOOOOO	OOOOOXOOOO	7
		2	XOOOOOXXOO	OOOXOXOOOO	OOOOOOOOOO	5
		3	OXOXXOOXOO	OOOOOOOOXX	OOOOOOOOOO	6
		4	OOXXOOOOOX	XOOOXOOOXO	OOOOOOOXOO	7
	Noncontingent praise	5	XOXXOOXOXO	OXOOOOOOOO	OOOOXOOOOO	7
		6	XXXOXXXOOX	OXOOOOXOOO	OOOOOOOOOO	9
		7	XXOXOXOOOO	XXXOOOOOOO	OOXXOOOOOO	9
		8	XOXXOOXXOO	OOOOOOOOOO	OXOXOOOXOO	8
2	Contingent praise	1	XOOOOOOOOO	OOOOOOOOOO	OOOOXOXOXO	4
		2	XOOXOXOOOX	OOOOOOOOOO	OOOOOOOOXO	5
		3	OOOOXXOXOO	XOOOOOOOOO	XOOOXOOOOO	6
		4	OXXOOXOOXO	OOOXOOOOOO	OOOOOOOXOX	7
	Noncontingent praise	5	OXXXOOXOXO	OOOOOOOOOO	OOOOOOOOOO	5
		6	XOOXXOOXOO	OOOOOOOOOO	OOXOOOOOOO	5
		7	OXXXXOOOXX	OOOOOOOOOO	OOOOOOOOOO	6
		8	OOOOOOXOOO	OOOXOOOOOO	OOOOOOOOOO	2
3	Contingent praise	1	OOOXOOOOOO	OOOOOOOOOO	OXOOOOOOOX	3
		2	OOOOOOXOOX	OOOOOOOOXO	OXOOOOXOOO	5
		3	OOXOOXOOOX	OXOOOOXXOX	OOOOOOOOOX	8
		4	OXOXXOOOOO	XXOOXOOOOO	OOXOOOOXOO	8
	Noncontingent praise	5	OXOOXOOOOO	XOOXOOOXOO	OOOOOXOOOO	6
		6	OOOOXOXOOO	XOOOXOOOOO	OOOOOOOOOO	4
		7	XOOOOOOOOO	OOOOXOOOOO	XOOOOOOOOO	3
		8	OOXOOOOXOO	OOOXOOOOXO	OOOOOOOOOO	4
4	Contingent praise	1	OOOOOOOOXO	OOOOOOOOOO	OOOOOOOOOO	1
		2	OOOOOOOOOO	XXOOOOOOOO	OOOOOOOOOO	2
		3	XOOOOOOOOO	OOOOOXXOXO	OOOOOOOOOO	4
		4	OOOXOOOOOO	OOOOOOOOXO	OOOOOOOOOO	2
	Noncontingent praise	5	OOOXXOOOXO	OOOOOOOOOO	XOXOOOOOOO	5
		6	OXXXXXOXOX	XOOOOXOOOX	OOXOOOOOOO	11
		7	XOXXOXXXOO	OOOOOOOXOX	XOOOOXOOXX	12

[a] X = Target hit
O = Miss

Table 29 (Continued)

Subject	Treatment	Day	Trials 1 through 30[a]			Total
5	Noncontingent praise	1	OXXOOXOOOO	OXXOOOOOOO	OOOOOOOOXX	7
		2	OXOXOXOOOO	OOOOXOOOOO	OOOOOOOOOO	4
		3	XXOOOOOXXO	XOXOXOOOOO	XOOOOOOXOO	9
		4	OXOOOXOOOO	OOOOOOOOOO	XOXOOOOOOO	4
	Contingent praise	5	OOXOOOXOOO	XOXOOOOOOO	XXOOOXOOOX	8
		6	XOOOXOOOXO	OOXOOOOOOX	OOOOOXOOOO	6
		7	XOXOOOOOOO	XOOXOXXOOO	OXOOOOOXOO	8
		8	XOOOOXXOOX	XOXOXOOOOX	OXXOOOXOOO	11
6	Noncontingent praise	1	OOXOXOOXXX	XOOOOXOOOO	OOOOOOXXOO	9
		2	OXOOXOOOXO	OOOXOXOOOO	OOOOOXOOOO	6
		3	OOXOOOOOOO	OOOOOXOOOO	OXOOOOOOXO	4
		4	OXOOXOXOOO	OOOOOXXOOO	OXOOOOOOOO	6
	Contingent praise	5	XOXOOOOOOO	OOXOOXOOXO	XOOOOOOOOO	6
		6	OXOOOOXOXO	OOOOOOXOOO	OOXOOXXOOX	8
		7	XXOXXOXXOO	XXXXOXXOOO	XOOOOOOOOX	14
		8	OOXOXXXXOO	OXXXOXOXOO	OXOOOOOOOO	11
7	Noncontingent praise	1	XOXOOOOOOO	OXOOXOOOOO	OOOOXOOOOO	5
		2	OOOOOOOOOO	OOOOOOOOOO	OOOOOOOOOO	0
		3	OOOOOOOOOO	OOOOOOOOOO	OOOOOOOOOO	0
		4	XOOOOOOOOO	OOOOOOOOOO	OOOOOOOOOO	1
	Contingent praise	5	OOOOOOOOOO	OOOOOOOOOO	OOOOOOOOOO	0
		6	OOOOOOOOOO	OOOOOOOOOO	OOOOOOOOOO	0
		7	OOOOOOXOXO	OOOXOOOOOO	OOOOOOOOOO	3
		8	OXXXOXXXOX	OOXXOOOOOO	OOXOOXOOOO	11
8	Noncontingent praise	1	XXOXOXOXOO	OXOXXXOOXO	OOXOOOXOOO	12
		2	OXXOOOXXOO	XOOOXOOOXO	OOXOXOOOOO	9
		3	OOXOXOXOOO	OXOXXOXOOO	OOXXOXXOXO	12
		4	OXOOXXOOOO	OXOOOXOOOO	OOOOOOOOOO	5
	Contingent praise	5	XXOOOXXOXX	OOOOOOOOXO	OOOOOOOOOO	7
		6	XOOOOOOXXO	XOXOOOOOXX	OOOOOXOOOX	9
		7	OOOXXOXXOX	OXOOXOXOXO	OOOXOOOOOO	10
		8	OOXOXXOOXO	OXOOOOOOOO	OOOOXOXXOO	8

[a]X = Target hit
O = Miss

SCORE SHEET

Practice Condition: Subject's Name _____

Date: Observer _____

Trial No.	Hit/Miss	Praise	Trial No.	Hit/Miss	Praise
1			16		
2			17		
3			18		
4			19		
5			20		
6			21		
7			22		
8			23		
9			24		
10			25		
11			26		
12			27		
13			28		
14			29		
15			30		

SCORE SHEET

TEST: Subject's Name _____

DATE: Observer _____

Trial No.	**Hit/Miss**		
1	_____	16	_____
2	_____	17	_____
3	_____	18	_____
4	_____	19	_____
5	_____	20	_____
6	_____	21	_____
7	_____	22	_____
8	_____	23	_____
9	_____	24	_____
10	_____	25	_____
11	_____	26	_____
12	_____	27	_____
13	_____	28	_____
14	_____	29	_____
15	_____	30	_____

APPENDIX B

Diagram of Ball Dispenser and Target

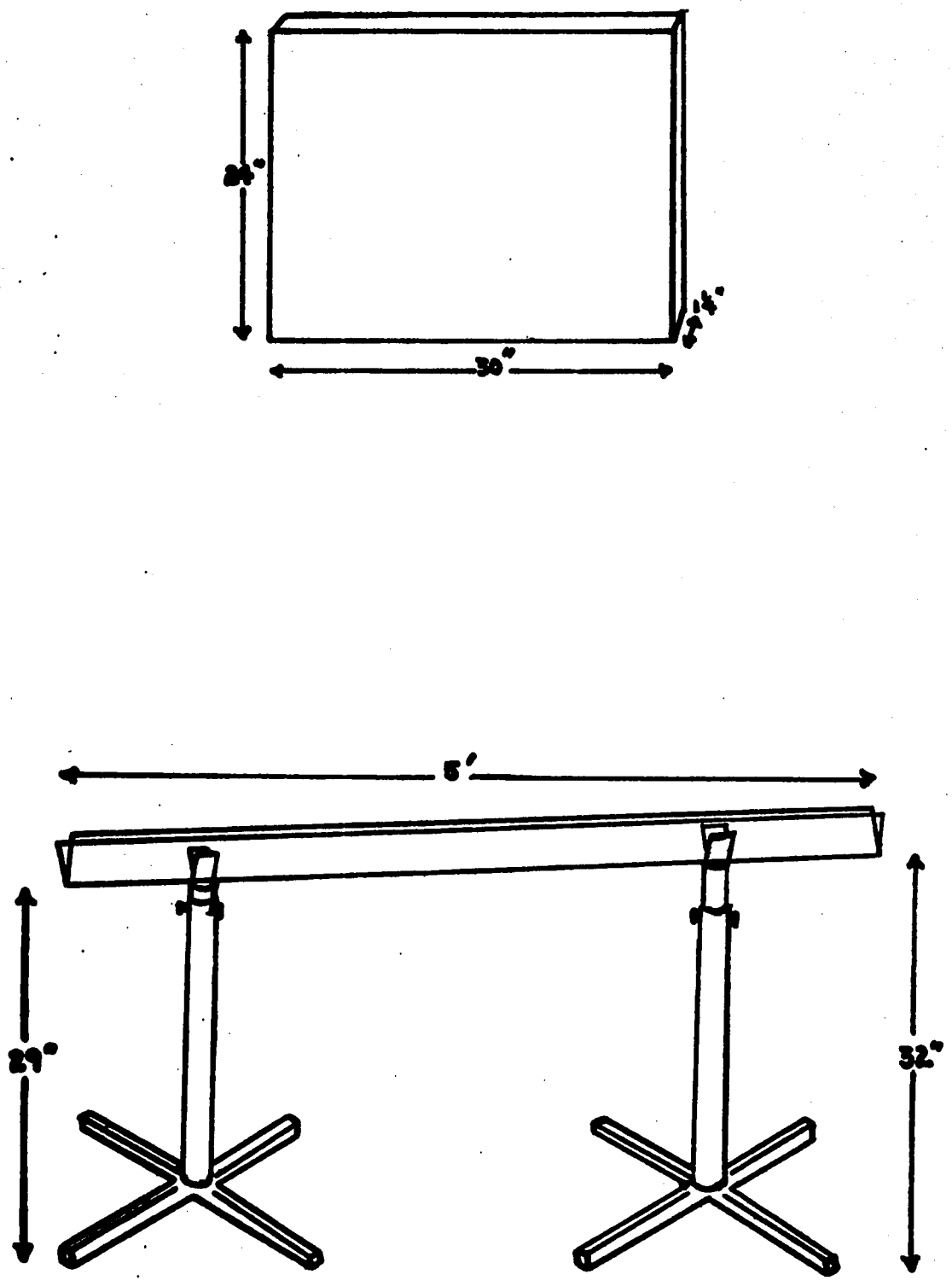
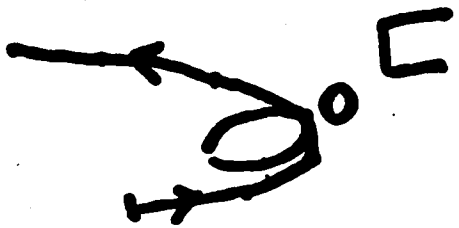


Figure 3. Diagram of Ball Dispenser and Target

APPENDIX C

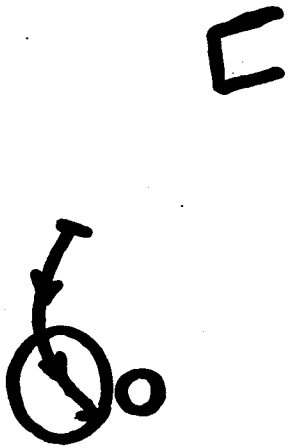
Sample Tracings and Form Consistency Scores

TRIAL 1



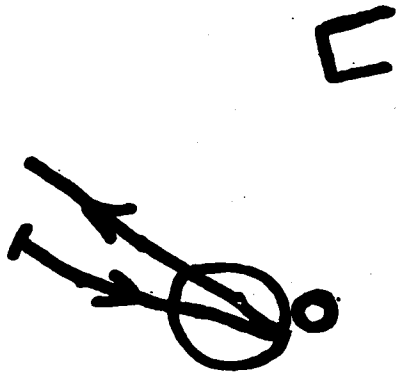
Oblique Swing:
Low-to-High
High Point of Contact
Short Backswing

TRIAL 2



Oblique Swing:
High-to-Low
Low Point of Contact
Short Backswing

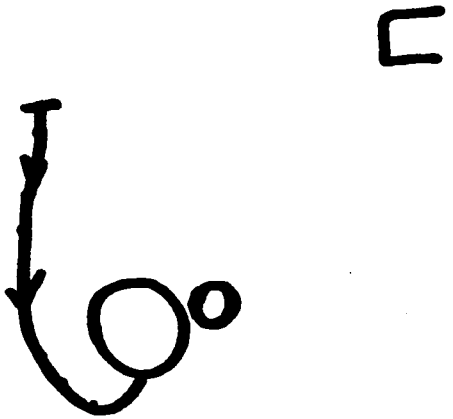
TRIAL 3



Horizontal Swing
Low Point of Contact
Short Backswing

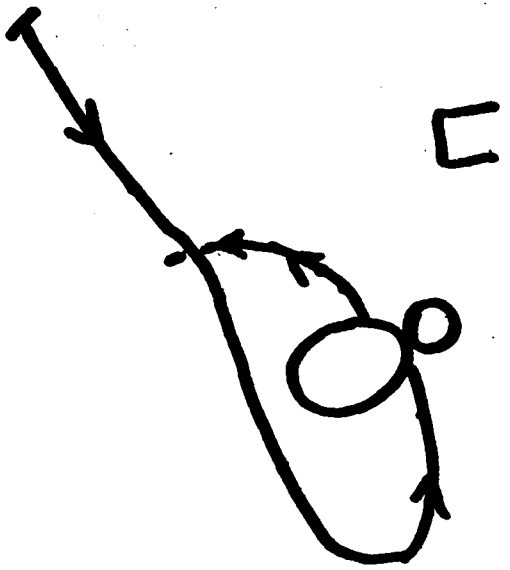
Figure 4. Sample Tracings for Consistency Scores

TRIAL 4



Oblique Swing:
High-to-Low
Low Point of Contact
Short Backswing

TRIAL 5



Oblique Swing;
High-to-Low
Low Point of Contact
Long Backswing

Figure 4. (Continued)

CONSISTENCY SCORE SAMPLE

Relative Height of the Hit[1]

Trial	1	2	3	4	5	
1		0	0	0	0	
2			+	+	+	
3				+	+	
4					+	
5						6 points

Relative Length of Backswing

Trial	1	2	3	4	5	
1		+	+	+	0	
2			+	+	0	
3				+	0	
4					0	
5						6 points

Swing Plane Direction

Trial	1	2	3	4	5	
1		+	0	+	+	
2			0	+	+	
3				0	+	
4					+	
5						7 points

19 = Consistency Score

[1] + = "similar" form (One point was scored for each +, and maximum score was 30.)
0 = "different" form
Scores were derived from tracings of one subject's pretest.

APPENDIX D

Formulations for the Friedman Rank-Order Analysis of Variance and the Walsh Test

FORMULATIONS FOR THE FRIEDMAN RANK-ORDER ANALYSIS OF VARIANCE

The Friedman Test:

1. Scores from each sample are ranked.

2. Ranks are arranged in a two-way table with the ranks across the rows and the samples to be compared arranged in the columns.

3. Rank totals of the columns are tested for statistical significance by the formula:[1]

$$Xr^2 = \frac{12}{N\,k\,(k+1)} \sum_{j=1}^{k} (R_j)^2 - 3N\,(k+1)$$

N = number of subjects or matched groups of subjects

k = number of treatments or test periods being compared

R_j = sum of rans of each of the three treatments or test periods

$\sum_{j=1}^{k}$ = sum of the squares of sums of ranks over three treatments or three test periods

[1] Formula and operations are described by Siegel (1956).

FORMULATIONS FOR THE WALSH TEST

The Walsh test:[2]

1. Difference scores for each pair of samples are obtained. In the present study, scores of individuals under two conditions of practice or scores from two practice periods were compared to obtain the difference scores.

2. Difference scores for each pair in the sample are ranked in order of magnitude.

3. The average of the difference scores is analyzed to determine whether the average differs from zero in a two-tailed test. In the present study, a one-tailed test predicted in advance that the difference scores would be negative.

4. When N = 4, if the smallest difference score is smaller than zero, the average difference is smaller than zero and the directional hypothesis predicting the average difference to be smaller than zero is supported.

5. When N = 8, if the sixth smallest difference score or one-half of the sum of the fourth and eighth smallest difference scores is larger than zero, then the average difference score is smaller than zero. The directional hypothesis predicting negative difference scores is supported.

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[2]Formulation and operations are described in Siegel (1956).