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THE EFFECTS OF VARYING TYPES OF REINFORCEMENT ON
GROSS MOTOR SKILL LEARNING AND RETENTION
IN TRAINABLE MENTALLY RETARDED BOYS

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate School
of The Ohio State University

By
Frederick Kurt Schack, B.A., M.A.

* * * * *

The Ohio State University
1976

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Approved by

[Signatures]
To my wife, Jan

and children, Wendy and Willie, whom I love very much
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inner strength under all circumstances. As God incarnate, He promised to each person who would receive Him as Lord and Savior that He would meet their needs. This He has done for both my family and me.
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Studies in Exceptional Children: Learning Disabilities, Behaviorally Disordered, Mentally Retarded, and Orthopedically Handicapped

Studies in Motor Learning
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CHAPTER I
INTRODUCTION AND STATEMENT OF THE PROBLEM

Background

Several investigations (38, 50, 53) during the period from 1958-1975 have shown that the mentally retarded population are two to four years inferior to normals of the same age on most indices of physical fitness. A question arises as to whether this lag is due to real physical differences, a lack of opportunity to participate, or whether it is a problem of motivation.

The mentally retarded, as a group, are physically less capable in motor skills performance than the normal population (14). However, one has only to observe a Special Olympics Track and Field Meet to recognize the more advanced athletic behavior possessed by some mentally retarded youth. Usually, the lower the IQ level the more pronounced become the physical differences in performance (56).

The regular public school child and the non-institutionalized mentally retarded child may be provided with greater opportunity for physical education experiences than the institutionalized mentally retarded person. Without active participation on a regular basis, the skill level of the mentally retarded, both institutionalized and non-institutionalized, may continue to be inferior to that of the normal school age children.
When the opportunity does exist for physical education experiences, it behooves the physical education specialist to provide the most influential environment possible. Hopefully, all of the physical surroundings will be adequate. This leaves the interaction between the teacher and his pupils as the critical variable in performance. Inherent physical weaknesses cannot be changed by a teacher, but inadequate motivation can possibly be reduced by the use of different motivational techniques. Johnson (13) has suggested that one of the reasons mentally retarded students lag behind normal children is motivation, a variable Huber (67:6) claims "is one of the more apparent areas in need of investigation."

Educators have been working with and applying motivational research for quite some time, but only since 1948 (31) have these techniques been seriously investigated with respect to the retarded child. Most of the past, from early Spartan and Greek periods to the mid-1960's, has shown neglect and lack of concern for this population (1). However, since 1968 more special schools have been constructed and a greater number of new programs have been introduced for the development of the mentally retarded than ever before (71).

Another, and perhaps more crucial, factor is Public Law 94-142, which has been interpreted to say that all handicapped persons have the right to education regardless of race, nationality, or physical condition. This means that more and more children with varying kinds of deficiencies will probably be entering regular school environments. The regular physical education teacher will need some method or technique by which he can improve the physical performance of those students, in this case, the mentally retarded.
Problem Statement

This study was designed to determine the effects of varying types of reinforcement on learning and retention of two novel gross motor skills by trainable mentally retarded boys. Included within this framework were: a) the determination of which type of reinforcement had the greatest effect, if any, on motor behavior, b) performance maintenance of the skills following seven days and twenty-eight days of no training, and c) the adequacy of the multielement baseline design for providing analysis.

The working hypothesis under which this study was conducted was that conditions with reinforcement have a greater affect on learning and retention than do conditions without reinforcement. Contained within this hypothesis were the following two problem areas:

Primary Problem

Which reinforcing condition produced the highest percentage of successful responses during the training and performance maintenance phases?

Secondary Problem

Does the multielement baseline design provide a sound base for analyzing subject responses in a physical education activity?

Rationale

Even though special schools continue to be built and new programs become available to the retarded (71), there is still a need to develop practical training techniques which effectively and efficiently raise the motor skill level of the mentally retarded (57). Stein (58),
present Director of Programming for the Handicapped for the American Alliance of Health, Physical Education, and Recreation, has recognized the need for research into the effects and techniques of motivation with respect to the mentally retarded.

At a national conference designed primarily to uncovering research and demonstrated needs of the handicapped, the following conclusion was reached:

To determine the role of behavior modification and operant conditioning as applied to physical education and recreation programs, and to ascertain techniques of motivation that are most effectively used with various handicapped groups at different age and functional levels (58:65).

The writer hopes to contribute to this recognized need by conducting an investigation into gross motor skill learning using the technique of operant conditioning.

With respect to the technique of operant conditioning, there are three basic designs that may be used, the reversal design (9), the multiple baseline design (4), and the multielement baseline design (17). Though not used that often, the multielement baseline design, the design used in the present research, is different than other designs used in most behavioral investigations for two reasons: 1.) The treatment variables may be compared on an on-going basis throughout the investigation period. 2.) It has a potential time-saving feature, that is, it may be able to reduce operant research time by as much as two-thirds. A more detailed discussion of this design may be found under Design, Chapter III.
Operational Definitions of Terms

In order to avoid confusion between the author and reader, the following operational definitions were used:

Educable Mentally Retarded. Persons whose IQ's fall between fifty-two and sixty-eight on the Stanford-Binet or fifty-five and sixty-nine on the Wechsler Scales and who are able to accomplish basic academic skills eventually progressing to semi-independent or independent functioning in the community have been classified as educable mentally retarded. [This term is in the process of being phased out of the terminology in the State of Ohio, however, it still functions to classify persons at the Columbus State Institute, Columbus, Ohio (69).]

Gross Motor Skill. This term references any task in which the center of gravity of two or more limbs is displaced in any direction.

Motor Learning. A permanent change in the motor behavior of an organism with respect to a particular stimulus, such that there is an increase in response consistency upon repeated presentation of the stimulus condition, defines motor learning. A limitation placed on this definition (11) is that the characteristics of the change in response consistency cannot be explained on the basis of native response tendencies, maturation, or temporary states of the organism, such as fatigue, drugs, etc.

Mental Retardation. Mental retardation refers to the significant subaverage general intellectual functioning which occurs with deficits in adaptive behavior and arises during the developmental period (8).

Operant Conditioning (Behavior Modification). The presentation or removal of a reinforcing stimulus following the emission of a response (18).
Reinforcement. Any token (poker chip), verbal praise, such as "Good boy," or non-verbal praise, such as a smile, pat-on-the-back, etc., which is delivered to a subject contingent upon appropriate responding to a stimulus condition is defined as reinforcement. The tokens were exchanged for tangible items. (See Appendix A).

Retention. Retention refers to the recovery of a previous rate or percentage of responding following a period or periods of no training. The no-training period or periods generally include a minimum of one day with no limit on the maximum.

Trainable Mentally Retarded. An individual classified as a trainable mentally retarded is one whose IQ ranges between twenty and fifty-one on the Stanford-Binet or twenty-five and fifty-four on the Wechsler Scale and who is limited in traditional academic skills. [The use of this term is also being phased out of the terminology in the State of Ohio, however, it still functions to classify persons at the Columbus State Institute, Columbus, Ohio (69).]

Training. This refers to the practice and/or repetition of a particular skill for a specified period of time.
CHAPTER II
SURVEY OR RELATED LITERATURE

Introduction

The need for more effective techniques to improve the abilities of the child with mental retardation is evident. According to Gold (32:517),

"The large volume of research with the exception of operant work, lacks theoretical foundation and falls short of providing a strong basis for developing an effective technology for increasing the skill functioning of the mentally retarded."

It is with this in mind that this study has been undertaken, to extend the theoretical base of operant research in physical education and to provide a more usable technology for working with the mentally retarded.

Also, there exists a need to be able to raise the level of motor ability and the level of fitness of the retarded population. This has been indicated by the sufficient documentation that mentally retarded children often display fatigue, poor posture, awkward movements and low endurance (6, 10, 12). It has also been shown that they are usually inferior to normals of the same age on most indices of physical fitness (38, 50, 53).

The scientific use of operant conditioning techniques to change the (motor) behavior of mentally retarded children was first introduced by Fuller (31) in 1949. He used warm sweet milk to obtain consistent responding of the right arm of a profoundly retarded eighteen year-old
male subject. Since then a number of studies have focused on the use of incentives to affect changes in motor skill behavior of mentally retarded boys and girls.

The review of literature that follows has been separated into four categories. The first two sections examine the effects of incentives on motor learning in both the educable mentally retarded and trainable mentally retarded populations. The third and fourth sections look at retention in these same two populations.

**Incentives and Learning in the Educable Mentally Retarded**

There is conflicting evidence regarding the effects of varying kinds of motivational variables on learning in the mentally retarded population. One study which considered this very question was devised by Perry and Stotsky (47). They used fifty mentally retarded individuals from two vocational training centers, forty-three orthopedic-neuromuscular students from an industrial school for crippled children, and thirty-five college-graduate students in education. The ages for the mentally retarded group were sixteen to forty-two while their IQ range was between fifty-two and eighty-nine. The IQ's of the others ranged between seventy-three and 121 with no IQ available for the college graduates. Five groups were established within each population as follows: (a) material reward with positive incentive followed by mixed incentive, (b) material reward with mixed incentive followed by positive incentive, (c) non-material reward with positive incentive followed by mixed incentive, (d) non-material reward with mixed incentive
followed by positive incentive, and (e) a control group. A total of thirteen trials were given. Three two-minute control trials were presented during which time the subjects were instructed to assemble as many double-blocks as possible. The system of rewards was then explained, after which each of the four experimental groups was given the remaining ten trials. An increase/decrease in money (in the form of nickels) was selected as the material reward because of its generalized reinforcing qualities. The increase/decrease in non-material reward varied by group: The mentally retarded were on a rating system, the same as was used in their training centers, while the non-retarded received a letter-grading system as was typical of the particular schools in which they were enrolled. The results indicated that the type of reward or incentive or incentive-sequence had no effect on the motor performance of the mentally retarded, the physically handicapped, or the graduate students.

Kahn and Burdett (41) studied the effects of different combinations of practice and reward schedules using three types of motor tasks. The subjects involved in their research were twenty-one girls and fifteen boys whose chronological ages ranged from twelve to seventeen years. Each subject performed twenty trials on each of three tasks: The Stromberg Dexterity Test, the "both hands" task of the Purdue Pegboard, and a Bean Stringing task. The subjects were placed into nine equal groups in which one of the following reward systems was used: (1) a fixed reward of three pieces of candy at the conclusion of each session, (2) one piece of candy per trial regardless of grade of performance, or (3) one piece of candy as a base and an additional piece for each trial
in which performance was improved over the immediate prior trial. Kahn and Burdett found that no practice condition, reward condition, or any combination of practice and reward appeared superior to others in affect upon learning. They suggested that with or without reinforcement, awareness of improvement had enough incentive to hide possible differences among conditions.

Auxter (21) used thirty-two educable mentally retarded subjects, ages ten to twelve, to determine the effects of reinforcement on gross motor skill learning and retention. Two groups of sixteen subjects each matched in chronological age and sex, performed twenty-five twenty-second trials on a stabilometer. One group was reinforced with candy after successful or improved performance while the second group was not reinforced. The findings indicated that the reinforced group of educable mentally retarded children learned better than those not reinforced.

In an attempt to investigate the effects of three reinforcement conditions on the motor performance of male educable mentally retarded children, Morrison (45) used fifty-six subjects between the ages of six and fifteen. He placed thirty-five subjects into the experimental group and twenty-one into the control group. The experimental group received one of three reinforcers delivered in random order on three different days. These reinforcers included: (a) verbal praise, (b) verbal reproof, and (c) a material item (the choice of a nickel, a bar of candy, or a toy). Morrison noted that (1) there were no differential effects among the three reinforcing conditions on the softball-throw performance of educable mentally retarded subjects and (2) subjects
who selected money performed better than those who chose candy and toys.

A similar study was conducted by Solomon (55). He looked at the effects of different motivational variables on the physical proficiency of educable mentally retarded and normal boys. Eighty-one subjects, ages fourteen to seventeen, were placed into three groups, two groups of mentally retarded boys, one institutionalized and one non-institutionalized, and a third group of normals. These groups were randomly divided into three subgroups: (a) basic motivation, (b) continuous verbal encouragement, and (c) continuous verbal encouragement plus material reward. Each subgroup received ten trials each on the following items: standing broad jump, shuttle run, bent-arm hang, 50-yard dash, and softball throw. The evidence showed that continuous verbal encouragement plus material reward was responsible for the best performance for both educable mentally retarded groups.

In a proposal very much like those of Auxter (21), Morrison (45), and Solomon (55), Wagner (64) considered the effects of three reinforcement conditions and repeated trials on the physical proficiency of educable mentally retarded and normal girls. The subjects were divided into three groups as follows: Group I—educable mentally retarded, Group II—normal children with comparable mental age to the retarded group, and Group III—normal children with comparable chronological age to the retarded group. The subjects were measured on grip strength, volleyball throw for distance, standing broad jump, and the 30-yard dash. The three incentive conditions under which these tasks were
performed were standard instruction, active encouragement, and candy reward. All three groups performed significantly better when active encouragement was added to standard instruction and another significant increase occurred when candy was added to active encouragement.

As can be seen from several of the above investigations (21, 45, 55, 64), the magnitude of the incentive seemed to have an affect on performance. The magnitude of incentive in the conduct of research with the mentally retarded was regarded as a very important variable by Heber (36). As such, he designed a study to investigate this particular aspect. He used two groups of eighteen high grade mentally retarded males, ranging in age from sixteen to forty-four years and in IQ from forty-one to sixty-eight. The subjects were given seventeen incentives from which they could choose until a ranking from one to seventeen occurred. The subjects were matched into pairs on the Seguin Form Board and placed into either a high reward or low reward group. Initially, this meant that each group of subjects worked for the high incentive or low incentive depending upon which group they were in. The training device used was the Minnesota Spatial Relations Test Board. The results demonstrated that those subjects performing under high incentive did significantly better than did those under the low incentive condition. When the incentive condition was reversed for each group, a significant decrement occurred in the original high incentive group and a rapid increase in performance of the original low incentive group. Heber concluded that high grade mental retardates are able to respond differentially to incentives, indicating the magnitude of incentive should be regarded as a variable which affects performance rather than learning per se.
In a departure from traditional rehabilitation approaches, Schroeder and Yarbrough (52) showed that an automated system of rewards based on individual work output produced extensive increases in performances. Their study involved twenty-five clients from a sheltered workshop who were divided into two rooms, each client working at a separate desk. The IQ's of these subjects ranged from thirty to eighty and in organic disability from blindness to partial paralysis. Each space had a contingency panel with feedback lights and a counter. The client also had a "Client Counter Tally" so that he could keep track of the rewards received during an entire session. A reward, in the form of a token, was delivered at a predetermined time. The next time the client used a tool, a reward light would flash, the counter would tally the reward, and a token would be delivered. This study was different from other research because it utilized specific goals which were arranged for individual clients.

One area of concern to the adapted physical educator is maintaining task behavior as well as improving motor task performance. Huber (67) attempted to reveal the relative effects of a token economy program for controlling appropriate behavior and performance of motor tasks of educable mentally retarded children within an adapted physical education setting. He used eleven subjects, ages seven to eleven and in IQ from fifty-three to eighty-two, in a token economy program in which they were awarded tokens for appropriate behavior as well as the number of tasks completed. The evidence suggested that a token economy was able to increase appropriate behavior and motor task performance on initial baseline. Appropriate behavior beyond baseline two was also significantly
Increased, however, the reinforcement contingencies did not appear strong enough to extend performance beyond this baseline.

Using three mildly retarded and two moderately retarded subjects between nine and thirteen years of age, Pierce (70) attempted to compare the effects of four treatment procedures on their motor performances. The motor tasks used were crawling, stair climbing, knee-ups, parallel-bar walking, sit-ups, ladder walking, peg placement, and knee standing. The following variables were used: (a) prior instruction only, (b) instruction plus social reinforcement, (c) instruction, social reinforcement, and material reinforcement, and (d) instruction, social reinforcement, and goal setting. Pierce's results were able to show the generality of effect of the experimental conditions across different tasks and subjects.

Although not considering incentives per se, Rotman (62) produced evidence suggesting that the more practice afforded the retarded, the greater the improvement in their performance on the majority of motor tasks. This conclusion was reached after he compared two groups of forty institutionalized mentally retarded patients and 100 male subjects from the general working population on tests of motor coordination, manual dexterity, and finger dexterity. Both groups ranged in age between eighteen and thirty, however, the IQ span of the mentally retarded patients was between fifty and seventy-five. The motor skills were measured by the General Aptitude Test Battery of Motor Coordination, Manual Dexterity, and Finger Dexterity. The experimental group of retarded subjects was divided into three subgroups in which the length of practice periods defined the groups. The subgroups practiced once
a day for two, five, and seven days, respectively. The findings showed that the general population sample was significantly superior to the mentally retarded population, however, on the retest, the mentally retarded subjects differed significantly from their initial performances on the measures of motor coordination and manual dexterity.

Are individual rates of gross motor activity under voluntary control? Is the relationship between the levels of sensory stimulation and gross motor activity positive or negative? Can the gross motor activity of institutionalized moderately mentally retarded individuals be subject to stimulus control? These were three questions which concerned researchers, Switzky and Haywood (60). Regarding question two, they felt that the majority of the evidence regarding highly active mentally retarded persons demonstrated that activity rates decrease with increases in sensory stimulation.

However, to provide more data on these questions, they placed nine male and nine female institutionalized mentally retarded adolescents and adults, mean age of twenty-four and mean IQ of sixty-five, on a conjunctive reinforcement schedule for ordered visual stimulation. Their gross motor activity was monitored and graphed as a function of variations in the schedule. The reinforcing stimulus was a silent 8mm motion-picture projected on a screen from the back of a chamber in which the subjects sat. The film apparatus was arranged electronically so that a variation in movement produced a consequent variation in film illumination via the conjunctive apparatus. In the low motion condition, illumination was adequate and constant, but following each recorded movement the illumination was reduced. Illumination was increased when the subject reduced
his movements. The subject had to reduce his gross motor activity in order to have enough illumination so that the film would be discernable. By contrast, in order to maintain illumination in the high motion condition, a subject had to move every second. Two baselines were taken: (1) time in the chamber without the movie, and (2) the same time with the movie, but no illumination contingencies. There were six more conditions: Conditions Three, Four and Five were three minute high motion treatments while Six, Seven and Eight were low motion conditions; Condition Nine was an extinction period (no movie) of three minutes. Each subject was in the chamber for a total of thirty-three minutes. The results suggested that individual rates are indeed under voluntary control and that increased sensory stimulation was able to reduce the rates of motor activity in moderately retarded subjects. The results also appeared to answer the third question, whether moderately retarded subjects could learn to decrease as well as increase their gross motor activity under a conjugate schedule of reinforcement.

Incentives and Learning in the Trainable Mentally Retarded

Although reinforcement studies have demonstrated fairly good results with the trainable mentally retarded (28, 31, 33, 43, 52, 54, 59) there is a division as to which type of reinforcement may have the greatest affect on motor skill learning. A number of investigators (28, 33, 59) seem to feel that intangible reinforcements, such as praise, negative feedback, and goal setting may have more significance with respect to learning than tangible rewards. This is not conclusive, however, since several studies (31, 52, 65) have indicated very good
results with tangible reinforcers. It was also concluded by some (37, 51) that practice itself may affect final performances.

Noting that pre-school programs for the trainable mentally retarded were sorely lacking, Smith (54) proposed a study designed to examine a reward and schedule basis of operant conditioning with this group of children, specifically those living outside the institution. Sixty children between the ages of three and ten years and whose IQ's ranged between twenty-five and fifty-one were randomly assigned to one of four treatment conditions: Condition I—continuous reinforcement/tangible rewards, Condition II—continuous reinforcement/verbal rewards, Condition III—fixed ratio (every three responses)/tangible rewards, and Condition IV—fixed ratio (every three responses)/verbal rewards. The task was to place clothespins in a bottle on command. The results of his study suggested that motor performance was improved to a significantly greater degree by verbal than by tangible rewards. However, the reinforcement schedule did not significantly affect motor performance.

Smith's results (54) are in agreement with those of Stevenson and Fahel (59) who contend that social reinforcement is more effective in changing behavior and performance of institutionalized than non-institutionalized children because of a more extensive deprivation of social contacts with supportive adults. They supported Smith's findings with an investigation comparing the effect of social reinforcement on the learning of a marble placement task. Two-hundred twenty-four institutionalized and non-institutionalized trainable mentally retarded subjects were divided into two groups, one neutral and one reward. Each
group had eight subgroupings of fourteen subjects each. In the neutral condition the experimenter maintained an observer role, while in the reward condition she was verbally reinforcing twice a minute as well as when the subjects were responding. Five supportive statements were used in a predetermined random order. The tasks were considered to be simple or complex depending on whether a one-hole or a six-hole template was used. The results supported the aforementioned contention regarding social reinforcement, however, a second hypothesis stating that social reinforcement is generally more effective than adult attention was not supported. This conclusion was reached because of the high level of performance of the institutionalized children in the neutral condition of the complex task. These results appear to agree with others (28, 33) who also have reported increases in performance and continual improvement through goal setting and the use of encouragement.

Ellis and Distefano (28) attempted to determine the effects of social influences, verbal urging and praise, upon the acquisition of rotary pursuit skill of twenty-eight institutionalized mentally retarded males and females ranging in age between thirteen and thirty-one. Their IQ's ranged between thirty-nine and sixty-three. They were randomly assigned, without bias, to an "urged and praised" group or a control group. The subjects received three twenty-second trial blocks per day for five days. The inter-trial interval was twenty seconds with an inter-block interval of five minutes. The results demonstrated that the "urged and praised" group performed significantly better than the control group.
Other evidence supporting the previously cited research occurred in a study by Gordon, O'Connor, and Tizard (33). They found that of three groups of trainable mentally retarded subjects, those subjects given a specific goal to strive for (goal group) performed significantly better on a motor task than did either a group divided into two teams, each team encouraged to surpass the other (cooperation group); or a group divided into pairs, each pair member urged to beat his partner (competition group). All three of these incentive groups performed better than did a control group. In this study it should be noted that the incentives, in the form of verbal encouragement, occurred prior to the performance of the task.

In research undertaken with sixty Down Syndrome subjects, Talkington (61) tested three kinds of verbal feedback. He randomly divided his subjects, who were from eleven to seventeen years of age and ranged in IQ from sixteen to fifty-three, into three groups of ten males and ten females. The three groups into which they were placed were as follows: Group I—positive verbal feedback for correct responses, Group II—negative verbal feedback for errors, and Group III—positive and negative feedback for correct responses and errors, respectively. The learning activity consisted of a simple alternation marble-dropping task. The task continued until a criterion of ten correct, consecutive alternations occurred out of a possible 100 trials. The dependent variable was the number of sessions necessary to reach criterion with a maximum possible score of 100 if a subject did not reach criterion. Talkington reported significant differences which revealed that negative feedback achieved better results than either positive ($P < .001$) or a combination of nega-
tive and positive feedback ($P < .001$). The combination feedback was also predominantly better than positive feedback ($P < .05$) for correct responses.

Talkington's evidence compared favorably with that gathered by Massey and Insalaco (43), who investigated the effects of various combinations of punishment and reward on discrimination learning in institutionalized trainable mentally retarded children. They used four matched groups which were presented with various combinations of candy reinforcers and aversive stimulation in a simple discrimination learning task. They found that aversive white noise can, under certain conditions, assist in acquiring a particular response. It was noted that the most facilitating characteristic of the white noise was when it served as a cue for an incorrect response. When associated with a correct response, aversive stimulation facilitated response acquisition. These results were very similar to those of Muenzinger (46) and Azrin (22) who noted that aversive stimulation of a mild to moderate intensity facilitated response acquisition. Although the conclusions drawn from these results have motivational significance for training, the possibility exists that they may reduce the socialization characteristics between the retardate and "significant others."

In contrast to the above research, which focused on verbal types of reinforcement, Watson, Orsen and Sanders (65) conducted two experiments to determine reinforcement preferences of severely retarded children. The first experiment was concerned with the conditioned reinforcement properties of tokens (poker chips) and involved seventeen institutionalized severely retarded males between the ages of seven and
fourteen. They were placed in either an experimental or control group. The experimental group exchanged their tokens for primary reinforcers while the second group received nothing for their tokens. The poker chips used acquired conditioned reinforcement properties as a function of training. In the second experiment primary reinforcement preferences were investigated. Fourteen male institutionalized severely mentally retarded males, ranging in age from eight to fourteen years, served as subjects. Twelve of these subjects served in the first experiment. The subjects could choose an edible or manipulative object as a primary reinforcer for "plunger pulling." The results showed that candy was preferred to "amusement."

Though not specifically designed to determine incentive effects, Holman (37) and Tizard and Loos (62) attempted to show the effects of practice on performance in trainable mentally retarded subjects. Holman (37) used a Ball and Slot Test to compare the abilities of normal versus trainable mentally retarded children on a test of manual dexterity. The test was a simple eye-hand aiming task consisting of a small glass covered box which the subject held in his left hand. The subject then inserted a small steel ball, letting it rest on a small platform, following which he tipped the box with one movement causing the ball to go into a specified slot at the bottom. Holman used two groups of children: Group A consisted of eighteen normal children while Group B involved thirty-three mentally retarded children. The subjects had four practice periods per week for four weeks. Each practice period consisted of 200 shots, the score being the number of balls correctly placed. The results showed no difference between the two groups after three weeks of practice.
The conclusions reached from this study seemed to have practical significance: Where differences in intelligence are negligible, differences in first performances are probably a fairly reliable indication of subsequent performances. Where differences in intelligence are extreme, differences in kinesthetic test results will be associated with differences in intelligence. This means that a correction should always be made for temporary influences of "general intelligence," an influence which appeared to be obliterated after a small number of practices.

Tizard and Loos (62) also conducted a study similar to Holman's in which eight trainable mentally retarded male adults, ranging in age from nineteen to twenty-nine, were trained on the Minnesota Spatial Relations Test. This was a task consisting of four boards and two different sets of fifty-eight pieces which varied in size and shape. One set was used for Boards A and B while the remaining set was used for Boards C and D. Only four of the eight subjects were able to finish the test on the first trial. The remaining four were given special training before repeating the test in its original form, however, only two of these were able to complete the research. The results showed that all subjects learned rapidly. The conclusion reported by Tizard and Loos was that a subject's initial score on a motor task, such as the Minnesota Spatial Relations Test, would likely give a poor estimate of his actual ability to do the test after practice.

In the research cited regarding the trainable and educable mentally retarded populations, Zigler (19) has suggested that retardates may be characterized by an outer-directed problem solving field that is extremely dependent on cues from others. This condition theoretically
occasions a failure-response or-syndrome in the retardate's attempt
to cope with his environment which may result in the production of a
failure-avoidance motivational syndrome. Green and Zigler (24) did
find that external cue dependency seemed to serve as a failure-
reduction mechanism by retardates. Talkington (61), however, strongly
indicated that more research is needed in this area.

Retention in the Educable Mentally Retarded

Retention of learned responses is extremely important if one
wishes to reproduce those responses or similar responses at a later
date. This has significance not only for academic but physical
skills, such that a teacher will not have to spend unusual amounts of
time having students re-learn previously acquired skills. This
position should not only apply to the normal population, but also to the
mentally retarded.

The mentally retarded to exhibit brief periods of retention
which may vary from brief seconds (63) to several months (21) or even
a year (32). Though the literature is sparse with respect to retention
of motor skills in this population, a number of studies have been com­
pleted indicating the potential of the mentally retarded for retaining
what they have learned.

Baumeister, Hawkins, and Holland (24) compared forty-eight normals
and forty-eight educable mentally retarded boys on rotary pursuit
performance as a function of supplementary knowledge of results and
practice. All subjects were tested individually with twenty pre-test
trials of twenty seconds each. The pre-tests were followed by rest periods of zero, two, and thirty minutes. The results of their investigation demonstrated that normals were superior in the beginning, but with practice the retarded subjects overtook them. Also, supplementary knowledge of results assisted both groups and comparable amounts of reminiscence were seen in both normals and retardates.

In Auxter's research (21) with educable mentally retarded children on the stabilometer (cited earlier, page 7.0), he found that six months following practice there were no significant differences between the two groups of subjects, one reinforced with candy, the other not reinforced. His conclusion was that reinforcement yielded greater learning, but did not facilitate retention. He also mentioned that without the proper rewards the retardate is an inconsistent performer.

Concerned with the effect of learning as well as overlearning on retention of motor tasks in the mentally retarded population, Chasey (25) used ninety-eight institutionalized trainable and educable mentally retarded subjects. They ranged in age from seven to twenty-seven and in IQ from fifteen to ninety-four. The subjects also came from the following etiological classifications: nineteen mongoloids, three hydrocephalics, twenty-eight encephalitics, eleven cultural familial, one congenital cerebral and thirty-six unknown. They were assigned to one of two groups in order to learn a modification of the Johnson Mat Test, which involved a double-leg hop and a double-leg hop left. Group I was to "learn" Levels I and II to a criterion of one time without error. Group II, on the other hand, was to "overlearn" the same tasks to a criterion of three without error. Chasey found that the
subjects "who overlearned (Group II) maintained significant retention of the task after four weeks of no reinforcement" (25:147). He also found that those "who overlearned the task (Group II) were superior in retention after four weeks of no reinforcement to those subjects who learned (Group I), but did not overlearn the task" (25:147). Though statistical significance was claimed, there were some procedural errors that may have influenced the results, namely the intersubject variability and the teaching and reinforcement methods used. Teaching was by "any" method while candy and verbal praise appeared to be delivered indiscriminantly.

Jens and Shores (39) conducted research showing that moderately to severely retarded individuals are capable of graphing their behavior and that this graphing accelerated subjects' performances. The subjects used in this study were adolescents whose IQ's ranged between thirty and forty-five. They were incorporated into an $A_1, B_1, A_2, B_2$ design where the "A" condition represented baseline periods and "B" phases represented experimental periods. Two tasks were used. The first involved putting together hinge mechanisms used in boxes for pen and pencil sets, while the second task required the subjects to assemble and package small plastic rings. The increase/decrease in production rates were affected by the introduction or removal of the behavioral charts. Some problem areas with respect to "other sources of motivation" were pointed out by the authors. Even though they appeared to subscribe to the influence of the graphing behavior, they reported that the critical question was really left unanswered or unclear: Were the charts reinforcing just by their presentation or did they serve the intended function of a reinforcer by indicating the number of assembled parts for that day?
Ullman (63) used 100 normal, educable mentally retarded, and trainable mentally retarded children with a mean mental age of six years. The normal children came from kindergarten classes while the educable mentally retarded and trainable mentally retarded came from special education classes. They were initially presented with a multidimensional demonstration object, following which they were to find one exactly like it from among a set of multidimensional objects from each of five dimensions. Retention was checked after zero, ten-, and thirty-second delay intervals. The findings indicated the following: (a) The performance of the trainable mentally retarded children was inferior to that of the educable mentally retarded and intellectually average children; (b) this deficit increased with increased demands on retention; (c) there were no differences between educable mentally retarded and intellectually average children; and (d) all IQ groups appeared capable of attending to several dimensions at the same time. Ullman suggested several reasons for the differences: 1.) The rapid forgetting rate may depend, in part, on the degree of retardation. 2.) The marked difference between trainable and educable mentally retarded cannot be accounted for by a direct relationship with intelligence. The mean IQ point differences were less than ten points between these two groups which suggested a potential qualitative difference between retarded individuals of different levels of retardation. A third alternative may reflect the much greater incidence of specifiable brain damage or congenital defects in trainable mentally retarded children.
Retention in the Trainable Mentally Retarded

In terms of severe retardation, Ball (23) studied six severely retarded boys who were placed back in their home wards after ninety days of intensive self-help skill training. The subjects' retention of learned responses was assessed periodically. The assessment was based on a testing instrument (44) which was related to three categories of behavior, Attention, Undressing, and Dressing. The undressing and dressing skills were based on the immediate response to a command which pertained specifically to one and/or the other of these two skills. Following the return of the subjects to a custodial routine, their immediate gains in undressing skills abruptly declined. A significant improvement in dressing skills was not noticed until nearly four years later. The results were viewed in terms of cues selectively maintaining performance in a custodial situation. In this case, once the subjects were returned to their respective wards there were no reinforcers being provided contingent upon dressing and/or undressing behavior.

In the earlier study by Chasey (25), significant differences in retention were cited between those students who "learned" (Group I) compared with those who "overlearned" (Group II) a motor task. The IQ range of his ninety-eight subjects varied from fifteen to ninety-four, such that a random distribution produced no significant differences between groups during the pre-test period. Since significant differences were found during the retention post-test, it might therefore be assumed that some retention occurred in the trainable mentally retarded population in the "overlearning" group (Group II). The assumption was not able to be substantiated, however.
A significant study was initiated by Gold (32) who used sixty-four trainable mentally retarded adolescents from four sheltered workshops. The significance lay in the fact that a practical application of behavioral principles was demonstrated. Gold began by randomly assigning sixteen students from each workshop into one of four groups. However, only four of the sixteen from each workshop were placed in any one group. Four experimenters were trained and each assigned to one of the groups. Each group learned to assemble a fifteen-piece bicycle brake and were tested for transfer to a twenty-four piece bicycle brake unit. Fifty-three subjects were re-tested one year later on both tasks and were found to have retained the assembly skills to a significant degree.

In the Tizard and Loos study (62) it was found that one month following the rapid learning of the Minnesota Spatial Relations Test (a peg-board type skill) the male adults, ages nineteen to twenty-nine, produced scores that remained much higher than their initial scores. These results were confirmed by Ellis (29) who also noted in his research that retardates' retention scores were higher than their acquisition scores. Tizard and Loos concluded from their research that a subject's initial score on a motor test would likely give a poor estimate of his actual ability to do the test after practice.

Crosson (26) studied the ability of seven severely retarded males to perform two operations, including the control of a drill press in manufacturing wooden pencil holders and the use of a hammer in the assembly of flower boxes. There were approximately 100 components which made up the operant chains for each task. After less than three hours of training all subjects were able to perform the tasks to a
criterion of two errorless trials. Two months following training the retention phase of the study showed that ninety-nine percent of the necessary task discriminations were retained with an average of only one trial required to meet criterion. After twelve months, the percentage retained was in the mid-nineties or higher with only four trials necessary to reach criterion.

If, in fact, there are retention problems in mentally retarded subjects, Ellis (7) has suggested that a short-term memory deficit is responsible for most of the retention problems. According to him, there is within the mentally retarded an ineffective stimulus-trace causing a reduction in short-term memory even when long-term memory functions are still available. Jensen and Rohwer (40), Fleischman (30), and Eisman (27) confirm Ellis' contention by failing to have discovered significant impairments when contrasting retarded and normal subjects in long-term retention tasks. In short, once a retarded subject has learned a response he will remember it in the same proportion as a normal individual. Failing to find long-term retention deficits, however, does not necessarily imply short-term deficits.

A number of authors (20, 21, 25, 30, 32, 42, 49, 62) have commented that the most important product in motor skill retention is the level of proficiency during the initial learning phase. These studies were not only conducted with educable (21, 25) and trainable (25, 32, 62) mentally retarded, but also with normal populations (20, 30, 42, 49). Further confirmation comes from Belmont (3) who comprehensively reviewed long-term memory in mental retardation. He concluded that, although research has been troubled with methodological problems, one result was
evident: Retention is related to the degree of original learning. It may well be that initial learning will have the greatest affect on short-term memory.

Summary

The review of literature opened with the position that operant research is the one effective area for establishing a technology for improving motor skill functioning of the mentally retarded (32). Also discussed in the introduction was the low level of conditioning and posture (6, 10, 12) as well as the inferiority of the mentally retarded on most tests of physical fitness (38, 50, 53). Concluding the introduction was Fuller's classical work (31) which clearly demonstrated the use and effectiveness of operant conditioning on the (motor) behavior of mentally retarded persons.

The first section of the background review was concerned with incentives and learning in the educable mentally retarded. It was noted that a conflict exists as to which type of incentive had the greatest effect on the learning of a motor skill in the educable mentally retarded population. Three authors (41, 45, 47) suggested that the type of practice and/or reward had no effect on the motor performance of the mentally retarded, while several other investigators (21, 52) found significant increases with food or material reinforcement. Still others noted that verbal (64) as well as verbal plus food/material reinforcement (52, 55, 67, 70) was best. One writer (36) indicated the necessity to be conscious of the magnitude of the incentive on learning. Practice
effects were also felt to have a bearing on motor performance of mentally retarded subjects (62). Lastly, it was pointed out that the motor behavior of the mentally retarded is indeed under voluntary control (60).

Section two treated incentives and learning in the trainable mentally retarded. Evidence in this area pointed out that, although good results were obtained by the use of a reinforcement system (28, 31, 33, 43, 52, 54, 59), there was a discrepancy as to whether intangible reinforcements, such as verbal praise (54, 59), goal setting and encouragement (28, 33), negative feedback (61) or punishment (22, 43, 46), had more effect on motor learning than tangible reinforcements (33, 52, 65). Two studies (37, 62) simply looked at practice effects, noting that initial scores are really poor predictors of final scores without carefully considering all the variables. Zigler (19) and Green and Zigler (34) suggested a reason for the variance in reinforcement effects was the development of a failure-reduction mechanism, such that retardates' performances are extremely dependent on external cues from others.

Retention in the educable mentally retarded, which comprised the third section, indicated that contrary to some research (21), it is possible for educable mentally retarded individuals to retain what they have learned, from a zero-second delay (24) to several days (39), to one month (25) following practice. One study (63), though not specifically looking at motor skill retention, suggested possible reasons for performance discrepancies between educable and trainable mentally retarded subjects whose IQ point differences were but ten or less.

The last area considered retention in the trainable mentally retarded, which seemed to suggest that retention exists, but the degree
varies from almost none (23) to one month (25), two months (62) and even up to one year (32) following training. According to several writers (7, 27, 30, 40) the main reason for the retention problem appeared to be in the short-term memory system.

Finally, the comment was made that the most important constituency of motor skill retention was the amount of proficiency gained during the initial learning stage (3, 20, 25, 30, 42, 49).
CHAPTER III
METHODS AND PROCEDURES

Introduction

According to Harter (35), most of the research using the mentally retarded as subjects has generally considered only one dependent variable. She and her co-workers (35:275) speaking to this point claim:

There is a need to consider more than one learning task and one learning measure in the assessment of non-retarded and retarded differences as well as the need to consider the effects of motivational variables on learning performance.

This investigation has attempted to focus on the recommendation of Harter by using two skills and four treatments. More specifically, the purpose of this study was to investigate the effects of varying types of reinforcers on the learning of two novel gross motor tasks by trainable mentally retarded boys. The following areas will be presented within this chapter: Pilot Study, The Selection of Subjects, The Environment, The Selection of Skills, The Setting, The Construction of Materials for The Setting, and The Execution of Skills; also Pre-Conditioning, Pre-Training, Treatment, Design, Recording Technique, and Interobserver Agreement Measures.
Pilot Study

A pilot study using two severely retarded subjects was conducted prior to the initiation of the principal research project. The ages of these boys were fifteen and sixteen, respectively, and their IQ's were twenty-five. They were seated individually, two feet from the investigator, in a small room measuring 15' x 15' x 11'. The observer sat four feet to the right of the subject blocking the door. His function was to record subject and investigator responses throughout the four days of the preliminary study.

The first phase of the pilot work consisted of establishing a consistent response that was already within the behavioral repertoire of the subjects. As a result of individual sessions with each boy, it was found to be easier to establish leg-lifting behavior than arm raising behavior. This occurred twice a day, from 8:40 to 9:30 A.M. and again from 2:25 to 3:25 P.M. Each subject responded to and was initially conditioned to leg-raising behavior throughout the use of verbal reinforcement as well as non-verbal reinforcement.

They were then conditioned to (chocolate) candy reinforcement and subsequently a token reinforcement. The token, a poker chip, was exchanged for a small piece of (chocolate) candy. This was done by placing the token in the subject's hand, immediately removing it, and replacing it with the candy. The back-up candy reinforcement was faded from a continuous schedule to a variable-ratio schedule of ten tokens. Tokens were next exchanged for small plastic toys at no loss of reinforcement strength. Both subjects were conditioned to this schedule on the second day.
During the afternoon of the second day, the bean-bag and ring toss apparatus was arranged to establish throwing distances as well as the size of the target opening of the bean-bag targets. Several target distances were used, forty-eight inches, seventy-two inches, eighty-four inches, and ninety-six inches. It was found that a distance of eighty-four inches from the target edges was best for developing the eye-hand motor skills of bean-bag throwing and ring tossing. The target openings tested were eight inches and six inches in diameter. The six-inch opening appeared to provide the most challenge since the eight-inch opening allowed too many bean-bags through it on initial performances. Both subjects were found to be capable of responding to both skills under the influence of material and social reinforcement.

This preliminary study provided the necessary guidelines and logistical information for arranging the environment, subjects, skills, and recording techniques for the major investigation. In summary, it established the following: a) familiarization of the investigator and observer with recording techniques, b) the reduction of potential sources of error in recording and management of the two motor skills, c) a determination of the most appropriate distance between the subject and motor skill target and between the subjects as they would stand in a horizontal line abreast, d) the size of the open-center of the bean-bag target, e) the determination of the number of throwing attempts per session for each skill, and f) the feasibility of token delivery during an on-going motor skill activity.
The Selection of Subjects

In order to begin the selection of subjects, initial contact was made with an administrative assistant, Mr. Brian Haller, of the Columbus State Institute, Columbus, Ohio. He referred the investigator to four social workers who handled the case loads for the necessary subjects. After explaining the nature of the investigation to the social workers indicating a need for a minimum of four subjects between the ages of fourteen and seventeen and in IQ between 25-39, they made available seventeen potential subjects meeting these requirements. Of the seventeen, only six subjects were available for use between 8:30 and 8:40 A.M. and 2:30 and 2:40 P.M. Only five of the six remaining subjects were able to be pre-conditioned to verbal and token reinforcement. According to the social workers' review of each subject's case record, all were free from any known physical disability. Table 1 describes the subjects in more detail.

The Environment

During this experiment, the subjects, an observer, and the investigator participated in a closed space, free of as many outside influences as possible. The investigator instructed and demonstrated the skill during the instruction phase of each session while the observer, a doctoral candidate in Adapted Physical Education at The Ohio State University, recorded the behaviors of each subject as well as the teacher.
Table 1

Subjects' Age, IQ and Clinical Diagnosis

<table>
<thead>
<tr>
<th>Subject</th>
<th>CA</th>
<th>IQ</th>
<th>IQ Test*</th>
<th>Date Given</th>
<th>Diagnosis**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16-2</td>
<td>39</td>
<td>SB</td>
<td>5-75</td>
<td>TMR (Severely Retarded)</td>
</tr>
<tr>
<td>2</td>
<td>14-7</td>
<td>32</td>
<td>SB</td>
<td>1-72</td>
<td>TMR (Severely Retarded)</td>
</tr>
<tr>
<td>3</td>
<td>15-1</td>
<td>30</td>
<td>LSP</td>
<td>11-74</td>
<td>TMR (Severely Retarded)</td>
</tr>
<tr>
<td>4</td>
<td>15-9</td>
<td>25</td>
<td>SB</td>
<td>7-75</td>
<td>TMR (Severely Retarded)</td>
</tr>
<tr>
<td>5</td>
<td>17-4</td>
<td>38</td>
<td>SB</td>
<td>3-75</td>
<td>TMR (Severely Retarded)</td>
</tr>
</tbody>
</table>

* IQ Test: SB—Stanford Binet, LSP—Leiter Scale of Performance.
** Diagnosis: This was based on the subjects' medical records as related to the author by their social workers.

This study basically involved a one-on-one learning environment, the exact teacher-pupil ratio was one to five. It should be pointed out that there is some evidence suggesting that face-to-face confrontation, as opposed to the separation of the experimenter and subject, can increase interference of the learning task. Harter (35) noted in her earlier research (66) that when there was an increased amount of social interaction between subject and experimenter there was more interference with subject interest in and attention to the learning task. However, one should recognize that in normal conditions when individuals are participating in an activity there is, or should be, a teacher or
supervisor in close proximity to the task or skill being performed. In this study, the investigator was very much a part of the learning environment. Harter postulated that the distracting characteristics of the social condition may be specific to task difficulty, such that in the less cognitively demanding task the subject is able to attend to both the task and the experimenter.

The Selection of Skills

Risley (15) and Pierce (70) made it very clear that human behaviors used in applied research should be chosen not for convenience or relevance to theory, but because society recognizes them as important. Though this research leans more toward a basic or theoretical approach, the two motor skills have an applied component—they can assist in the eye-hand throwing skill of the participants. The two skills selected for this investigation were the underhand bean-bag throw into an open-centered target and a ring toss onto a wooden peg mounted on a stationary wooden base.

The Setting

The general setting for this investigation was the gymnasium located in the Rehabilitation Center of the Columbus State Institute, Columbus, Ohio. There were four different areas used, each area representing a different treatment. The dimensions and the treatment areas of the gymnasium are depicted in Figure 1. The four treatment areas representing the four treatment conditions were arranged as follows:
The Happy Face Room (Figure 2). This represented the potential social reinforcement (Treatment II) area and was located to the immediate left of the gymnasium entrance as indicated in Figure 1. The Happy Face Room was so named because the white posters, located just above the targets, had black "happy faces" painted on a white background.

The Black Stage Room (Figure 3). Represented here was the potential social plus token reinforcement (Treatment IV) station. It was named because of its location (the stage) as well as the color of the posters (black). The posters also had an orange fluorescent triangle with an orange dot painted in the middle of the triangle. They also hung just above the targets.

The Green Room (Figure 4). The Green Room was located to the right of the stage and had lime green posters which represented the potential token reinforcement treatment (Treatment III). The posters were void of any drawings or pictures and were placed just above the targets as in the Black Stage Room and the Happy Face Room. There was a piano just to the left of where the subjects stood, the back of which was facing the throwing area. The piano formed what may be called the left barrier or border to the throwing area. (The piano is not shown since it was moved prior to the photographing of this area, however, it was fifty-nine inches long and forty-eight inches high. It protruded from the edge of the stage lengthwise while its backside faced the throwing area.)

The Instruction Only Station (Treatment I) (Figure 5). This station was not verbally presented to the subjects as the other stations were. Also there were no posters. It was located in the far right-hand
FIGURE I

SCHEMATIC OF GYMNASIUM
FIGURE 2

THE HAPPY FACE ROOM
FIGURE 3

THE BLACK STAGE ROOM
FIGURE 4

THE GREEN ROOM
corner of the gymnasium (Figure 1) and it had a wall which supported Swedish Stall Bars, a set of round wooden bars, each bar separated by four inches, reaching a height of seven feet ten and one-half inches and spanning a width of nine feet. There was a fourteen and one-half inch space located between the second and third bars from the top.

(All dimensions of the throwing areas remained constant and are represented by The Happy Face Room in Figure 1.)

The Construction of Materials for the Setting

The materials used in the setting were posters, bean-bag targets, ring toss targets, bean-bags, rings, restraining lines and cardboard boxes. Each of the materials was so designed in order to make for the most efficient environment possible.

The posters were of one-thirty-second inch cardboard, twenty-two inches by twenty-seven and three-quarters inches, and were purchased in the art section of a department store. They were positioned immediately above the bean-bag targets (Figure 2), which placed them at or near the eye-level of the subjects. The same approximate level was used for the ring toss as for the bean-bag apparatus. (A comparison may be seen by observing Figures 2 and 3.)

The bean-bag targets were constructed of three-eighths inch plywood, eighteen by thirty inches, with a six-inch diameter hole placed in the center of the target, five inches from the top of the board. The boards were so placed that the bottom edges were eighty-four inches from the leading edge of each restraining line.
FIGURE 5
THE INSTRUCTION ONLY STATION
The ring toss targets were composed of two parts: a wooden base and a twelve-inch wooden peg. The base was made of three-quarter inch pine, twelve inches square, painted black, with a one-half inch hole countersunk to hold the peg. The peg was also made of pine, twelve and one-half inches in length, and painted yellow. It was placed in the one-half inch hole in the center of the base so that twelve inches remained above the base. The front edge of the base was located eighty-four inches from the leading edge of the restraining line.

The bean-bags ranged in size from 3" x 3" to 4" x 4" and in weight from two ounces to ten ounces. They were filled with beans, some bags bigger and heavier than others, but none were so heavy as to affect the muscular endurance of the subjects during the investigation.

The rings were made of three-quarter inch manilla rope cut in two-foot strips. The ends of the strips were bound together with one and one-half inch athletic adhesive tape forming a twelve inch diameter ring. Once the ends were secured the entire ring was wrapped once with the athletic tape, enclosing all of the rope.

There was a restraining line placed before each of the subjects. It was one inch by eighteen inches and was located eighty-four inches from each subject's target. This line may best be observed in Figure 2. Each line was separated from the adjacent line by two feet.

There was a fourteen by fourteen by fourteen inch box made of cardboard which was used to hold the throwing objects. These boxes were placed on the floor to the immediate left of the subjects.
The Execution of the Skill

In each case the skill was performed from behind a one-inch by eighteen inch restraining line, eighty-four inches from the base of each target. The subjects were allowed to touch, but not go over this line.

The two skills were presented twice a day, once in the morning, between 8:30 and 8:40, and once in the afternoon, between 2:30 and 2:40. This resulted in four skill treatment sessions per day. The arrangement of the skills were such that when one skill was completed (including the delivery of the back-up reinforcers), the subjects walked to the second skill.

There was a total of forty-eight treatment sessions presented during this investigation, such that each time a throwing skill activity occurred, it was recorded as one treatment session. This allowed for each treatment to have been presented to the subjects six times per skill, i.e., social praise delivered six times during the bean-bag throw and six times during the ring toss.

The treatment conditions followed the Table of Random Numbers (Table 2) after Treatments II, Potential Social Reinforcement, IV, Potential Social plus Token Reinforcement, III, Potential Token Reinforcement, and I, Instruction Only, had been presented. This allowed for the initial shaping of appropriate behavior. The first four sessions, then, followed this order: Session 1—Treatment II, Session 2—Treatment IV, Session 3—Treatment III, Session 4—Treatment I. The four treatments varied such that no one condition appeared more than two consecutive sessions per day throughout the investigation. The remaining days
Table 2
Daily Treatment and Skill Order*

<table>
<thead>
<tr>
<th>Day</th>
<th>Morning Treatment Skill</th>
<th>Morning Treatment Skill</th>
<th>Afternoon Treatment Skill</th>
<th>Afternoon Treatment Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>II—BB</td>
<td>IV—RT</td>
<td>III—RT</td>
<td>I—BB</td>
</tr>
<tr>
<td>2</td>
<td>II—RT</td>
<td>III—BB</td>
<td>IV—BB</td>
<td>I—RT</td>
</tr>
<tr>
<td>3</td>
<td>II—BB</td>
<td>IV—RT</td>
<td>I—RT</td>
<td>III—BB</td>
</tr>
<tr>
<td>4</td>
<td>IV—BB</td>
<td>I—RT</td>
<td>II—RT</td>
<td>III—BB</td>
</tr>
<tr>
<td>5</td>
<td>II—RT</td>
<td>IV—BB</td>
<td>I—BB</td>
<td>III—RT</td>
</tr>
<tr>
<td>6</td>
<td>III—RT</td>
<td>IV—BB</td>
<td>I—BB</td>
<td>II—RT</td>
</tr>
<tr>
<td>7</td>
<td>IV—RT</td>
<td>III—BB</td>
<td>II—BB</td>
<td>I—RT</td>
</tr>
<tr>
<td>8</td>
<td>III—RT</td>
<td>I—BB</td>
<td>II—BB</td>
<td>IV—RT</td>
</tr>
<tr>
<td>9</td>
<td>I—BB</td>
<td>I—RT</td>
<td>II—RT</td>
<td>III—BB</td>
</tr>
<tr>
<td>10</td>
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<td>IV—BB</td>
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<td>11</td>
<td>IV—RT</td>
<td>I—BB</td>
<td>II—RT</td>
<td>III—BB</td>
</tr>
<tr>
<td>12</td>
<td>I—RT</td>
<td>IV—BB</td>
<td>III—RT</td>
<td>II—BB</td>
</tr>
</tbody>
</table>

* 
I—Instruction Only  
II—Potential Social Reinforcement  
III—Potential Token Reinforcement  
IV—Potential Social plus Token Reinforcement  
BB—Bean-Bag  
RT—Ring Toss
contained a random order of treatments and skills and may be found in Table 2.

Each throwing task began with the subjects seated on the floor behind their restraining lines and in front of their targets with the throwing objects placed in the box to their left. Prior to the demonstration the following statement was made regarding the environment and the requirements for the throwing position:

This room is called the Happy Face Room (Black Stage Room, Green Room) (The experimenter pointing to the posters.) (Repeated a second time.) First you stand up and stand behind the line like this. After you are up and standing behind the line, you throw the bean-bag (ring) like this.

The manner in which the objects were thrown was demonstrated by the experimenter three times prior to the execution of the skill by the subjects. The bean-bags were demonstrated using an underhand throw similar to pitching a softball, while the ring toss was shown using a sidearm motion. In this case, the throwing side was facing the target, the throwing arm held diagonally across the chest, down to the waist, and the throwing hand (with the ring) next to the waist on the non-dominant side. No emphasis was placed on which hand the subjects should use. They were free to use either hand.

Following the demonstration, with the subjects still seated on the floor behind their lines and their boxes to their left, this statement was made:

You may stand up and stand behind the line. (Once all subjects were standing, the command to begin throwing was given.) You may throw each bean-bag (ring) into (on) the hole (peg) in the wood.
Each subject had the opportunity to make twenty attempts per skill by throwing the objects in groups of ten, that is, ten bean-bags were thrown, retrieved, and thrown again. The rings were thrown in the same manner.

Once each subject completed tossing his round of ten objects he sat down until all the others had completed throwing their rounds of ten. After the ten throws were made the investigator counted the number of successful attempts. He then gathered the ten bean-bags or rings and placed them in front of the target for the subjects to pick up. The subjects were instructed verbally, as a group, to pick up their bean-bags or rings in the following manner:

Pick up the bean-bags (rings) and put them in my box. (This was a large box located next to the investigator, behind and to one side of the subjects.)

Once the objects were placed in "my box," the subjects were instructed as follows: "Now, pick up your box and follow me."

The reinforcements were delivered according to the condition under which the subjects operated. However, the back-up reinforcers were delivered at the conclusion of the placement of the objects into "my box."

Pre-Conditioning

Prior to the initiation of the study it was necessary to determine whether or not the social and material reinforcers were, in fact, reinforcing. One task was selected that was within the repertoire of behaviors of each subject. The task, "leg-lifting discrimination,"
was arranged in a reversal design method for determining the effect of the two kinds of potential reinforcements.

Potential social reinforcement was investigated first. Each subject was told twenty times, "Lift your leg," during which a baseline (Experimental Condition One) was taken to determine leg-lifting frequency for each leg. Baseline was constructed by recording the number of times each leg was lifted following the command, "Lift your leg." (The figure of twenty times was determined from the pilot study conducted previous to this pre-conditioning phase.)

Following baseline and during Experimental Condition Two, the statement, "Lift your leg," was given again. When the "least chosen leg" was lifted, as determined by the baseline condition, the subjects were reinforced with verbal praise, such as "Good boy," "Very good," "Excellent, excellent," etc. If neither leg was "least chosen," then reinforcement was administered when the leg which was not lifted during the last request was lifted, such that if the right leg was the last leg lifted following the twentieth request, then when the left leg was raised upon the command, "Lift your leg," the subject was reinforced.

Experimental Condition Two continued until the leg-lifting behavior was maintained under control of the potential social reinforcement treatment. This decision was arbitrary, but based on the author's knowledge and training in behavioral analysis techniques. This meant that each subject was treated individually, and as such, the treatment demonstrated varying degrees of control, but control nevertheless.

Experimental Condition Three, the extinction phase, followed Experimental Condition Two. During this condition, leg-lifting behavior
was extinguished, that is, the response frequency of the leg under control of the potential social reinforcement treatment was reduced in the direction of the baseline behavior. Once baseline or near-baseline responding occurred, Experimental Condition Four was introduced, in which the leg not reinforced during Experimental Condition Two was reinforced during this condition.

The assumption was made that the increase in the response frequencies under Experimental Conditions Two and Four were affected by potential social reinforcement, since this was the only variable introduced to the conditioning program.

In order to investigate potential material reinforcement, the subjects again were told, "Lift your leg." The same arrangement for investigating treatment effects under potential social reinforcement was also used for potential material reinforcement. Five of the original six selected subjects were pre-conditioned to both types of reinforcement.

Pre-Training

The pre-training phase took place immediately following the pre-conditioning of the potential social and material reinforcers. This consisted of conditioning the use of tokens as secondary reinforcers. The tokens were administered contingently and under the same conditions as during the pre-conditioning stages.

During this training period, once the appropriate response was made, a token was delivered in the palm of the subject's hand, then immediately removed and replaced by a candy reinforcer. Gradually the
number of tokens necessary for the exchange for a candy reinforcer increased until there was no exchange for a candy reinforcer. The candy was faded out and replaced by a small inexpensive toy that was provided after a minimum of ten tokens had been accumulated by the subjects. This time delay between the token delivery and exchange for the toys was necessary because there was a similar time delay between the token delivery and toy exchange during the bean-bag and ring toss activities.

All subjects used in this research were conditioned to the tokens in one session following the pre-conditioning sessions. Immediately following this training period the gross motor tasks of bean-bag throwing and ring tossing began.

**Treatment**

The treatment arrangement for this investigation was as follows:


Reinforcement was given on an intermittent schedule, but as close to a continuous schedule as possible. The reason for the intermittent schedule was that it is highly improbable and not realistic to expect a teacher or investigator to witness every correct response and respond accordingly.

**Treatment I—Instruction Only**

(Throughout the demonstration of the skills, each subject was seated behind the restraining line eighty-four inches from and in front
of his target.)

Prior to the execution of each motor task the investigator explained the throwing technique and then demonstrated the task. (The verbal explanation was given under the section, The Execution of the Skill.) The investigator threw three bean-bags or rings, one at a time. They were then returned to the subject's box from which they were taken. (This demonstration was also explained under the section, The Execution of the Skill.)

The subjects were neither touched nor told whether their method of throwing was right or wrong, since these variables might have acted as unintentional additional reinforcements. It was up to each subject to replicate the investigator's position as best he could. The only comment given during the first three days of throwing was given at random and included the following: "Remember to stand behind the line."

Excessive inappropriate line behavior, which was stepping over the restraining line on every throw by twelve inches or more, was noted and shaped by successive approximation.

Treatment II—Instruction plus Potential Social Reinforcement

The subjects were given the same instructions and demonstrations as in the Instruction Only period. Each subject was verbally and/or non-verbally praised (these terms are defined below) if he threw either the bean-bag into the open-centered wooden target or the ring around the peg from behind the restraining line. If any subject did not adhere to the restraining line and/or did not make a successful attempt, he was not reinforced. However, if a subject went over the line, but was closer to
the restraining line than before and he made a successful attempt, he was reinforced verbally plus the comment, "That was much better—you were almost behind the line. Stand behind the line this time." No attempt was made to count correct responses with respect to this shaping procedure. It was only used if a subject violated the restraining line rule with every toss.

Potential social reinforcement was defined in terms of potential verbal and potential non-verbal reinforcement. The following describes these two classes of reinforcement.

**Potential Verbal Reinforcement.** This was considered as any combination of words delivered contingently upon the successful throwing attempt of either the bean-bag or the ring which indicated approval of a subject's response. These words included: "Good," "Good boy," "O.K.," "Very good," "That's right," or other words to this effect.

**Potential Non-Verbal Reinforcement.** This was considered as any physical or non-physical contact delivered contingent upon the successful throwing attempt of either the bean-bag or ring indicating approval of a subject's response. Physical contact included: rustling of the hair, pat-on-the-back, -neck, -shoulder, or -head; hand shake, hugging, etc. Non-physical contact consisted of such items as investigator clapping, a smile with eye-contact, or responses similar to these.

With respect to counting the number of potential social reinforcements delivered, the following criteria applied: One or more "pats" was considered as one non-verbal reinforcement unless more than one area of the body was touched, in which case one reinforcement was recorded for
each area touched. By the same measure, if one type of verbal rein­
forcement was repeated more than once following a successful response,
then only one reinforcement was given and recorded. However, if two
different types of verbal reinforcements were given, such as "Good,"
followed by "Good boy," then two reinforcements were recorded.

Treatment III—Instruction plus Potential Token Reinforcement

Prior to any instruction, each subject was to attach a pouch to
his waist which held any tokens received during this phase. The pro­
cedures for the instruction phase was again identical to those listed
above. The subjects were not told prior to the beginning of the session
that they would receive a token which could be exchanged for a toy at
the conclusion of the session, however, placement of the pouch onto their
clothing was to act as a cue for tokens. The subjects were allowed to
handle the toys for a minimum of thirty seconds, depending upon who the
last person was who exchanged tokens. If necessary, the subjects were
told how to play with the toys. After experimenting with the toys they
were told to pick up their boxes and follow the investigator to the next
station.

Treatment IV—Instruction plus Potential Social and Token Reinforcement

All subjects were provided with pouches and instructed as before.
When the correct response was made the subjects received verbal and/or
non-verbal praise plus a token. The tokens were exchanged in the same
manner as in the Instruction plus Potential Token Reinforcement condition.
Token Exchange

Tokens were exchanged for designated types of toys at the conclusion of Treatments III and IV as noted above. Appendix A sets forth the discrimination exchange value between the kinds of toys.

Design

Three common designs used in applied behavior analysis are: the reversal design (9), the multiple baseline design (4), and the multielement baseline design (17). The reversal design is usually used when one wishes to observe a particular behavior of a subject and the effect of the alternate presentation, withdrawal, and re-presentation of a specific intervention. The multiple baseline design may be used when one wishes to alternate treatments across subjects, conditions or behaviors.

The design selected for this study was the multielement baseline design. This design provides for the alternation of treatments across skills and subjects, such that a different treatment is applied during each skill session; no treatment occurs more than twice in succession. One may then observe, at any time, the differential effects of all treatments. In order that the reader may fully understand the multielement baseline design, a hypothetical graph of a student's behavior has been included in this section (Figure 6). This graph depicts the amount of behavior, in this case, percent of successful responses on the ordinate and the sessions on the abscissa. The following key will assist the reader in interpreting the graph:
A—Treatments

I. △--△ -- Instruction Only

II. □ · · · · · □ -- Instruction + Social Reinforcement

III. × · · · · × -- Instruction + Token Reinforcement

IV. O-- -- -- O -- Instruction + Social and Token Reinforcement

B₁—Performance Maintenance seven days following session twenty-four.

B₂—Performance Maintenance twenty-eight days following session twenty-four.

Ulman and Sulzer-Azaroff (17) have listed several advantages for this design over the traditional reversal and multiple baseline designs. The first advantage is that of non-reversibility, such that when date overlap, the efficacy of the experimental procedure is not ruled out as can be the case in reversal type experiments.

A second advantage is that an experiment may be terminated at the discretion of the investigator following his judgment that experimental control has been reliably demonstrated. This is not so in either the reversal or multiple baselines where several sessions must be measured before proceeding to the next phase (reversal) or that two behaviors be monitored concurrently (multiple baseline). In case of abrupt or unexpected termination the multielement baseline design may preclude the necessity for repeating the experiment from the beginning.

Unstable baselines can be very disturbing in conducting operant research. This is quite common when new behaviors are taught, the resulting conditioning being an ascending baseline or irregular variable due to task complexity. According to Ulman and Sulzer-Azaroff (17),
FIGURE 6

GRAPHIC REPRESENTATION OF THE MULTIELEMENT BASELINE DESIGN
Instruction Only = \(\Delta \quad \Delta\)
Instr. + Soc. Rment. = \(\Box \quad \Box\)
Instr. + Tok. Rment. = \(\times \quad \times\)
Instr. + Soc. & Tok. Rment. = \(\circ \quad \circ\)

A = Treatments
B_1 = Performance Maintenance After 7 Days
B_2 = Performance Maintenance After 28 Days
Sidman (16) was able to compare experimental conditions in his animal research even though a baseline may be changing. Powell and Hake (48) encountered a similar problem with humans in that matching-to-sample performance in high school students improved steadily under all experimental conditions. Experimental control, however, was still demonstrated because they used the multielement baseline design. This showed the third advantage.

Fourth, the multielement baseline design seems best suited for conducting complex behavior analyses, especially when one wishes to isolate the effects of interrelated controlling variables:

Especially with complex behavior analyses the more often the independent variables are manipulated, the more believable is the demonstration of experimental control. Thus, when conducting a complex behavior analysis, it is better to vary the order of their presentation than not to do so (17:384).

This can be contrasted with the problem of conducting complex analyses using either the reversal or multiple baseline designs where several sessions of one condition must be given before the next condition can be introduced. More critically, the behavior should reach a stability criterion prior to instituting the change (16).

As a fifth advantage, stimulus generalization may be assessed using the multielement baseline design. By observing daily performance comparisons under the various experimental conditions it is possible to demonstrate generalization of particular effects across situations.

Sixth, and lastly, condition-change interactions may be minimized. Condition-change interactions refer to differential responding that is seen in one situation that is the result of the individual's contact with another condition. There are two classes of condition-change interaction:
sequence effects and contrast effects. Sequence effects may be found in a reversal or multiple baseline design, whereas contrast effects are interactions within and/or between the sessions of a multielement baseline design. The multielement baseline design reduces the sequence effects by involving each condition briefly (a maximum of two consecutive sessions), vice a prolonged period of time. Contrast effects may be controlled by counter-balancing the presentation of conditions in such a way that each condition is followed equally often by every other condition. A second way of reducing contrast effects is by programming only one condition per session. Third, the most direct approach of controlling for these effects would be to determine the extent to which these effects are present. Assessment of these effects may be done by conducting control experiments in which each component appears separately. If reliable effects are found with the multielement baseline design, that is, if condition-change interactions are small, then this type of design would be quite advantageous for use in educational research (17).

The arrangement of this design is such that stimuli must be available in the environment so that the subjects can discriminate between the conditions under which they are operating. The two major stimuli, common to all, which were used for discrimination were colored poster boards (with and without painted designs) and the particular area in which the poster boards were located. Figure 1 provides the schematic of the area layouts while Figures 2 through 5 illustrate the particular discrimination used in each area. Auditory cues were used in combination with the poster board just prior to the instruction and demonstration
phase of the particular skill under investigation. (These cues may be found in the section, The Execution of the Skill.) Except for the Instruction Only station, these cues referenced the name of the "room" and were associated with the poster boards located just above the targets. The experimenter, standing in a center-front position, with his back to the poster boards, pointed to these posters as they were mentioned during the verbal cues. The only other potential major discrimination was the use of pouches which signaled the use of tokens during Treatments III and IV.

**Recording Technique**

The method of choice used for observing successful attempts in this investigation was event recording. Event recording consists of recording the number of events occurring throughout the measurement period. It is normally used when there are a limited number of individuals or when the frequency is low enough to allow for simultaneous observations of a large number of people. In this case, the frequency was low enough and there were only five subjects to be observed simultaneously.

Recording was done simultaneously, but independently, by both the investigator and observer. It occurred during the throwing activities which began between 8:30 and 8:40 A.M. and between 2:30 and 2:40 P.M. The preliminary information, however, was recorded upon arrival at the testing area and prior to the beginning of the respective throwing activity for that time period. This included Skill, Subjects, Day, Sessions and Condition (Figure 7). Just prior to the initiation of the skill, the investigator took a standing position two to three feet
behind the five subjects while the observer sat in a metal chair six feet to the right and two feet forward of the subjects. Once started, the observer remained seated facing perpendicular to the throwing area, while the investigator moved back and forth in order to deliver reinforcements. After each successful attempt by each subject, the investigator and observer would place a vertical check-mark in the column titled, "On-Target." For each reinforcement delivered, a check-mark was placed in the appropriate column designating the type of reinforcement received by the subjects. This included verbal, non-verbal, and token. Also, if any disruptive behavior occurred, it was noted under the column titled, "Disruptive Behavior." The number of successful attempts and the number of reinforcements for each subject were totalled and recorded immediately following the return of the subjects to their respective living units.

Data Gathering

The following score sheet, Figure 7, was used to record the number of reinforcements given under each treatment condition for every twenty attempts for each skill.

Subject. Under subject was placed each subject's first name.

Day. Day indicated a number representing the consecutive day during which the study took place.

Session. Session was lettered either A.M. or P.M. with the appropriate one circled depending upon whether it was the morning or afternoon session of the day of the study.
FIGURE 7
DATA GATHERING SHEET
**SKILL: Bean-Bag/Ring Toss (Circle One)**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Day</th>
<th>Session</th>
<th>Condition</th>
<th>On-Target</th>
<th>Reinforcements Per 20 Attempts</th>
<th>Disruptive Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AM-PM</td>
<td>I,IS,IT,IST</td>
<td></td>
<td>V</td>
<td>NV</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>5</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Condition.** The abbreviations, I, IS, IT, IST, stood for Instruction, Instruction plus Potential Social Reinforcement, Instruction plus Potential Token Reinforcement, and Instruction plus Potential Social and Token Reinforcement, respectively. The condition under which the subjects operated was circled.

**On-Target.** This indicated the number of successful responses made by the subjects during each ten-throw attempt during each session. For the bean-bag throw, a successful attempt included any bean-bag which passed through or landed on the edge of the open center; the ring toss included any ring whose center was bisected by the wooden peg as it landed on the target. Further, any ring whose edge landed on top of, but not over, the wooden peg was considered a successful attempt.

**Reinforcements Per Twenty Attempts.** Under this section was listed the letters V, NV, and T, which represented, in order, verbal reinforcement, non-verbal reinforcement, and token reinforcement.

**Disruptive Behavior.** This column was used to indicate any disruptive behavior by any of the subjects, so that as it arose, the investigator would be able to see how the various conditions affected successive instances of the same or similar behavior. Disruptive behavior would be defined as any response by a subject which deviated from the required directions, such that it would normally require an intervention by the investigator to extinguish it.

**Interobserver Agreement Measures**

Both the investigator and observer were trained in the event recording method during the pilot study. At this time, each recorder,
independently, was required to place a vertical check-mark in the appropriate space under, "On-Target." At the conclusion of each session, the recordings were compared for agreement. Agreement was based on the definition of a successful attempt as described on page 72 under, "On-Target." The scoring was considered reliable when the agreement between the investigator and observer was 85% or better. Reliability was then defined as the number of agreements over the number of agreements plus disagreements multiplied by 100, i.e.

\[
\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100 = \text{percent agreement}
\]

Performance Maintenance

Performance maintenance tests for each activity were given seven days and twenty-eight days following completion of the multielement baseline for each skill. These tests were given on a Thursday and included twenty attempts per subject per skill. The reinforcing condition which produced the highest percentage of successful attempts for each subject was used in order to affect recovery of these responses. The graphic representation of this condition may be found under Figure 6 and denoted by the letters B_1 and B_2, which respectively indicated a seven and twenty-eight day no training period.

Part of the performance maintenance phase was referred to as the Recovery Percentage. The recovery percentage demonstrated the extent to which a subject approached his mean response percentage of his highest ranked treatment condition. This was determined by dividing the
performance maintenance percentage by the mean response percentage obtained during the training period. For example, if the mean response was 30% and the performance maintenance phase was 30%, then the recovery percentage would be \( \frac{30}{30} \times 100 = 100\% \) recovery. It must be understood that this figure does not represent 100% recovery of the total possible responses, only a recovery of the mean percentage of successful attempts.
CHAPTER IV
RESULTS

This chapter will present the results individually by activity, first the bean-bag followed by the ring toss. Individual graphs were used to present the percent of successful responses under each treatment in the order in which the treatments occurred. Also the combined effects of all the treatments were individually graphed for each subject. Finally, the group mean effect of all treatments for both skills combined were graphed and analyzed.

The results presented in Figures 8-26 indicated that when the stimulus conditions were available there was an increase in the percentage of successful responses by most of the subjects under reinforcing conditions as opposed to non-reinforcing conditions. The most productive intervention for both skills was Treatment IV, Social plus Token Reinforcement. Interobserver reliability for scoring was 100% throughout the study.

Bean-Bag Throw

Subject 1

Subject 1 (Figure 8) performed most consistently under Social plus Token Reinforcement followed respectively by Token Reinforcement, Instruction Only, and Social Reinforcement. He had a mean response of 17.5% with a high of 30% (Table 4). The Instruction Only condition
produced no successful responses following the second use of this treatment, while the Social Reinforcement condition yielded no successful responses after the first intervention.

With respect to performance maintenance following cessation of training, Social plus Token Reinforcement provided for 15% success after seven days and 0% after twenty-eight days.

When combining treatment effects (Figure 9), Social Reinforcement with Social plus Token Reinforcement had a greater affect than the combined Instruction Only with Social Reinforcement.

The respective recovery percentages for the performance maintenance periods were 85.7% and 0% (Table 4).

The ratio of reinforcements per successful attempt was: Instruction Only--0:1, Social Reinforcement--2:1, Token Reinforcement--1:1, and Social plus Token Reinforcement--2.28:1 (Table 6).
FIGURE 8

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 1 DURING BEAN-BAG THROWING
Figure 8

Instruction Only = △—△
Instr. + Soc. Rment. = □ • □
Instr. + Tok. Rment. = × • ×
Instr. + Soc. & Tok. Rment. = O—O

A = Treatments
B1 = Performance Maintenance After 7 Days
B2 = Performance Maintenance After 28 Days
FIGURE 9

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S1 DURING BEAN-BAG THROWING
Figure 9

Combined Soc. and Soc. + Tok. Rment = O—O
Combined Instr. and Soc. Rment = ■ ■ ■

A = Treatments
Subject 2

The performance of Subject Two (Figure 10) was best under Social plus Token Reinforcement, followed by Social Reinforcement, Token Reinforcement, and Instruction Only. His mean response percentage under the Social plus Token Reinforcement condition was 16.6% with a high of 25% (Table 4).

Combining effects for Subject Two (Figure 11) showed that all reinforcing conditions were better than the non-reinforcing condition of Instruction Only. However, the difference, as signified by the vertical distance between those conditions, was not great.

The performance maintenance phase under the Social plus Token Reinforcement condition provided a successful response percentage of 15% following seven days of no training and a 20% successful response percentage after twenty-eight days of no training.

The respective recovery percentages for the performance maintenance periods were 90% and 120%, respectively (Table 4).

His ratio of reinforcements per successful attempt was: Instruction Only—0:1, Social Reinforcement—1.88:1, Token Reinforcement—1:1, and Social plus Token Reinforcement—2.25:1 (Table 6).
FIGURE 10

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 2 DURING BEAN–BAG THROWING
Figure 10

Instruction Only = △—△
Instr. + Soc. Rment. = □•□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = O--O

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
FIGURE 11

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 2 DURING BEAN-BAG THROWING
Combined Soc., Tok., and Soc. + Tok. Rment = O—O   A = Treatments
Instr. Only = ■ ■ ■
Subject 3

Although very few successful responses were recorded (Figure 12), Instruction Only and Social Reinforcement yielded three successful responses of one completion on each of three sessions, followed by Social plus Token Reinforcement and Token Reinforcement, respectively. Instruction Only and Social Reinforcement showed a mean response of 2.5% with a high of 5% (Table 4).

Treatment effects were not combined for Subject Three since the differences between all conditions were really non-existent.

In terms of performance maintenance, the decision as to which condition would have the most effect on performance was strictly arbitrary. Social Reinforcement was selected with the result being 0% of twenty attempts on both Day 7 and 28 following no training.

The recovery percentage was also 0% for both periods (Table 4).

The ratio of reinforcements per successful attempt was:
Instruction Only--0:1, Social Reinforcement--1:1, Token Reinforcement--1:1, and Social plus Token Reinforcement--.45:1 (Table 6).
FIGURE 12

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 3 DURING BEAN-BAG THROWING
Figure 12

Instruction Only = △△
Instr. + Soc. Rment. = □...□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = O--O

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
**Subject 4**

Subject Four (Figure 13) performed best under Social plus Token Reinforcement, where his mean response was 23.3%. His high score under this condition was 45% (Table 4). Following the Social plus Token Reinforcement were Social Reinforcement, Token Reinforcement, and Instruction Only, respectively.

The combination effect (Figure 14) of Instruction Only, Social Reinforcement, and Social plus Token Reinforcement were better than Token Reinforcement at influencing performance in Subject Four. It should be noted, however, that four of the five Token Reinforcement treatments were just as effective at influencing subject performance as the previously mentioned treatments.

Performance maintenance testing showed that Social plus Token Reinforcement produced 5% successful responses on the seventh day while twenty-eight days following no training yielded a 20% successful response percentage.

This was an effective recovery percentage of 21.4% for Day 7 and 85.7% for Day 28 (Table 4).

Subject's Four ratio of reinforcements per successful attempt was: Instruction Only--0:1, Social Reinforcement--2.08:1, Token Reinforcement--1:1, and Social plus Token Reinforcement--2.07:1 (Table 6).

(Subject Four was absent during session twelve, during which time the Instruction Only condition was in effect. This meant he was exposed to this treatment one less time than Subjects One, Two, and Three, but the same number of times as Subject Five.)
FIGURE 13

GRAPHIC REPRESENTATION OF THE TREATMENT EFFECTS OF S 4
DURING BEAN-BAG THROWING
Figure 13

Instruction Only = △—△
Instr. + Soc. Rment. = □•□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = O—O

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
FIGURE 14

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 4
DURING BEAN–BAG THROWING
Combined Instr., Soc., and Soc. + Tok. Rment = ○—○  A = Treatments
Tok. Rment = ■ ■ ■
Subject 5

Subject Five (Figure 15) was brought into the study following the unsuccessful attempt to pre-condition the "original" Subject Five. This meant that Subject Five began with session number eight (Day 4) resulting in an unequal number of treatments, that is, Instruction Only was administered five times, Social Reinforcement, three times, and Token Reinforcement and Social plus Token Reinforcement four times each. With this limitation, Token Reinforcement provided the highest mean response at 27.5% with a single session of 30% (Table 4). Following the Token Reinforcement condition, respectively, were Social plus Token Reinforcement, Social Reinforcement, and Instruction Only.

Although the combined effects of Token Reinforcement and Social plus Token Reinforcement (Figure 16) were greater than the combined effects of Instruction Only and Social Reinforcement, only three of these combined treatments ranked higher during the twenty-four treatment sessions.

Performance maintenance results showed that Token Reinforcement after seven days of no training yielded a successful response percentage of 20% and, following twenty-eight days of no training, a 30% successful response percentage.

These figures converted to a recovery of 72.7% and 109% for the seven- and twenty-eight-day periods of no training (Table 4).

The ratio of reinforcements per successful attempt was: Instruction Only—0:1, Social Reinforcement—2:1, Token Reinforcement—.95:1, and Social plus Token Reinforcement—2.09:1 (Table 6).
FIGURE 15

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 5 DURING BEAN-BAG THROWING
Instruction Only = △—△  
Instr. + Soc. Rment. = □•□  
Instr. + Tok. Rment. = ×●×  
Instr. + Soc. & Tok. Rment. = ○—○  

A = Treatments  
B₁ = Performance Maintenance After 7 Days  
B₂ = Performance Maintenance After 23 Days
FIGURE 16

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 5 DURING BEAN-BAG THROWING
Figure 16

Combined Tok., and Soc. + Tok. Rment = ○--○
Combined Instr., and Soc. Rment = ■--■

A = Treatments
**Ring Toss**

**Subject 1**

The highest consistency of responding for Subject One (Figure 17) was determined to have occurred under Social plus Token Reinforcement, which yielded a mean response of 14.15% with a high of 25% (Table 5). Following this condition, respectively, were Social Reinforcement, Token Reinforcement, and Instruction Only.

The combined effects for the Ring Toss (Figure 18) showed that only after session nine was the effect of Social plus Token Reinforcement greater than the combined effects of Instruction Only, Social Reinforcement and Token Reinforcement.

The performance maintenance phase demonstrated 0% successful attempts under the Social plus Token Reinforcement influence after seven and twenty-eight days of no training.

This performance maintenance percentage was also considered as a 0% recovery percentage (Table 5).

Subject's One ratio of reinforcements per successful attempt was: Instruction Only--0:0, Social Reinforcement--2:1, Token Reinforcement--1.3:1, and Social plus Token Reinforcement--2.12:1 (Table 6).
FIGURE 17

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 1 DURING RING TOSING
Figure 17

Instruction Only = △—△
Instr. + Soc. Rment. = □•□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = ○—○

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 23 Days
FIGURE 18

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 1 DURING RING TOSSING
Figure 18

Soc. + Tok. Instr. = O

A = Treatments
Subject 2

While the response percentages during any one session never rose above 10% (or two successful completions) for Subject Two (Figure 19), Token Reinforcement yielded the greatest number of sessions during which two successful responses were recorded. The mean response under Token Reinforcement was 5% (Table 5). The other treatments followed in decelerating order from Social Reinforcement, to Social plus Token Reinforcement, to Instruction Only.

When combined (Figure 20), Social Reinforcement, Token Reinforcement, and Social plus Token Reinforcement were only slightly better than Instruction Only during the first fifteen sessions. After session fifteen, no condition or group of conditions were effective at producing successful responses.

During performance maintenance, Token Reinforcement failed to produce any successful responses following seven or twenty-eight days of no training.

The recovery percentages were likewise 0% (Table 5).

The ratio of reinforcements per successful attempt was: Instruction Only—0:1, Social Reinforcement—2:1, Token Reinforcement—1.27:1, and Social plus Token Reinforcement—2:1 (Table 6).
FIGURE 19

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 2 DURING RING TOSSING
Instruction Only = △—△
Instr. + Soc. Rment. = □•□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = ○—○

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
FIGURE 20

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 2 DURING RING TOSSING
Figure 20

Combined Soc., Tok., and Soc. + Tok. Rment = ○—○  A = Treatments
Instr. Only = ■ ■ ■
Subject 3

Subject Three (Figure 21 failed to produce any successful responses except for one session, Instruction Only, during which a response of 5% (one successful attempt) was recorded. The mean response for this treatment was .83% (Table 5). All other treatments failed to produce one successful response.

There was no combination effect of the treatment conditions since there was only one successful response during the entire twenty-four session treatment phase.

During the performance maintenance phase, Social plus Token Reinforcement was selected, even though the Instruction Only condition yielded the most successful responses (one). This was done based on the subject's peculiar throwing behavior exhibited throughout the study. Since the one successful attempt occurred during the second day of the study, it appeared to have been extinguished and, therefore, the selection of any condition was strictly arbitrary and considered to be as effective as any other treatment. Social plus Token Reinforcement was selected on that basis. It yielded 0% successful responses on Day 7 and Day 28 following no training.

A recovery of 0% was also recorded (Table 5).

The ratio of reinforcements per successful attempt was: Instruction Only--0:1, Social Reinforcement--0:0, Token Reinforcement--0:0, and Social plus Token Reinforcement--0:1 (Table 6).
FIGURE 21

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 3 DURING RING TOSSING
Subject 3

<table>
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</tbody>
</table>

Figure 21

Instruction Only = △-△
Instr. + Soc. Rment. = □...□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = ◦-◦

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
Subject Four (Figure 22) performed best under the Social plus Token Reinforcement condition, a condition which produced a mean response of 19.16% with a high of 35% (Table 5). The respective conditions approaching the Social plus Token Reinforcement treatment were Token Reinforcement, Social Reinforcement, and Instruction Only.

Not until session thirteen did there appear to be any difference in responding between Social plus Token Reinforcement and the combined effects of Instruction Only, Social Reinforcement, and Token Reinforcement (Figure 23). At this point, the Social plus Token treatment had a greater affect on successful responding than the combination of treatments.

During the performance maintenance phase Social plus Token Reinforcement showed 10% successful attempts after seven days of no training and 25% following twenty-eight days of no training.

The recovery percentage during this time was 52.1% for the seven-day period and 130.33% for the twenty-eight-day period (Table 5).

The ratio of reinforcements per successful attempt was:
Instruction Only --0:1, Social Reinforcement--2:1, Token Reinforcement--1:1, and Social plus Token Reinforcement--2.3:1 (Table 6).
Figure 22

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 4 DURING RING TOSSING
Figure 22

Instruction Only = △—△
Instr. + Soc. Rment. = □•□
Instr. + Tok. Rment. = ×•×
Instr. + Soc. & Tok. Rment. = ○—○

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
FIGURE 23

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 4 DURING RING TOSSING
Figure 23

Soc. + Tok. Rment = ○—○
Combined Instr., Soc., and Tok. Rment = ■ ■ ■

A = Treatments
Subject Five (Figure 24), as indicated in the bean-bag analysis, entered the study on session eight (Day 4). The treatments were unequally applied because of this variable. However, based on the information available, Social Reinforcement was the most effective treatment at producing successful responses (Table 5). A mean response of 7.5% with a high of 15% were recorded under this treatment. Following Social Reinforcement, respectively, were Social plus Token Reinforcement, Token Reinforcement, and Instruction Only.

Only during three of the first ten treatments, sessions 8-17, did the combined effect (Figure 25) of Social Reinforcement and Social plus Token Reinforcement have a greater influence on successful responding than did the combined effect of Instruction Only and Token Reinforcement. After that the only effect that occurred was one successful response under the combined treatments of Instruction Only and Token Reinforcement.

With respect to performance maintenance, Day 7 demonstrated a response of 15%, but Day 28 following no training showed a 10% successful response percentage (Table 5).

The ratio of reinforcements per successful attempt was: Instruction Only--0:1, Social Reinforcement--2:1, Token Reinforcement--1:1, and Social plus Token Reinforcement--2.4:1 (Table 6).
FIGURE 24

GRAPHIC REPRESENTATION OF TREATMENT EFFECTS OF S 5 DURING RING TOSSING
SUBJECT 5

Instruction Only = △—△
Instr. + Soc. Rment. = []
Instr. + Tok. Rment. = □
Instr. + Soc. & Tok. Rment. = O—O

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
FIGURE 25

GRAPHIC REPRESENTATION OF THE COMBINED TREATMENT EFFECTS OF S 5 DURING RING TOSSING
Combined Soc. and Soc. + Tok. Rment = ○—○
Combined Instr. and Tok. Rment = ■ ■ ■
A = Treatments

Figure 25
Group Mean Effect of Treatment Conditions

The Group Mean Effect of Treatment Conditions (Figure 26) consisted of obtaining each subject's mean response percentage (Table 3) for each treatment for each of the six sessions during which the treatments were applied. A grand mean for each treatment for each session was then calculated. Since each treatment was applied a total of six times, there were six grand means for each treatment for each of the six sessions.

Analyzing these group mean effects showed that the most prominent mean effect was the Social plus Token Reinforcement condition with a combined mean percent range of successful responding between 9-15%. This finding should be tempered by the fact that most all of the treatment effects were on a descending scale, indicating that the successful responding of all the subjects tended to decrease across sessions. The order of effect also indicated that Instruction Only (a non-reinforcing condition) was less effective at influencing subject responding than all other reinforcing conditions, having a combined mean percent range of successful responding between 2.5-8%.
FIGURE 26

GRAPHIC REPRESENTATION OF THE GROUP MEAN EFFECT OF TREATMENT CONDITIONS
GROUP MEAN EFFECT OF TREATMENT CONDITIONS

Instruction Only = △—△
Instr. + Soc. Rment. = □• □
Instr. + Tok. Rment. = ×• ×
Instr. + Soc. & Tok. Rment. = ○—○

A = Treatments
B₁ = Performance Maintenance After 7 Days
B₂ = Performance Maintenance After 28 Days
TABLE 3

COMBINED BEAN BAG AND RING TOSS GROUP TREATMENT MEANS
### Table 3

**Treatment I: Instruction Only**

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Table 3 (Continued)

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Treatment IV: Social plus Token Reinforcement

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<td>12.5</td>
<td>12.5</td>
<td>12.5</td>
<td>7.5</td>
<td>5</td>
</tr>
<tr>
<td>S3</td>
<td>0</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>S4</td>
<td>15</td>
<td>17.5</td>
<td>17.5</td>
<td>17.5</td>
<td>30</td>
<td>2.5</td>
</tr>
<tr>
<td>S5</td>
<td>12.5</td>
<td>25</td>
<td>20</td>
<td>7.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ΣX</td>
<td>50</td>
<td>75</td>
<td>72.5</td>
<td>60</td>
<td>47.5</td>
<td>45</td>
</tr>
<tr>
<td>GM</td>
<td>10</td>
<td>15</td>
<td>14.5</td>
<td>12</td>
<td>9.5</td>
<td>9</td>
</tr>
</tbody>
</table>
Treatment Effects

Treatments were analyzed in terms of their individual effects on each subject for each skill. The mean percentage and the single-session highest percentage of the highest ranked treatment condition were recorded (Tables 4 and 5).

With respect to bean-bag throwing (Table 4), Social plus Token Reinforcement was most effective with three of the five subjects, followed equally by Instruction Only, Social Reinforcement, and Token Reinforcement. The mean percentage of the highest ranked treatment for each subject demonstrated the following:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Treatment</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four</td>
<td>Social plus Token Reinforcement</td>
<td>23.33%</td>
</tr>
<tr>
<td>One</td>
<td>Social plus Token Reinforcement</td>
<td>17.50%</td>
</tr>
<tr>
<td>Two</td>
<td>Social plus Token Reinforcement</td>
<td>16.60%</td>
</tr>
<tr>
<td>Five</td>
<td>Token Reinforcement</td>
<td>27.50%</td>
</tr>
<tr>
<td>Three</td>
<td>Social Reinforcement</td>
<td>2.50%</td>
</tr>
</tbody>
</table>

The highest percentage recorded (Table 4) in terms of the subjects' highest ranked treatments was 45% (Social plus Token Reinforcement) in one of the five subjects and 30% in two of the five subjects under Token and Social plus Token Reinforcement. A fourth subject recorded a high of 25% under Social plus Token Reinforcement, while a fifth had a high of only 5% under both Instruction Only and Social Reinforcement.

The seven day performance maintenance phase produced a successful response percentage of 20% in one subject with Token Reinforcement, 15% in two subjects under Social plus Token Reinforcement and, in two others, 5% (Social plus Token Reinforcement) and 0% (Social Reinforcement), respectively.
The recovery percentage occurring as a function of the highest ranked treatment was as follows for the seven day performance maintenance period:

Subject Two  Social plus Token Reinforcement -- 90%
Subject One  Social plus Token Reinforcement -- 85.7%
Subject Four  Social plus Token Reinforcement -- 21.4%
Subject Five  Token Reinforcement -- 72.7%
Subject Three  Social Reinforcement -- 0.0%

Twenty-eight days following the no training period produced the following recovery percentages:

Subject Two  Social plus Token Reinforcement -- 120.0%
Subject Four  Social plus Token Reinforcement -- 85.7%
Subject One  Social plus Token Reinforcement -- 0.0%
Subject Five  Token Reinforcement -- 109.0%
Subject Three  Social Reinforcement -- 0.0%

The ring toss (Table 5) demonstrated that Social plus Token Reinforcement ranked highest in two of the five subjects followed equally by Token Reinforcement, Social Reinforcement, and Instruction Only. The mean percentage of the highest ranked treatment condition showed the following:

Subject Four  Social plus Token Reinforcement -- 19.16%
Subject One  Social plus Token Reinforcement -- 14.15%
Subject Five  Social Reinforcement -- 6.00%
Subject Two  Token Reinforcement -- 5.00%
Subject Three  Instruction Only -- .83%

The highest percentage of the highest ranked treatment condition was 35% in one subject under Social plus Token Reinforcement, 25% in a second under Social plus Token Reinforcement, 15% in a third, also under Social plus Token Reinforcement; 10% in a fourth influenced by Token Reinforcement, and 5% in a fifth with an equal effect from Social Reinforcement, Token Reinforcement, and Social plus Token Reinforcement.
The performance maintenance phase after seven days showed 0% in three of the five subjects under Social plus Token Reinforcement, Token Reinforcement, and Instruction Only. Fifteen percent was seen in a fourth subject, influenced by Social Reinforcement. Ten percent was the amount of performance produced in a fifth subject by the Social plus Token Reinforcement condition.

Subject Four  Social plus Token Reinforcement -- 52.1%
Subject Five  Social Reinforcement       -- 200%
Subject One   Social plus Token Reinforcement -- 0%
Subject Two   Token Reinforcement         -- 0%
Subject Three Instruction Only            -- 0%

After twenty-eight days of no training there was 0% maintenance in three of the five subjects under the following treatments:
In two subjects after this period of time 25% retention was seen under the Social plus Token Reinforcement condition and 10% retention produced by Social Reinforcement.

The recovery percentages were as follows:

Subject Four  Social plus Token Reinforcement -- 130.44%
Subject Five  Social Reinforcement       -- 133.33%
Subject One   Social plus Token Reinforcement -- 0.00%
Subject Two   Token Reinforcement         -- 0.00%
Subject One   Instruction Only            -- 0.00%

The overall treatment rankings from both the bean-bag (Table 4) and ring toss (Table 5) activities, which, when considered together, were based on a total of ten subjects, showed that Social plus Token Reinforcement to be the highest ranked treatment in five of the ten subjects. With equal ranking were Instruction Only, Social Reinforcement, and Token Reinforcement in the remaining five subjects. Social reinforcement ranked first as the most successful secondary source of influence.
Summarizing the treatment effects demonstrated the following rank order, from the most successful to the least successful treatment: Social plus Token Reinforcement, Social Reinforcement, Token Reinforcement, and Instruction Only.
Table 4
Effect of Treatments on Bean-Bag Throwing Behavior

<table>
<thead>
<tr>
<th>Subject</th>
<th>Rank Order of Treatment Conditions</th>
<th>Mean Percentage of the Highest Ranked Treatment Condition on a Single Session</th>
<th>Greatest Percentage of the Highest Ranked Treatment Condition</th>
<th>Performance Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Day 7 Recovery Day 28</td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>IV, III, I, II</td>
<td>17.5%</td>
<td>30%</td>
<td>15% 85.7% 0% 0%</td>
</tr>
<tr>
<td>S2</td>
<td>IV, II, III, I</td>
<td>16.66%</td>
<td>25%</td>
<td>15% 90% 20% 120%</td>
</tr>
<tr>
<td><strong>S3</strong></td>
<td>I/II, IV, III</td>
<td>2.5%</td>
<td>5%</td>
<td>0% 0% 0% 0%</td>
</tr>
<tr>
<td>S4</td>
<td>IV, II, III, I</td>
<td>23.33%</td>
<td>45%</td>
<td>5% 21.4% 20% 85.7%</td>
</tr>
<tr>
<td>S5</td>
<td>III, IV, II, I</td>
<td>27.5%</td>
<td>30%</td>
<td>20% 72.7% 30% 109%</td>
</tr>
</tbody>
</table>

*Treatments:  
I—Instruction Only  
II—Instruction + Social Reinforcement  
III—Instruction + Token Reinforcement  
IV—Instruction + Social and Token Reinforcement

**S3—Treatments I and II had an equal effect.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Rank Order of Treatment Conditions</th>
<th>Mean Percentage of the Highest Ranked Treatment Condition</th>
<th>Greatest Percentage of the Highest Ranked Treatment Condition on a Single Session</th>
<th>Performance Day 7 Recovery Day 28</th>
<th>Maintenance Day 28 Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>IV, II, III, I</td>
<td>14.15%</td>
<td>25%</td>
<td>0% 0% 0%</td>
<td>0%</td>
</tr>
<tr>
<td>S2</td>
<td>III, II, IV, I</td>
<td>5%</td>
<td>10%</td>
<td>0% 0% 0%</td>
<td>0%</td>
</tr>
<tr>
<td>**S3</td>
<td>I, II/III/IV</td>
<td>.83%</td>
<td>5%</td>
<td>0% 0% 0%</td>
<td>0%</td>
</tr>
<tr>
<td>S4</td>
<td>IV, III, II, I</td>
<td>19.16%</td>
<td>35%</td>
<td>10% 52.1% 25%</td>
<td>130.4%</td>
</tr>
<tr>
<td>***S5</td>
<td>II, IV, III, I</td>
<td>6%</td>
<td>15%</td>
<td>15% 200% 10%</td>
<td>133.33%</td>
</tr>
</tbody>
</table>

*Treatments:  
I--Instruction Only  
II--Instruction + Social Reinforcement  
III--Instruction + Token Reinforcement  
IV--Instruction + Social and Token Reinforcement

**S3--Treatments II, III, and IV had the equal effect of no successful attempts.

***S5--See Subject Five summary of Ring Tossing Behavior.
Table 6

Total Responses by Treatment Over Ratio of Reinforcements Given Per Successful Response

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Bean-Bag Treatments</th>
<th>Ring Toss Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>S1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0:1</td>
<td>2:1</td>
</tr>
<tr>
<td>S2</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>0:1</td>
<td>1.88:1</td>
</tr>
<tr>
<td>S3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0:1</td>
<td>1:1</td>
</tr>
<tr>
<td>S4</td>
<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>0:1</td>
<td>2.08:1</td>
</tr>
<tr>
<td>S5</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>0:1</td>
<td>2:1</td>
</tr>
</tbody>
</table>

*Key: Total Successful Responses Average Number of Reinforcements Per (:) Successful Response
Effect by Skill

The two skills were analyzed in terms of the highest mean percentage of the highest ranked treatment condition, the greatest percentage of the highest ranked treatment on a single session, and the performance maintenance response percentage. The highest mean percentages were recorded in the bean-bag activity with the highest mean at 27.5% in Subject Five. This score occurred with the Token Reinforcement treatment in effect. The highest single-session percentage was 45% for Subject Four under Social plus Token Reinforcement in the bean-bag skill. He also had the highest single-session percentage in the ring toss activity with 35%, also affected by the Social plus Token Reinforcement condition. The greatest number of subjects with the highest single-session percentage was noted in bean-bag throwing with four of the five subjects ranging from 25-45%, whereas the ring tossing produced a successful response percentage between 5-19% in four of the five subjects.

Performance maintenance figures for the seven-day period produced a 15-20% successful response percentage in three of the five subjects in the bean-bag skill while three of the five subjects in the ring toss had a 0% response percentage. Following twenty-eight days of no training three of the five subjects in bean-bag throwing scored between 20-30%, but in the ring toss only two of the five scored between 10-25%.

The overall effect was that during the training sessions the bean-bag throwing skill had the highest mean percentage of successful responses per session at 17.4% with a range of 2.5-27.5%. The ring toss had a 9.03% mean with a range of .83-19.16% during this same time period.
Summary

Each subject was analyzed individually to determine the highest ranked treatment condition. Following subject analysis, treatment effects and skill effects were studied. The highest ranked treatment was Social plus Token Reinforcement. This was followed in order by Social Reinforcement, Token Reinforcement, and Instruction Only.

Effects by skill indicated that Social plus Token Reinforcement ranked highest in producing the highest percentage of response consistency for both skills. It should be pointed out, however, that the bean-bag skill had the highest percentage of successful responses when compared to the ring toss skill.

All findings should be qualified by the fact that the individual behavioral graphs for the multielement baseline design did not approach the classical behavioral graph showing real differential effects of the treatment conditions.
CHAPTER 5

DISCUSSION, LIMITATIONS, IMPLICATIONS, RECOMMENDATION, AND SUMMARY

Discussion

Research Questions

The major purpose of this study was to determine the effects of varying types of reinforcement on the learning and retention of two novel gross motor skills by five trainable mentally retarded boys. Based on the definition of motor learning, as used in this investigation, it appeared that there was no increase in response consistency. This also meant that there could be no retention, since the definition of retention is predicated on the fact that learning has taken place. However, there was a higher consistency of responding under Social plus Token Reinforcement than any of the other treatment conditions. It should therefore be noted that although learning of the skill did not seem to occur, learning to perform more effectively under reinforcing conditions as opposed to non-reinforcing conditions was evident. With respect to Question I, then, "Which reinforcing condition produced the highest percentage of successful responses during the training and retention phases," Social plus Token Reinforcement was the highest ranked treatment condition.

Social plus Token Reinforcement may have been most successful at producing the desired behavior for several reasons, primary of which may have been the amount of interaction available to the subjects from
the investigator. There was a token receipt, verbal and non-verbal praise, and the exchanging of the tokens following the completion of the skill.

These results appear to be in agreement with several authors (21, 37, 45, 52, 55, 62, 54) who studied the educable mentally retarded population as well as those writers (23, 52, 54, 59, 65) who investigated the trainable mentally retarded. However, a primary difference between this study and the others must be pointed out. This study used the same subjects while applying a variety of treatments, but the previously mentioned research investigations, except for Ball (23), Schroeder and Yarbrough (52), and Smith (54) used group study approaches. Also four (45, 53, 55, 64) of these studies appeared to combine different types of reinforcers as was done by this writer, but they used the group study approach. While agreement exists, disagreement with these same authors also exists, since the primary reinforcers were not only tangible (toys for tokens) and intangible (social praise), but combinations of these.

As for a secondary source of reinforcement, social praise was most prominent. This may have been because of the lack of social contacts with supporting adults as was indicated by Smith (54) and Stevenson and Fahel (59).

Regarding Question II, "Does the multielement baseline design provide a sound base for analyzing subject responses in a physical education activity?", the answer is yes. This research was done in a limited amount of time because of the demands of the academic department of the Columbus State Institute and the author. Most investigations
using the multiple baseline approach or reversal design would probably have
required two to three times more time to complete the study, especially with two
dependent and four independent variables. Of course, this cannot be
documented without previous or follow-up investigations to this study. Recognizing
the approximate time it takes to establish a baseline as well as instituting the
interventions in these two types or research methods, it seems reasonable that there
would be an extensive amount of time involved. The multielement baseline design was
able to show the differential effects of reinforcing and non-reinforcing in a short
period of time. It was also able to demonstrate the rank order of reinforcing
conditions as indicated in Tables 4 and 5. These results did not appear to be as
significant as those of Ulman and Sulzer-Azaroff (17), Sidman (16), and Powell and
Hake (48), but it did demonstrate varying amounts of experimental control over
changing variables in a short period of time.

In company with the advantages listed for this type of design, the experimental
control was more believable because of the changing stimulus conditions, that is, the
particular treatment effects could be seen across the two skill activities.

The reliability of the multielement baseline design was to be governed by
condition-change interactions, such that if these were reduced, this design could
then be a very useful tool for educational research, more specifically, research in
physical education. These interactions, more commonly known as sequence and
contrast effects, were reduced by counter-balancing the presentation of conditions,
hence, this design does appear to lend itself to research in physical education settings.
Discussion of the Skills

The evidence would seem to suggest a difficulty factor was involved in performing the skills, the ring toss activity being more difficult or complex a task than the bean-bag throwing. The grasp, body position, and toss of the rings were more sophisticated than the bean-bags. It required a finer "touch" with the fingers as well as a smaller target point at which to aim. Even though the bean-bags varied in volume and weight, they did appear to be easier to hold and throw.

Although all subjects were right-handed, three of the subjects, S2, S3, and S4, on occasion, used what appeared to be the non-dominant hand, but no attempt was made to record the number of times each hand was used or its effect on performance. Also, no intervention was presented to effect the use of the primary hand. Subject Three appeared more prone to using either hand, however, this was a subjective judgment on the part of the investigator.

Another throwing variable noted was that S3, S4, and S5, during the bean-bag skill, threw overhand as well as underhand. Again, no count was recorded since the subjects were never instructed nor conditioned not to throw in a particular way. Subject Three appeared to be very consistent (almost daily) about this particular behavior, however, S4 and S5 seemed more infrequent about changing their throwing method.

Discussion of Disruptive Behavior

Two subjects, S1 and S3, were more prone to disruptive behavior than the others. The most disruptive was S1. He violated the rule
regarding the restraining line during twenty-four of the forty-eight sessions, which meant at least one disruption per day except for the first day. Of note was the fact that this inappropriate behavior occurred ten out of the twenty-four times (41% of the disruptive time) during the Instruction Only condition. This behavior was further broken down by skill, seven disruptions during the ring toss and three during the bean-bag sessions. No special intervention (s) was (were) attempted during this time, only the original treatment conditions which were instituted at the beginning of the study for the control of throwing accuracy. It was hoped that this procedure would have shaped appropriate responding, but did not appear to do so.

Subject Three violated the restraining line beginning the third day of the investigation and continued for sixteen of the forty-eight sessions, the majority (15 of 16 sessions) occurring between Days 6-12, excluding Day 8. During Instruction Only there were six disruptions, while five disruptions were recorded during Social Reinforcement. The Token Reinforcement and Social plus Token Reinforcement conditions seemed to exert more control over this behavior than either the Instruction Only or Social Reinforcement conditions.

In each case the subjects would walk close enough to the targets so that all that was required was to gently toss the bean-bags into the target center or drop the rings over the pegs. It must be assumed that these behaviors had more reinforcing strength than those extended or delivered as a result of the treatments.
Though not specifically detailed as disruptive behavior in terms of that cited in Chapter III, but behavior which could be classified as such, was that of S1. On a number of occasions, although not counted or recorded, he approached the investigator or the observer with inquiries as to what was in their pockets. He would ask for or tell them he wanted to have their keys. At the same time he would begin to place one of his hands inside their pockets as if to retrieve the keys. At other times he would just approach them and begin to reach into their pockets. This particular behavior pattern was more evident during the morning than the afternoon sessions. If he happened to have taken a nap just prior to the afternoon sessions, he was fairly docile and much easier to control.

No particular interventions were attempted by either the investigator or observer at this time except to ignore his behavior and move in another direction. Sometimes this was not possible and the subject was restricted from entering the pockets by turning his hand out and sit down at his station. This he did.

**Limitations**

Some limitations have been cited throughout the discussion phases of this study, however it is necessary to bring them to light in a more cohesive manner, as well as presenting other limitations not previously mentioned. The limitations will be discussed in the order in which they appeared in the investigation followed by others that might have influenced the results.
The first limitation occurred when it was determined that the original Subject Five was not able to be pre-conditioned. Another subject was obtained, pre-conditioned, and brought into the study beginning with session eight, Day 4. The major limitation, then, was that Subject Five did not have the same number of opportunities to respond under all the treatment conditions as did the other subjects, however, his responding was still analyzed based on what he did accomplish. This type of adjustment was possible with the multielement baseline design.

The second limitation to appear was the violation of the restraining line by S1 and S3. Subject One was more flagrant than S3, stepping over it by more than one foot twenty-four times; S3 stepped over it sixteen times. This did have an influence on the results since all successful responses made during the violations were not counted nor reinforced. It should be noted that this behavior occurred more often for S1 during Instruction Only than any of the other treatments. Subject's Three responding was more equally distributed, six disruptions during Instruction Only, five during Social Reinforcement, four during Token Reinforcement, and two during Social plus Token Reinforcement.

A third limitation was the "approaching" behavior of S1, who was concerned about having the investigator's or observer's keys, or any particular item he might retrieve from their pockets. The major effect of this bizarre behavior was to slow down the time it took to complete the session during which the behavior occurred.
The fourth and fifth conditions which might have placed limiting effects on the results were the occasional switching of throwing hands by S2, S3, and S4, and the use of an overhand throw by S3, S4, and S5, rather than the underhand throw as was demonstrated by the investigator. Since no record was made of these variables it was difficult to tell what effect they had, if any, on throwing accuracy. It was felt that the consequences of their throwing would determine how they threw, that is, if more reinforcements were delivered following overhand throwing success, then overhand throwing would become the dominant behavior.

The sixth variable to have a potential influence on the study occurred during session 12, in the afternoon of Day 7. During this session there were six college students assigned as recreation assistants at the institute who were decorating or preparing decorations for the gymnasium for some kind of sports or recreation affair. Their presence tended to provide a stimulus for S1 who proceeded to ask several of them for their keys. It was more difficult to maintain the subjects' attention during the instruction phase of the treatment condition in effect at that time. This was accomplished verbally by reminding the subjects to "Look this way...look at me." This interruption did not seem to have an appreciable effect on the successful responding during this session, to the contrary, some of the better scores for the Token Reinforcement treatment occurred at this time; session fourteen (Instruction Only) scores were mostly zero.

During the afternoon of Day 12, a Recreation Stage Show, including singing and skits, was being presented in the gymnasium, forcing the
investigator to find another area in which to complete the training phase of the study. On the second floor of the gymnasium was an all-purpose room that contained some chairs, and a small pool table. Two areas were arranged to simulate, as much as possible, the Happy Face Room (Treatment II, Potential Social Reinforcement) and the Green Room (Treatment III, Potential Token Reinforcement). This was done by moving the chairs back away from two walls and the pool table to one side. One end of the room was used for Treatment III, session twenty-three for ring tossing, the other end for Treatment II, session twenty-four for bean-bag throwing. The results showed that one of the subjects during the bean-bag throw had one successful attempt less than he had the last time Treatment II was presented (session nineteen) and, two subjects during the ring toss, each had one more successful attempt than they had the last time Treatment II was presented (session twenty). In other words, the room change did not seem to be that detrimental to the subjects' throwing behavior.

An eighth consideration was the effect that practice and practice distribution had on consecutive performances of the subjects. The practice schedule was considered to be massed, that is, each skill was practiced twice daily with no rest interval between practice days except for two weekends which intervened between Days 3 and 4 and between Days 8 and 9. Massing of practice, according to Cratty (5), is suggested for the mentally retarded when learning motor skills. This is done in order to repeat and to provide for correct responding so that specific motoric behavior can be processed as appropriately as possible. Also
Rotman (51) and Tizard and Loos (52) seemed to suggest from their research on motor skills that the more practice afforded the retarded, the greater their performance on the majority of motor tasks.

It was interesting to note that after the fourth day, all subjects seemed to come closer to making successful responses even though these responses could not be recorded. That is, the throwing style of the subjects seemed to be more effective, in turn, providing more accuracy to their throws. Had there been some kind of electronic circuitry attached to the targets to measure "almost responses" it might have shown this improved throwing performance.

Implications and Recommendations for Further Research

Implications

Several implications which may be warranted from the present investigation have to do with the effect of the multielement baseline design as a research tool in physical education. First, this study demonstrated the multielement baseline technique to be an effective tool for analyzing multiply varying treatment effects on motor skill development. It is a very rigorous design that should allow for faster and just as direct a determination of the rank order of a variety of directive teaching methods than any of the previously mentioned potentially more time consuming approaches. However, this is not to say that under certain circumstances the multiple baseline or reversal design methods would not be better techniques. Each investigation may lend itself to one or the other of these techniques, but for research of the type just undertaken, the multielement baseline seems most appropriate.
A second implication inherent in this design and briefly mentioned earlier, was the ability to have several treatments and several skills all varying at the same time. As was pointed out by Ulman and Sulzer-Azaroff (17) the more one can vary the independent variable in complex behavior analyses, the more believable is the experimental control over the dependent conditions.

Other implications resulting from this research, but which are fairly self-explanatory are: Four to five trainable mentally retarded boys can be instructed using selected directive teaching methods. Performances may be sustained through a planned reinforcement program. And, lastly, retention of a gross motor skill may not be as valuable a result unless more demonstrated learning takes place.

Recommendations for Further Research

A number of studies could be initiated from the results of the present investigation. The replication and treatment generality assessment would be of highest priority. As far as this author can determine, this study was the first to use the multielement baseline design in a physical education setting with mentally retarded subjects. Since it appeared to be the first, it will probably not have as good a control feature as will future studies, but it will provide the guidelines for conducting investigations of a similar nature. As can be seen by the individual graphic representations of subjects' behaviors (Figure 8-26), the various treatments can demonstrate their particular power or lack of it in maintaining subject behavior. This will allow for the possibility
of more efficient use of investigator or teacher time provided the
same subjects are the participants in subsequent motor skills.

Another series of studies might involve more serious considera-
tion to the use and study of the multielement baseline design on more
traditional skills such as basketball dribbling, catching, throwing,
shooting, etc., in both normal and mentally retarded populations. It
is also expected that future research will lengthen the study time to
include eight or more interventions of each treatment for each motor
skill used.

It is this writer's opinion that what education is looking for
is the most effective way to assess and control student behavior. By
replicating this study as often as possible, in as many different
environments and subject classifications as possible, more reliable
teaching contracts for instructing not only the mentally retarded, but
normal populations will occur. In this manner more empirical data may
be provided upon which a positive direction in physical education
research may be set.

A closing remark with respect to operant research should be made.
Locke (68), while speaking at a session of the National Alliance of
Health, Physical Education and Recreation in 1975, said that replica-
tion must become the standard mode of action. He further pointed out
that we have got to get over the notion that replication is wrong:
"The first rule of science is do it over again."

Baer (2) concludes from "In the beginning was the response...", in
Behavioral Analysis: Areas of Research and Application, that
systematic replications have generalizability. The effect of experimental analysis in behavioral research has shown generality across subhuman species (rats), social problems, such as juvenile delinquency, non-reading of some school children, family problems, etc.

By following Locke's recommendations regarding replication of research and Baer's remarks about generalizability, generalizability can be strengthened with respect to behavioral research in physical education.

**Summary**

The thrust of this study was to determine the effect of varying types of reinforcement on learning and retention of two novel gross motor skills by five trainable mentally retarded boys. The boys ranged in age from fourteen to seventeen and in IQ between twenty-five and thirty-nine. An ancillary part of this investigation was to determine the adequacy of the multielement baseline design for use as a tool in physical education research.

The subjects participated in the two gross motor activities of bean-bag throwing and ring tossing from behind a one and one-half inch by eighteen inch restraining line at a distance of eighty-four inches from their respective targets. All subjects threw as a group. The dependent variable was the number of successful attempts emitted by the subjects on target accuracy. Each skill was presented twice a day, once in the morning and once in the afternoon, for twelve days. Performance maintenance tests were administered following a seven day and twenty-eight day no training period.
Four different treatment conditions, the independent variables, were applied according to the Table of Random Numbers (Table 2) in such a way that no treatment occurred more than twice in succession. Each treatment was presented six times per skill.

Each subject was analyzed individually with respect to the effects of the treatment conditions on each skill (Tables 4 and 5). The findings indicated that the overall treatment order for both skills, from the highest ranked to the lowest ranked, was: Social plus Token Reinforcement, Social Reinforcement, Token Reinforcement, and Instruction Only. Each treatment had a particular frequency of effect, such that Social plus Token Reinforcement was ranked highest in five of the ten subjects when both skills and subjects were combined. The other treatments had an equal ranking as a primary source of reinforcement, however, as a secondary source of reinforcement, Social Reinforcement was ranked first.

The group mean effect of treatment conditions supported the above finding that the most prominent treatment was Social plus Token Reinforcement. This treatment had a combined mean percent range of successful responding between 9-15%. The least prominent treatment was Instruction Only, having a combined mean percent of successful responding between 2.5-8%. These effects should be tempered by the fact that most all of the treatment effects were on a descending scale, indicating that successful responding of all subjects tended to decrease across sessions.

Based on the definition of motor learning, as used in this investigation, it appeared that there was no increase in response consistency. This also meant that there could be no retention, since the definition
of retention is predicated on the fact that learning has taken place. However, a performance maintenance phase for each skill was instituted. The performance maintenance phase for bean-bag throwing (Table 4) showed that the amount of recovery of the mean percentage of the primary ranked treatment condition for each subject ranged from 0% after seven days, with four subjects between 21.4% and 90%, to between 0% and 120% following twenty-eight days, three subjects having a recovery percentage of between 85.7% and 120%.

Ring tossing performance maintenance (Table 5) demonstrated that the recovery of the mean percentage of the highest ranked treatment condition for each subject varied between 0% and 15% seven days subsequent to the training period with only two subjects scoring between 10% and 15%; twenty-eight days after the training period found the range between 0% and 25% with same two subjects scoring 25% and 10%, respectively. The recovery percentage for Day 7 was from 0% to 200%, with two subjects between 52.1% and 200%; Day 28 found these same subjects with scores of 130.4% and 133.33%, respectively. The other subjects had 0% recovery.

One should not be misled by these figures—they do not represent recovery of the total possible responses (twenty out of twenty attempts) for a particular skill session, but represent how close the subjects approached or passed their mean percentage of responding under their respective primary reinforcing treatments.

It may be concluded, based on the results and within the limitations of this research that: (a) Social plus Token Reinforcement was the highest ranked treatment for producing the highest motor
response consistency in the five trainable mentally retarded boys. It should be noted that generalizability to other similar subjects and conditions is not warranted at this time. Future research will bear out whether or not this is true. (b) The results appear to indicate the potential use of the multielement baseline design for research with a limited number of institutionalized trainable mentally retarded subjects and it may well prove useful for other types of research in physical education settings. Again, the strength and quality of this design, as with the generalizability of treatment effects, will only be borne by replication in a variety of settings with a variety of subjects.
APPENDIX A

EXCHANGE OF TOKENS FOR TOYS
ONE-TWO TOKENS (6" x 4" x 3" brown cardboard box)

1. Ball-on-a-string
2. Pop-guns
3. Small (2" diameter) balls
4. Monkey-on-a-high bar
5. "Old Maid" playing cards (one choice)
6. Small (3" high) rubberized plastic soldiers

THREE-FOUR TOKENS (6" x 4" x 3" cardboard box with red, white and blue checked contact paper wrapped around it)

1. Small airplanes
2. Small cars

FIVE-SIX TOKENS (10" x 6" x 5" brown cardboard box)

1. Plastic whistle in shape of a train engine
2. Colored plastic finger-rings

SEVEN-EIGHT TOKENS

1. One choice from "Five-Six Token" box and "One-Two Token" box

NINE-TEN TOKENS

1. One choice from "Five-Six Token" box and a second choice from any of the boxes, including a second choice from the "Five-Six Token" box, if desired.
REFERENCES

Books


Articles


