Effects of Reinforcement on the Rate and Generalization of Play Behavior in Four Severely Retarded Children

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EFFECTS OF REINFORCEMENT ON
THE RATE AND GENERALIZATION OF PLAY
BEHAVIOR IN FOUR SEVERELY RETARDED CHILDREN

by

Elizabeth Anne Labanowski

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
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Elizabeth Anne Labanowski
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INTRODUCTION

Many retarded children have a narrow range of behaviors resulting from minimal contact with stimuli in their environment. They may be excluded or delayed from interacting with objects and people because of physical handicaps, appearance, excessive or deficit behaviors, or a limited range of brain development (Bijou, 1963; Ferster, 1958; Ferster and DeMyer, 1962; Gardener, Klopp, and Kaufman). Their learning rate is usually slow (Ferster and DeMyer, 1962). This learning rate reflects their past learning history and present level of physiological development. Together, these factors influence the development of play behavior in children.

Play can be an educational and a recreational activity. It develops attending behaviors, visual perception, motor coordination, speech, and peer interaction. Mentally retarded children need to develop these behaviors. Most studies of play behavior have focused on increasing the frequency of a child's play behavior and measuring the effect of reinforcement on play behavior. With play behavior, reinforcement, shaping and differential reinforcement of other behavior have been successfully used.

In putting a puzzle together, Altman, Talkington, and Cleland (1971) obtained a higher individual rate in
thirty-six retarded children under reinforcement than non-reinforcement conditions. Using the same task, Sechrest (1963) had three groups of children with one child from each pair receiving either positive reinforcement, punishment, or neutral statements for completing the puzzle. The results suggested that positive reinforcement given to one child acts as an implicit punishment for the other child doing the same task or vice versa.

To increase the play behavior of an emotionally disturbed, withdrawn boy in a special education class, Rinaldi (1968) gave tokens, social reinforcers, and prompts dependent on the child playing with adults and peers. Using contingent and non-contingent social reinforcement, Hart, Reynolds, Baer, Brawley, and Harris (1968) found that contingent reinforcement significantly increased cooperative play.

Through reinforcement of a ball rolling and block passing task, Whitman, Mecurio, and Caponigri (1970) increased peer interaction of severely retarded children in a training and non-training situation. No reinforcement was given in the non-training situation. Peer interaction with children not participating in the training sessions occurred.

Using a shaping and reinforcement procedure, Buell, Stoddard, Harris, and Baer (1968) increased a child's use of play equipment. With the same procedure, Auxter (1969)
observed after training that ten emotionally disturbed boys attained a higher level of motor performance and a faster learning rate, but he presented no data.

Harris, Wolf, and Baer (1964) showed that differential reinforcement of play behavior (climbing) could increase and maintain that behavior. Similar results were obtained for isolate play (Johnston, Kelley, Harris, and Wolf, 1966; and Allen, Turner, and Everett, 1970) and peer interaction (Allen, Buell, and Harris, 1965). Johnston et al (1966) also reported that by reinforcing all play responses to other equipment generalization behavior occurred.

In their study of twenty autistic children, Lovass, Koegel, Simmons and Long (1973) found that behavior therapy could increase the appropriate play, social non-verbal and speech behavior, and decrease inappropriate speech and self-stimulation behavior.

These studies demonstrated that play behavior could be taught through operant principles. But only Johnston et al (1966) and Whitman et al (1970) measured the generalization of play behavior from a training to a non-training situation. Generalization of behavior from a training to a non-training situation where it was not reinforced has been demonstrated in the area of verbal behavior (Brown, Hermanson, and Ora, 1969; Fygetakis and Gary, 1970; Sulzbacher and Costello, 1970; etc.), attending behaviors (Walker and Buckley, 1968), studying behavior (Sulzer, 1965),
and imitation (Martin, 1971).

The present study measured the effects of reinforcement on the rate and generalization of play behavior in four severely retarded children. It specifically asked four questions. First, what effect does reinforcement have on play behavior in a training situation? Second, does play behavior generalize from a training to a control session where it was not reinforced? Third, were experimenter given reinforcers necessary to maintain play behavior after training? Finally, does the play behavior of two of the four subjects not directly reinforced increase because of vicarious reinforcement?
METHOD

Subjects

Four children attending the Day Training Center for Severely Retarded Children in Kalamazoo, Michigan, participated in this experiment. Subject 1 was a twelve year old girl with a minimal brain dysfunction who has attended the center for two years. Her I.Q. score on the Binet was 46. During the experiment, she was taking Ritalin. Subject 2 was an eleven year old Mongoloid girl who has attended the center for eight years. Her I.Q. score on the Binet was listed as untestable. Subject 3 was an eleven year old Mongoloid boy who has attended the center for eight years. His I.Q. score on the Binet was below 30. Subject 4 was a thirteen year old severely retarded boy who has attended the center for eight years. His I.Q. on the WISC was between 10-20.

Apparatus

The training and control session took place on a 30' x 15' stage in a play gym with the following toys: two dolls, one can of Lincoln Logs, one gingerbread shape game, one bag of blocks and beads, one jumbo lotto picture matching game, one peg board set, four sewing cards and laces, two small trucks, two balls, one colorform kit,
one box of crayons, paper, two coloring books, and three puzzles.

To record data, the experimenter and the observer used a Panasonic cassette tape recorder, two stop watches, and a data sheet. The cassette tape provided the number of the subject to observe at the beginning of each 15-second interval.

During the shaping and reinforcement phase of the training session, potato chips, m & m's, or tokens were used as reinforcers for two subjects.

Procedure

Recording

In the training and control sessions, the subject's and experimenter's behavior was recorded daily by the experimenter. During each successive 15-second interval, the experimenter observed one subject at a time in the following order: Subject 1, 2, 3, and 4, recording only their behavior that occurred in that interval.

The subject behaviors recorded were:

1. Play Behavior: (a) Isolate Play: The subject manipulated a play material in the way it was designed to be used (see Appendix A) in his hands by himself for at least six of the fifteen second observed period. This behavior included the subject taking out or putting in an object from a box, bag, or can.

   (b) Cooperative Play: One subject gave the same piece of play material to another subject; Two subjects used a similar piece of play material with each one alternating turns; One subject asked another one what the name
of an object or a picture was such as "What is this?" and the latter subject responded with a vocalization or verbalization of the object's or picture's name. If the latter subject did not respond, the former subject's behavior was recorded as isolate play. If one subject used an object or his hand to comb the other subject's hair, wash him, polish his nails, etc., it was recorded as cooperative play for both subjects.

(2) Destructive Behavior: The subject threw, kicked, ripped, or dropped objects; The subject hit, pushed, or kicked another subject. For subject 3, destructive behaviors also included taking off his glasses because they could easily be damaged. These behaviors were followed by an experimenter prompt to stop the behavior. If the subject's behavior continued, the experimenter used a time out procedure (see experimenter behaviors 1 and 2).

(3) Experimenter Directed Behavior: Any of the subject's behavior directed to the experimenter such as verbal requests (e.g. "Look." or "Come here.") or non-verbal requests (e.g. pulling or tapping the experimenter's arm or pointing).

(4) Sucking Behavior: The subject put one or more fingers, from the fingertips downward, or any portion of an object in his mouth.

(5) Repetitive Movement: The subject moved back and forth while in a standing or sitting position; The subject turned in a one foot or greater radius in a circle; The subject took two or more steps forward followed by two or more steps backward or vice versa.

For a single subject, more than one behavior could be recorded per interval. If the subject emitted none of the previously described behaviors, a zero was recorded for that interval.

The experimenter behaviors recorded were:

(1) Experimenter Prompt: Any occurrence of a subject's destructive behavior was followed by the experiment saying "No, stop that." For subject 3, prompts also included "Put your glasses back on."

(2) Time Out: After the prompt, if the subject continued the destructive behavior, the experimenter placed the subject in a chair with his head down toward the floor.
or the experimenter placed the subject's head face down on the floor. This procedure continued till the subject was quiet for at least ten seconds. If necessary, the experimenter restrained the subject's arms and head.

(3) Experimenter Given Reinforcers: The experimenter presented potato chips, m & m's, tokens, praise such as "good" or "that's right", hugs, or pats to subject 1 and 2 for play behavior. Whenever any of the mentioned reinforcers were presented together, the experimenter's response was recorded as one reinforcer presented.

During each session, the frequency of the experimenter's behavior toward all subjects was recorded continuously regardless of which subject was currently being observed.

If any of the subject or experimenter behaviors occurred when a subject number was announced, the behavior was recorded in the following interval. The subject number was announced in a normal speaking voice among the 3-6 tone level on the tape recorder.

**Interobserver reliability checks**

At least once per experimental phase, an observer simultaneously recorded data in either the training or the control session. The experimenter sat on the opposite side of the room from the observer and used a 2 inch pencil to record data to assure independence of recording. For group data, reliability was computed by dividing the total number of intervals where the experimenter and the observer agreed on all behaviors by the total number of intervals they agreed plus the total number of intervals where both disagreed on one or more categories and multiplied by 100.
For each individual category of subject and experimenter behavior, the ratio of low to high number of observations recorded was computed and multiplied by 100. When less than ten occurrences of a behavior were recorded, they were added to the following session till at least ten occurrences were recorded before a reliability score was computed.

**Experimental conditions**

The training and control session were conducted at 12:00-12:30 p.m. and 2:00-2:30 p.m., respectively, Monday through Thursday. The experimenter placed all the toys for the subjects to play with on the stage prior to the session. The toys were not positioned in any specific location. The tape recorder was placed in a corner of the stage behind a curtain. The subjects were taken from their classroom five minutes before the session began. The experimenter told them that they could only play with the toys on the stage. During the session, the experimenter sat on the floor in a position where all four subjects could be seen. When the session ended, the experimenter asked the subjects to help clean up by placing the toys in a box. This procedure was used to teach the children to put toys away when they finished playing. The experimenter praised the subjects for their assistance in this task.
Training session

A reversal (ABA) design was used in the training session. The first (A) condition was a baseline. The second (B) condition was a reinforcement phase. The third (C) condition was a return to baseline phase.

Baseline Phase: The experimenter simply recorded the subjects' behavior for thirteen days. During the session, the experimenter interacted with the subjects only with prompts to stop destructive behaviors and through the use of time out procedures to stop destructive behaviors.

Reinforcement Phase: Subject 1 and 2 were the experimental subjects. Subject 3 and 4 were the control subjects. The experimenter used non-verbal prompts (e.g. modeling play behavior or manually guiding a subject's hand in a play behavior) and reinforced any play behavior of the experimental subjects during sessions 14 to 31. Non-verbal prompts were used because the subjects usually responded by following verbal instructions when given them. The experimenter did not directly reinforce the control subjects. The control subjects could therefore be used as controls to measure for possible contaminating variables, for possible cues from subject 1 and 3 for play behavior, and the effects of vicarious reinforcement could be measured from their play behavior. From session 23 to 31, the experimenter also used verbal prompts (e.g. "Can you build a log cabin?", "Put some beads on the string.", or "Throw
the ball." for the experimental subject's play behavior. The use of verbal prompts allowed the training sessions to closer approximate those of the classroom play time.

Return to Baseline Phase: Experimental conditions were returned to the same as those during the initial baseline phase to determine if the subject's behaviors would return to their baseline level or remain at or near their level in the reinforcement phase. Return to baseline conditions was conducted during sessions 32 to 49.

Control session

During the control session, the experimenter simply recorded behavior from session 1 to 49 to measure the effects of training on play behavior. The subject's and experimenter's behavior was recorded as in the training session.
RESULTS

The total percent of intervals spent playing was the primary dependent variable. It was computed by dividing the total number of intervals where any kind of play behavior was recorded by the total number of intervals the subject was observed and multiplying by 100. Figure 1 indicates the total percent of intervals spent playing for subject 1, 2, 3, and 4, respectively, in the training and control session. A break in the data line shows that the subject was absent from that session or the session was not held that day. Table 1 gives the mean percent of time spent playing for the last five days the subject was present.

The baseline phase was conducted for thirteen days. In the training session, the mean percent of total play for the experimental subjects was 16.2% for subject 1 and 13.4% for subject 2, and for the control subjects was 48.2% for subject 3 and 12% for subject 4. Play behavior varied from 0% to 100% for subject 1, 3% to 53% for subject 2, 16% to 88% for subject 3, and 3% to 56% for subject 4. During the control session, the mean percent of play was 36.4% for subject 1, 2.8% for subject 2, 41.8% for subject 3, and 10.4% for subject 4. Play behavior varied about the same percent as in training.

*Figure 1 and Tables 1 and 2 appear in the Appendices pages 21-29.
The reinforcement phase was conducted for seventeen days. The mean percent of play increased for the experimental subjects and subject 3 but it decreased for subject 2 in both sessions. During the training sessions, variability increased for the experimental subjects but remained unchanged for the control subjects. Variability in the control session decreased for subject 1 and 4, but remained near baseline level for subject 2 and 3.

Table 2 gives the number of reinforcements presented to the experimental subjects. They received reinforcements approximately on the average of a variable-interval two minute schedule.

The return to baseline phase was conducted only for fourteen days because two of the four subjects were being transferred to another school. The mean percent of play behavior decreased for subject 1 and 3, and increased for subject 4. Subject 2 decreased play time during the training session, but she increased it during the control session. Play behavior decreased in variability for subject 1 and 2, but it stayed the same as in the reinforcement phase for subject 3 and 4.

Data for the other recorded behaviors are not graphed because the percent or frequency was too low. The percent of isolate play almost paralleled the graph of total percent of time spent playing in both sessions. Cooperative play remained at zero except for a few instances.
The percent of intervals a subject engaged in destructive behavior during the training session baseline ranged from 0%-27% for subject 1, 0%-18% for subject 2, 0%-20% for subject 3, and 0%-17% for subject 4. These behaviors during the reinforcement phase remained unchanged except for subject 2 whose destructive behavior decreased to zero. During the return to baseline phase, the range of destructive behavior for subject 1, 2, and 4 remained unchanged, but subject 3 decreased to 0%-7%.

During the control session baseline, destructive behaviors ranged from 0%-7% for subject 1, 0%-55% for subject 2, 0%-33% for subject 3, and 0%-13% for subject 4. These behaviors decreased for subject 2 to 0%-11% and subject 3 to 0%-3%, but increased for subject 1 to 0%-9% and subject 4 to 1%-25% during the reinforcement phase. Destructive behaviors during the return to baseline phase increased for subject 1 to 0%-33%, subject 2 to 0%-14%, and subject 3 to 0%-10%, but decreased for subject 4 to 0%-10%.

A much better evaluation of destructive behavior could be made from the frequency of prompts used to stop destructive behavior and of the use of the time out procedure in both sessions. This experimenter behavior was recorded continuously in each session in relation to all subjects. During the training session baseline phase, the number of prompts varied from 0-9 for subject 1, 0-17 for subject 2, 0-13 for subject 3, and 0-5 for subject 4. This frequency
during the reinforcement phase declined for all subjects except for subject 3 who remained at baseline level. Destructive responses during the return to baseline phase increased for subject 1 to 0-16 and subject 2 to 0-20, but they stayed about the same as baseline level for subject 3 and 4. The overall frequency of the use of the time out procedure was about 0 except in the cases of subject 2 for a few days in every phase and of subject 1 in return to baseline.

In the control session, the frequency of prompts during baseline is nearly equal to that of the training session. In the reinforcement phase, prompts remained unchanged for subject 1, decreased for subject 2 to 0-11, and increased for subject 3 to 0-25 and for subject 4 to 0-25. Prompts increased for subject 1 and 2, and decreased for subject 3 and 4 in the return to baseline phase. The frequency of the use of the time out procedure was near 0 for everyone except subject 2 during two days of baseline.

In general, all subjects had a frequency near 0 of experimenter directed behavior.

Except for a few days, sucking behavior was at zero for subject 1, 3, and 4. In about one-half of the observation sessions, subject 2 spent more than 20% of the time engaged in sucking behavior.

The percent of time spent in repetitive movement was at zero for subject 1 and 4. Subject 3 had only a few
instances of this behavior. For subject 2, sucking behavior decreased from 73% in baseline to 7% in the return to baseline during the training session, and from 63% in baseline to 0% in the return to baseline during the control session.

During the experiment, five reliability checks were taken. Stars on the figures 1a–d indicate the days and session where a check occurred. The mean percent of agreement was 81%. Reliabilities for each recorded behavior across all subjects are reported only if the behavior occurred at least ten times in a session or across successive reliability sessions. The reliability varied from 77%-84% for isolate play, 91%-95% for destructive behavior, 71%-90% for sucking behavior, and 93%-100% for experimenter prompts.
DISCUSSION

The experimental subjects (subject 1 and 2) and one control subject (subject 3) increased their percent of total play during the reinforcement phase of the training session. Similarly, their total play increased somewhat less during the reinforcement phase of the control session. Since subject 3 was not directly reinforced by the experimenter, the increase in his play behavior is probably the result of vicarious reinforcement. When baseline conditions were reinstated, subject 1, 2, and 3 declined in their percent of total play to near or below baseline level in both sessions. In contrast to the subject 1, 2, and 3, subject 4 showed no systematic change in his play behavior across experimental conditions. These data demonstrated that reinforcement accounted for the changes in the play behavior of the experimental subjects.

The play behavior of one of the control subjects (subject 4) showed no systematic increase when the experimental subjects were reinforced. Subject 3 (control subject) increased play time in the training session but only a small increase occurred in the control session. The increase in the play behavior of the experimental subjects during the reinforcement phase in control sessions is probably the result of generalization. Generalization occurred without reinforcement being given by the experimenter.
for play behavior in the control session.

The reinforcement of the experimental subjects' play behavior had no systematic effect on the play behavior of subject 4. There are several possible explanations for the lack of vicarious reinforcement. First, retarded children might not be aware of what their peers nearby are doing (Kazdin, 1973). Second, each subject was probably working on a different activity when reinforcement was delivered. Finally, the subjects could not compare their performances since they were doing different activities (Sechrest, 1963).

During the reinforcement phase, the experimental subjects played during sessions 23 to 31 because they received prompts to play and experimenter given reinforcers dependent on play behavior. Whether prompts or reinforcers would separately maintain play behavior is questionable. Another extinction phase would need to be conducted where prompts or reinforcers alone would be presented to determine which stimulus controlled their play behavior.

During the experiment, cooperative play occurred at a low rate. This low rate could be explained by the idea that play develops in three stages: (1) isolate play, (2) parallel play, and (3) cooperative play. The subjects were at the first level with only a few instances of the latter stages occurring. On the other hand, behaviorists would probably attribute the lack of cooperative play to poor
programming of criterion to develop cooperative play, of reinforcement contingencies, or of the small number of activities requiring cooperative behavior.

In the return to baseline condition, the experiment was not conducted for the first six days because subjects were absent. Therefore, the total percent of intervals spent playing might be showing the effects of spontaneous recovery rather than a second baseline. To determine this possibility, this condition would have to be conducted a longer time.

The low percent of total play in the return to baseline condition suggests that playing with toys had not become intrinsically reinforcing for the children except subject 4 since it did not persist after the experimenter stopped reinforcing it. Perhaps, a longer reinforcement condition with a gradual reduction in the number of reinforcements given would result in the maintenance of play behavior after experimenter given reinforcements is stopped.

The effectiveness of prompts to stop destructive behavior is questionable. It appeared that the experimenter's prompts which are a form of attention did not function as conditioned punishers to stop play behavior. Instead, the prompts might have functioned as a reinforcer (subject's response → attention) for destructive behavior and as a conditioned stimulus to stop the behavior to avoid being put in time out.
In summary, play behavior will generalize to another situation as long as reinforcement is delivered in one situation for the behavior. Eventually, it may be possible for the child to receive self-reinforcement for engaging in the activity from the activity itself or his peers. In a classroom, this technique could readily be used by a teacher with a group or individual children.
APPENDIX A

ISOLATE PLAY ACTIVITIES
Isolate play was recorded as the subject engaging in one of the following activities.

1. Placing one or pieces of a puzzle into the corresponding outline in a board or connecting the matching pieces.

2. Placing plastic forms into the corresponding ones.

3. Placing one or more blocks or logs atop or spaced between each other.

4. Sliding beads on a string; holding each end on a string with beads on it and pulling it loose and tight.

5. Placing plastic forms onto a colorform board.


7. Coloring with a crayon in a coloring book or on a piece of construction paper.

8. Rolling, bouncing, or kicking a ball.

9. Sitting on, pushing with his hand, or pulling on a string with his hands a truck; tying the trucks together with a string.

10. Lacing a shoe.

11. Buttoning, zipping, or snapping the clothes on a doll; walking the doll or making the doll sit.

12. Flipping plastic ants into molded plastic pants with suspenders.

13. One subject asking another one what the name of an object or a picture is (e.g. "What is this?"). The former subject could include a prompt (e.g. "Say ________" or "_______."). The other subject does not reply to the question.

14. Saying the name of an object or picture aloud. This excluded a subject replying to another subject's question.

15. Matching picture lotto cards to corresponding pictures on a board.

16. Folding paper.
17. Removing or putting objects in a bag, box, or can.
18. Shuffling and dealing out lotto cards.
19. Pounding a stick atop a can.
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FIGURE 1

LEGEND

Total percent of play time as a function of days in the training and control sessions. Stars indicate the day and session where an interobserver reliability check was taken.
FIGURE 1

SUBJECT 1

BASELINE REINFORCEMENT RETURN TO BASELINE

SESSIONS

Training Session
Control Session
Interobserver Reliability Check

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