ABSTRACT

THE EFFECT OF ALTERNATING SOCIAL
APPROVAL COMMENTS AND TANGIBLE REWARDS
ON TASK PERFORMANCE OF KINDERGARTEN CHILDREN

By

Richard Allan Brown

Treatment programs for children based on operant conditioning principles often utilize social approval comments and tangible rewards like candy and toys as positive reinforcement. This study focused on the following questions: 1) Are tangible rewards generally more effective than social approval comments in influencing performance of kindergarten children?, 2) Can interaction effects be caused by exposure to two different magnitudes of reinforcement such as tangible rewards (high magnitude) and social approval comments (low magnitude)?, 3) Does superior performance that has been maintained by tangible reinforcement remain superior in a non-reinforcement situation when compared with performance that has previously been maintained by social reinforcement?, and 4) Can direct teacher ratings on cooperation, persistence, response to approval comments, and response to tangible rewards predict children's performance in a task situation under conditions of social approval, or tangible reward?

The task was key pressing. Twenty kindergarten children were assigned to each of three experimental groups under social approval comments from an adult, tangible reinforcement, or alternated social and tangible reinforcement. To

test for confounding sex effects an equal number of boys and girls was included in each group. To test for confounding effects due to satiation half of each group was run under high or low density schedules of reinforcement. Trials consisted of 20 second presentations of the key. There were 4 trials following initial instructions, then 20 trials under reinforcement, and 8 trials under no reinforcement.

There was no evidence that tangible reinforcement was better than social reinforcement except when they were alternated. Performance under the tangible condition of the alternated group increased more than performance under any of the other conditions. Alternation with social reinforcement increased the influence of the tangible reinforcement. Under the non-reinforcement period performance of the group with a tangible reinforcement history dropped below the groups with social and alternated reinforcement histories.

This was discussed in terms of Amsel's frustration hypothesis and the notion that the tangible reinforcement situation was more unlike non-reinforcement than the other two reinforcement conditions. Girls were more responsive to reinforcement than boys and there were no confounding interactions with other variables. In the non-reinforcement period there was an interaction between density of reinforcement and trial blocks but there were no confounding interactions with other variables. Correlations between rating scales filled out by teachers were of no value in predicting children's performance in the experimental situation.

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Richard Allan Brown

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

1969

ACKNOWLEDGEMENTS

I would like to thank my chairman, Dozier Thornton, for his patience in the development of this thesis. I would like to thank Lucy Ferguson and Terry Allen for their helpful suggestions in the design of the study and final revisions of the manuscript. And I would like to thank Bill Kell for giving me his attention in some very helpful ways related more to the motivational problems of writing this thesis than the specific content.

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INTRODUCTION

During the past few years the author has been associated with a day school project for emotionally disturbed children conducted by the Psychology Department at the Institute for Juvenile Research (Perce, 1968; Brown, Pace & Becker, In Press). In this project there was heavy emphasis on operant conditioning principles, particularly the use of tangible reward systems in the classroom which were styled after those of Wolf, Giles & Hall (1968) and Birnbrauer, Wolf, Kidder & Tague (1965). The children in the Institute for Juvenile Research (IJR) program could earn in excess of 2000 points a week for academic work and good behavior in the classroom. These points could be used to "buy" toys at the end of each schoolday as well as for planned parties and trips. In addition, candy and treats were distributed during the class periods to reward specific behaviors. Within a few months these children were behaving very nicely in the classroom. However, outside the classroom they were often still unmanageable when treated with ordinary social conventions. As these children passed through the doorway of the classroom a Dr. Jekyll - Mr. Hyde phenomenon was observed. Passing over the threshhold from the classroom to the outside the children became "wild" but in returning over the same

threshhold they became very quiet, polite, and generally well-behaved. At a time when tangible reward systems are more frequently included as part of treatment programs, experience with our project has led us to ask several questions about the application of these kinds of systems:

1) Are tangible rewards more effective than social approval in shaping and maintaining desired responses?

It was our impression that many of the desired behaviors tangibly rewarded in our classroom situation had occurred previously in natural social interaction. Conventional rewards from adults in natural social interaction are usually little more than approval, often expressed verbally by statements like "Good", "Fine", "M-h'm!", "You're doing a nice job!", etc. The potency of these kinds of statements as rewards has been demonstrated by a number of experiments (Gerwitz & Baer, 1958a, 1958b; Stevenson & Odom, 1961; Green & Zigler, 1962; Hill & Stevenson, 1964; Patterson & Hinsey, 1964; and Stevenson & Fahel, 1965). Approval comments not only influence children's behavior but are more effective after conditions of social "deprivation" and less effective after social "satiation". The effectiveness of contingent attention from adults has been demonstrated in a variety of treatment situations. The form of this attention has varied from approval comments to smiles and physical contact. The usual procedure is to attend to desired behaviors which are often chosen so that they will be incompatible with inappropriate behavior. Inappropriate behaviors are usually

ignored as much as possible. Variations of this procedure have been effective for treating children's problems in nursery school situations (Harris, Johnston, Kelly & Wolf, 1964; Hart, Allen, Buell, Harris & Wolf, 1964; Allen, Hart, Buell, Harris & Wolf, 1964; and Brown and Elliott, 1965), natural classroom situations (Becker, Madsen, Arnold & Thomas, 1967; Madsen, Becker & Thomas, 1968; and Thomas, Becker & Armstrong, 1968), and simulated home situations (Wahler, Winkel, Peterson & Morrison, 1965; Johnson & Brown, In Press).

When a tangible reward system is employed as part of a treatment program for children the rationale is that the occurrence of desired responses can be increased more quickly and maintained at higher rates than under contingent social approval alone. Tangible reward systems ranging from highly elaborate token systems to simple direct rewards such as food and trinkets have been utilized in institutional and school programs (Ayllon & Azrin, 1968; Wolf et al., 1968; Birnbrauer et al., 1965; O'Leary & Becker, 1969) and in individualized treatment programs, particularly with autistic and schizophrenic children (Brown et al., In Press; Ferster & DeMyer, 1961; Wolf, Risely & Mees, 1964; Lovaas, Berherich, Perloff & Schaffer, 1966). In cases where children are not responsive to adult approval or in cases where adult approval is aversive, tangible reinforcement is clearly more effective during the initial stages of treatment (Brown et al., In Press). There is little empirical evidence, however, that

tangible rewards are generally more effective than social approval, particularly where children are not systematically deprived of food, toys, etc. Examination of treatment procedures where tangible reinforcement is utilized often reveals a strong component of social reinforcement in the form of instructions and distribution of the rewards by adults. Because tangible rewards may have value both as tangible rewards and as tokens of social approval they are probably more potent than social approval alone.

2) Can interaction effects be caused by exposure to two different magnitudes of reinforcement such as tangible rewards (high magnitude) and social approval comments (low magnitude)?

In the LJR project it appeared that the pervasive use of tangible rewards in class may have made the more natural rewards available outside the classroom, primarily social approval, less effective. The Dr. Jekyll - Mr. Hyde phenomenon may be analogous to the results of experiments demonstrating contrast effects. Dunham (1968) has recently reviewed these experiments and has labelled the results of "within - subjects" methodology "behavioral contrast" and the results of "between - subjects" methodology "incentive contrast". Behavioral contrast is a shift in performance from a situation under one or more magnitudes of reinforcement to a situation in which some new magnitude of reinforcement is introduced, where the shift in performance under the old level or levels of reinforcement is in an opposite direction from the new magnitude of

reinforcement. Incentive contrast is a shift in performance caused by an upshift or downshift in magnitude of reinforcement where the increase or decrease in performance exceeds the expected level of performance indicated by control groups under only the high or low magnitudes of reinforcement.

In Dunham's (1968) critical review of the contrast phenomena he finds some support for positive contrast effects, strong support for negative contrast effects, and in some experiments in which high and low magnitudes of reward have been alternated there is some evidence for a biphasic process in which the negative contrast effect is preceded by facilitation of performance. Experiments employing alternation procedures are most analogous to the IJR project in which the classroom situation (high magnitude rewards) was alternated with the natural environment (low magnitude rewards) outside the class. Two of these experiments are summarized below:

Peiper & Marx (1963) magazine trained 3 groups of rats in a Skinner Box. The groups were trained on 4%, 11.3%, or 32% concentration of sucrose solution. Magazine training was then alternated with bar press training at 11.3% sucrose for all groups. The downshifted group first responded higher and then lower than the unshifted control resulting in a stable negative contrast effect. The upshifted group first responded lower and then higher than the non-shifted group resulting in a stable positive contrast effect.

Bower (1961) trained rats in two distinctly different alleys. The experimental group was alternately trained with

a large magnitude of reward (S+) in one alley and a small magnitude of reward in the other alley (S-). Control groups were run only under the large or small magnitude of reward. When the S- condition of the experimental group was compared with controls run only under the small magnitude condition the experimental group was at first significantly faster but in later trials significantly slower in their performance. A similar experimental procedure of Glass & Ison (1966) also resulted in a facilitation effect followed by a negative contrast effect.

If conditions existed in our treatment project that were analogous to these contrast experiments there may have been several possible interaction effects. The classroom situation with a high density tangible reinforcement system was alternated with the natural environment outside of the classroom where contingent adult approval was the primary reinforcement.

Alternation with social approval could have accentuated the effect of the tangible reinforcement creating a Dr. Jekyll effect (positive contrast). Alternation with tangible reinforcement could have decreased the effect of social reinforcement creating a Mr. Hyde effect (negative contrast). Over a series of alternations with tangible reinforcement the effect of social approval could have first been facilitated and then decreased (biphasic effect).

3) Does superior performance that has been maintained by tangible reinforcement remain superior in a non-reinforcement situation when compared with performance that has

previously been maintained by social reinforcement?

An important question for the IJR project was whether the appropriate classroom behavior maintained by high density tangible reinforcement would transfer back to the local school situations where there was no tangible reinforcement and where the teachers often provide minimal social reinforcement. Hulse (1958), Armus (1959), and Wagner (1961) have found faster extinction following larger magnitudes of reward. This suggests that although tangible reinforcement may originally maintain higher levels of response, response in a non-reinforced situation may be less than if the response were originally maintained at a lower level with social reinforcement.

Amsel (1958, 1962) makes a strong argument toward an active role for non-reward. He believes non-reinforcement can produce frustration responses which are incompatible with the previously rewarded responses. Many sequences of interaction observed outside the IJR classroom situation seemed to confirm his views. They were usually variations on the following theme: Adult makes a request of child. Child replies, "What do I get?" Adult says, "Nothing" and repeats request. Child is observed to do various things like scream, cry, break things, sit like a stone, use abusive language, stomp feet, make fierce faces, make sad faces, flop around on the floor, bang head, strike adult, suck thumb, run away, etc.

Is it possible that a high density tangible reinforcement

system such as we had in the classroom could contribute to frustration and poor performance in situations where desired responses are not reinforced with tangible rewards?

4) Can direct teacher ratings on cooperation with adult instructions, persistence, response to adult approval comments, and response to tangible rewards predict children's performance in a task situation under conditions of social approval, or tangible reward?

In the IJR project there were many individual differences between the children including their response to various kinds of reinforcement. There was a large variation in response to the tangible rewards as well as to social approval comments from adults. It would be useful in setting up individual therapy and remediation programs if teachers could accurately predict how a child would respond to various kinds of reinforcement.

Some attempts have been made to relate scales and ratings to performance in social approval situations but the results have been less than impressive. Marlowe (1962) indicated that need for social approval facilitates verbal conditioning, however Spielberger, Berger & Howard (1963) found no relationship between Crown - Marlowe scores on need for approval and rate of verbal conditioning. In another study Costello (1967) found no relationship between the effect of social approval comments on task performance of pre-school children and teacher ratings of the children on a "social competence" scale by Kohn & Silverman (1966). Many items

on this scale are general and it may be that more specific ratings by teachers would be more fruitful in predicting the performance of individual children.

STATEMENT OF THE PROBLEM

This study is intended to be an experimental analogue designed to answer some of the major questions raised above. Answers to these questions are critical in the development of treatment programs for children which include the use of tangible reinforcement systems. Given one group of children reinforced with tangible rewards (T), another group with social approval comments from an adult (S), and another group alternately reinforced with tangible rewards and social approval comments (A):

1) Will T perform better than S?

2) Will there be positive contrast, negative contrast, and/or biphasic effects in A?

3) Will T, S, and A differ in a non-reinforcement situation?

4) Can a child's response to social approval and tangible reinforcement be predicted by his teacher?

Specific Hypotheses

1) Performance may be higher under tangible reinforcement than under social approval comments ($T > S$).

2) Where tangible reinforcement is alternated with social approval comments a) performance under the tangible alternation may first be lower ($T > A_T$) and then higher ($A_T > T$) than the performance of the group under tangible reinforcement alone, and b) performance under the social alternations may first be higher ($A_S > S$) and then lower

($S > A_S$) than the performance of the group under social approval comments alone.

3) In the non-reinforcement situation immediately following the reinforcement condition performance of the group with a tangible history may not be significantly higher than the group with a history of social reinforcement. It is possible that there may be more of a frustration effect associated with a history of tangible rewards. If this is the case, performance of group T may drop below group S in the non-reinforcement situation ($S > T$), and performance of group A may fall between the other two groups ($S > A > T$).

4) Teacher ratings may predict children's performance in response to tangible rewards and social approval comments.

METHOD

Contrast effects were tested by having S's operate a telegraph key under conditions of tangible, social, or alternated tangible and social reinforcement. The reinforcement period was followed by a period of key presentation without reinforcement. Because of the possibility that there might be confounding interaction effects due to sex and satiation, sex and density of reinforcement were included as variables in the experimental design. Before S's were run their teachers were asked to predict their performance under the different reinforcement conditions.

Subjects

Sixty children from four Parochial Kindergartens served as subjects. These classes were from two Catholic schools in central Chicago. Kindergarten children were used because most of them are old enough to understand verbal instructions and young enough that inexpensive candy and trinkets can be used effectively as rewards. The ages of the S's ranged from 4 years, 9 months to 6 years, 2 months.

There is some suggestion (Gerwitz & Baer, 1958a; Stevenson, 1961) that girls may respond more to approval comments from a male E than boys. To control for possible sex effects an equal number of each sex was assigned to each experimental group.

The tangible, social, and alternating reinforcement groups were each divided into conditions of high (Fixed ratio

of 1 reinforcement per 10 responses, FR10) and low (Fixed ratio of 1 reinforcement per 20 responses, FR20) density reinforcement. The rationale for using FR10 and FR20 schedules of reinforcement rests on the research of Long, Hammack, & Cambell (1958) on tangible reinforcement of children's bar pressing behavior. Using a variety of FR schedules they found that small ratios produced rapid satiation while initial large ratios were often aversive. The FR20 was chosen as a ratio that might produce the least satiation while maximizing the probability that every subject would receive at least one reinforcement within each 20 sec. response period. The FR10 schedule of reinforcement was included to control for possible interaction effects between satiation and kind of reinforcement.

Five girls and five boys were assigned to each of six experimental groups:

Tangible Reinforcement

Group T - high density (FR10) N = 10 (5 girls, 5 boys)
Group T - low density (FR20) N = 10 (5 girls, 5 boys)

Social Approval Comments

Group S - high density (FR10) N = 10 (5 girls, 5 boys)
Group S - low density (FR20) N = 10 (5 girls, 5 boys)

Alternation of Tangible Reinforcement with Approval Comments

Group A - high density (FR10) N = 10 (5 girls, 5 boys)
Group A - low density (FR20) N = 10 (5 girls, 5 boys)

The assignment of subjects may be summarized in terms of a 3 (kind of reinforcement) X 2 (density of reinforcement) X 2 (sex) design.

Apparatus

The task was pressing a telegraph key. There were several reasons for selecting this task. In most cases high, stable response rates can be quickly obtained in response to instructions. A very simple motor response is required that is not physically incompatible with looking at the reinforcing stimuli. And, the task is relatively boring. There is little about the task itself that might reinforce further responding.

The apparatus (Figures 1, 2, 3, and 4) consisted of a 35" x 21" table with a 2" high step 6½" back from the front edge. A telegraph key (Johnson Standard 114-320) was mounted on a wooden paddle which E could manipulate to expose or withdraw the key through a 2" x 1¼" hole in the center of the step. Screens (21" x 21") were mounted at each side of the table and two 17½" x 21" sliding screens were placed 12½" back from the front edge of the table. One of these screens could be moved to expose E. The other could be moved to expose a screen with a protruding tube through which candy (a mixture of M & M's, candycorn, "Good 'n Plentys", and jellybeans) could be dropped into a clear plastic cup. The entire apparatus was white except for the black key, clear plastic cup, and a red line over the candy delivery tube.

A stopwatch was used to time the intervals of key presentation. An electrical counter (General Controls CE40BS402) kept a cumulative record of key pressing. The counter was insulated but still made a small audible click

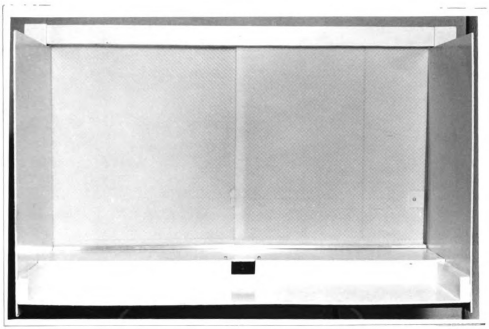

Fig. 1. Apparatus During Rest Periods.

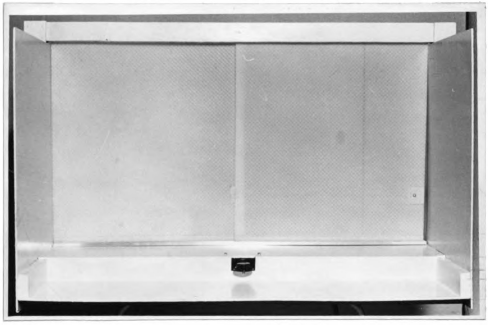

Fig. 2. Apparatus During Base And Non-Reinforcement Periods.

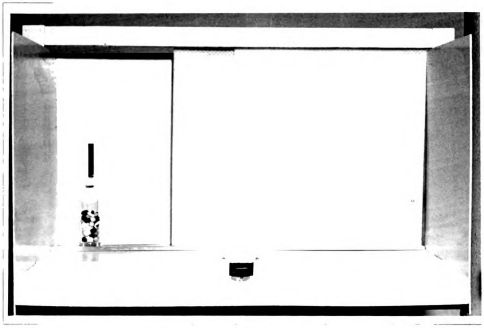

Fig. 3. Apparatus During Tangible Reinforcement Periods.

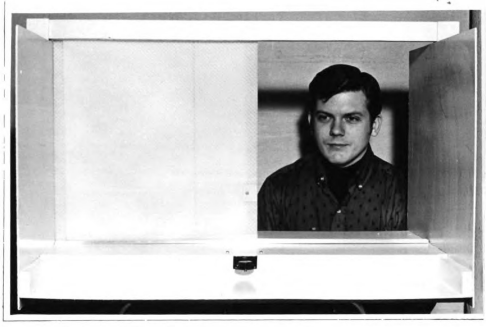

Fig. 4. Apparatus During Social Reinforcement Periods.

with each key press. E recorded the cumulative frequency after each interval of key presentation.

Procedure

The apparatus was set up in an unused room of each school. The children in each class were told that E had a list of their names and he would call each of them to come and do something for him. E, a male adult, walked S's to and from the classrooms and attempted to keep verbal interaction to a minimum by responding as briefly as possible to questions from the children and otherwise not initiating conversation except as delineated by the procedure.

Instructions. Each S was told to "Sit here!" Standing beside the apparatus, E pointed to the chair in front of the key pressing apparatus and said, "See the black button? It goes in and out like this." E demonstrated by twice withdrawing and presenting the key. E said, "When it is out I want you to push it down and up like this!" E demonstrated by pushing the key 8 times at a rate of two per second. E said, "Now you do it." E presented the key and after 5 presses withdrew the key while S's hand was still on it. It was presented again and withdrawn after S made 8 more responses. If S failed to respond E said, "When the button is out, I want you to push it down and up." E made no approval comments in this condition.

Base period. A base rate was established for each S in response to instructions only. After the instructions above

and with the key withdrawn E said, "Remember, when the button is out I want you to push it down and up." E sat down behind the screen and presented the key for four 20 sec. intervals (Fig. 1) separated by a "rest period" of 10 - 15 sec. during which the button was withdrawn (Fig. 2). E made no approval comments in this condition.

The major reason for including the "rest period" between trials was a wish for rapid discrimination between tangible and social reward conditions by the experimental group under alternating conditions of reinforcement. Where a high-rate response follows a low-rate response the low-rate response may increase in frequency (Premack, 1959). The "rest period" was included in order to minimize this effect. For comparable controls the "rest period" was held constant for all groups and all experimental manipulations.

Reinforcement period. Following the period for establishing a base rate for the telegraph key, twenty 20 sec. presentations of the key were given under various conditions of reinforcement. All key presentations were preceded and followed by a 10 - 15 sec. rest period, except where instructions were given, as described below. The groups were rewarded in the following ways:

1) Group T (Tangible Reinforcement) - After the 10 - 15 sec. rest period following the base period E opened the panel revealing the reward chute and plastic candy container (Fig. 3). E said, "See the plastic cup. Candy can drop in the cup, like this." E demonstrated. "When you see

the cup you can win candy by pushing the button down and up. After we are all finished today, just before I take you back to class, I will put the candy in a bag for you. If you win enough candy you can trade it for some nice toys." The panel was then closed. The panel was reopened and the key presented for 20 sec. Group T - high density, was rewarded on FR10 and Group T - low density, on FR20 schedules of reinforcement. The button was withdrawn after the 20 sec. period and the panel closed. After a 10 - 15 sec. rest period this procedure was repeated. The procedure remained the same through 20 trials.

2) Group S (Social Approval Comments) - After the 10 - 15 sec. rest period following the base period in response to instructions the panel was opened revealing E and the key was presented for a 20 sec. interval (Fig. 4). Group S - high density, was rewarded by social approval comments on FR10 and Group S - low density, on FR20 schedules of reinforcement. The comments were those used by Patterson & Hinsey (1964) and were said in the same sequence for each subject: "You're doing fine; M-hm; Good; Very nice; Very good; Fine; That's good; That's fine; Very good;" (Repeat sequence). After each 20 sec. interval the key was withdrawn and the panel closed. After a 10 - 15 sec. interval the procedure was repeated. This procedure remained the same for 20 trials.

3) Group A (Alternation of Tangible Reinforcement and Social Approval Comments) - After the base period this group received 10 trials under the procedure described for Group T

under which tangible reinforcement was presented for key pressing during the 20 sec. intervals of key presentation. These trials were alternated with 10 trials under the procedure described for Group S under which social approval comments were made for key pressing during the 20 sec. intervals of key presentation. Group A - high density, received an FR10 schedule through all alternations. For half of this group the alternations started with tangible reinforcement. The other half started with social approval comments. Group A - low density, received an FR20 schedule of reinforcement. Alternations started with tangible reinforcement for half the group and with social approval comments for the other half.

Non-reinforcement period. After the 10 - 15 sec. rest period following the reinforcement period E presented the key for eight 20 sec. intervals preceded and followed by 10 - 15 sec. rest periods. In this condition both sliding panels remained closed concealing E and the candy cup (Fig. 2). E did not speak during this period.

After the Non-reinforcement condition the candy was bagged or traded for small trinkets and each child was led back to his classroom.

Teacher Ratings

The button pushing task and reward conditions were described to the teachers of the four kindergarten classes before the experiment and they were asked to predict the

performance of their children. They received a set of rating sheets covered by the following instructions (Appendix A). "Estimate how well you think each child would perform when asked to do a boring task like pushing a button down over and over again. Rate each child on cooperation, persistence, responsiveness to social approval and responsiveness to tangible rewards."

The rating sheets consisted of a list of the children's names. By each name was a scale from 1 to 7 on which the children were rated. There were separate sheets for "Cooperates with adult instructions", "Persistence - performs well throughout an extended period of time", "Responsiveness to adult approval - Performance increases when an adult says encouraging things like 'You're doing a good job'; 'Very good'; etc."; and "Responsiveness to tangible rewards - Performance increases when encouraged by tangible rewards, such as candy and toys". For each scale the teacher was asked to give the most cooperative, persistent, or responsive child a 7, the least a 1, and then rate the remainder of the children in her class along the full 7 point scale.

RESULTS

Analysis of Reinforcement Effects

A common way to analyze data from this kind of experiment is in terms of difference scores (Stevenson & Hill, 1966). Because there is usually a large variance between subjects in response rates and since this kind of experiment is primarily concerned with variance due to reinforcement effects, the initial base rate for each subject is subtracted from his rates under the experimental conditions and the analyses are performed on the resulting difference scores.

In this analysis the mean of trials 3 and 4 of the base period was used as an index of the base rate for each subject. The correlation between Trial 3 ($\bar{x}$ = 47.6, N = 60) and Trial 4 ($\bar{x}$ = 46.7, N = 60) indicates a high degree of individual consistency ($r = .90$, $p < .0005$).

Except for the group under alternated reinforcement conditions, mean response rates were computed for each subject over blocks of 4 trials in the experimental periods. This results in means for 5 blocks of trials under the Reinforcement Period and 2 blocks of trials under the Non-Reinforcement Period. Because the alternated group received 10 trials of social reinforcement and 10 trials of tangible reinforcement under the Reinforcement Period and these conditions were to be analyzed separately, means were computed for each subject over blocks of 2 trials. For the alternated group in the Reinforcement Period there are, therefore, 5 block means computed from the tangible reinforcement

situation and 5 block means computed from the social reinforcement situation. Because the 5 blocks during the reinforcement period are based on 2 trials for the alternated conditions and 4 trials for the other conditions, a check was made on the reliability of the trial scores within blocks to see if a valid comparison could be made between blocks of 2 and blocks of 4 trials. The average inter-trial correlation within blocks is .90 for the alternated group under tangible reinforcement and .90 for the alternated group under social reinforcement. The average inter-trial correlation within blocks for the other groups during the Reinforcement Period was calculated two ways. The mean correlation between successive trial scores within blocks is .84. The mean correlation between the average of the first 2 scores and the average of the second 2 scores within blocks is .89. The average of inter-trial correlations within blocks of 2 trials for the alternated conditions are high enough that these blocks can be compared with the blocks of 4 trials under the other reinforcement conditions.

Each subject's mean base rate was subtracted from the means of his 5 blocks of trials in the Reinforcement Period and the means of his 2 blocks of trials in the Non-Reinforcement Period. The analyses were then performed on these difference scores. The mean difference scores for the experimental groups under the Reinforcement and Non-Reinforcement Periods are plotted in Fig. 5.

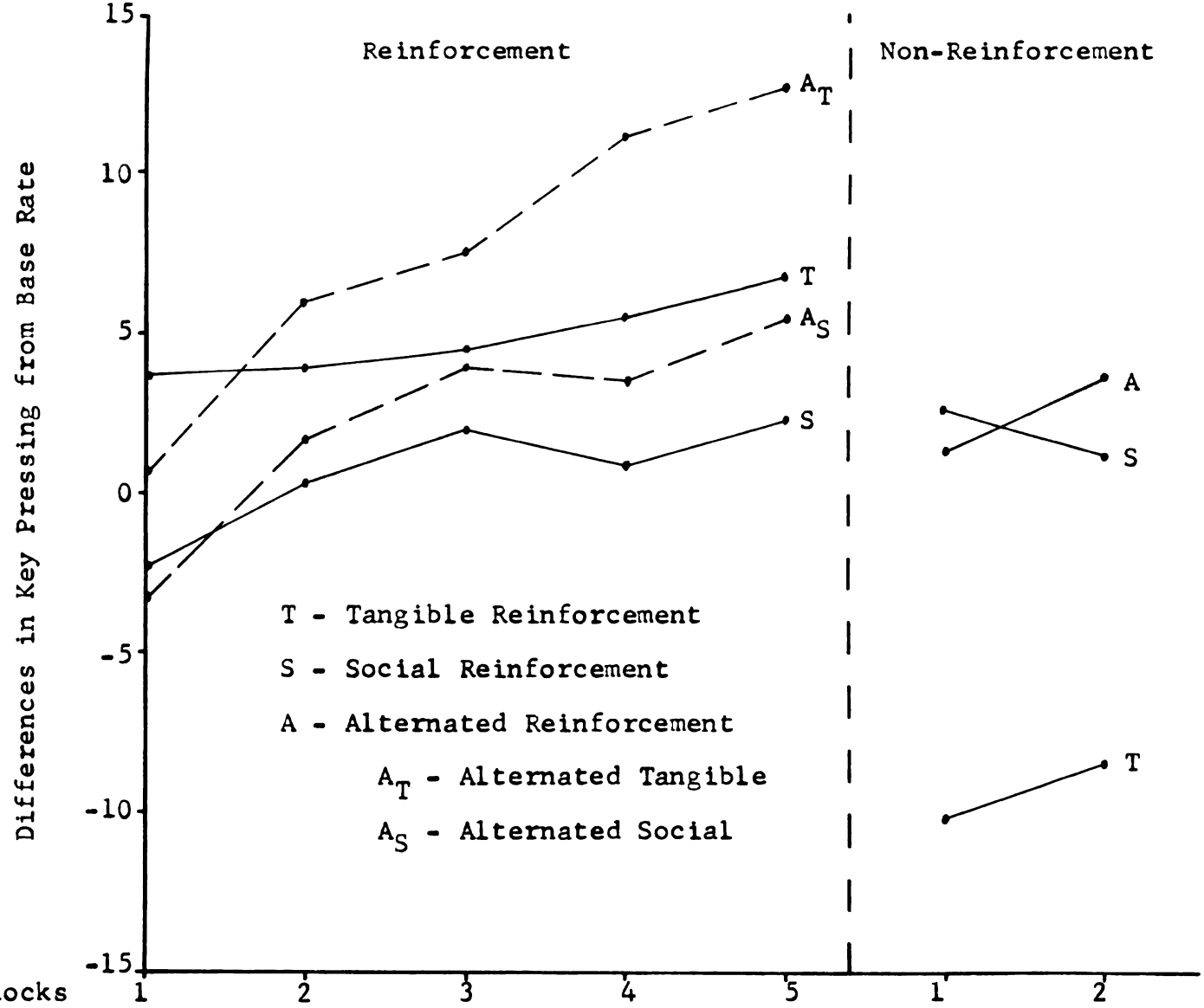

Figure 5. Comparison of Groups under Different Kinds of Reinforcement in Conditions of Reinforcement and non-Reinforcement.

Comparison of Tangible, Social, and Alternated social reinforcement. An analysis of variance was performed on the difference scores under the Reinforcement Period for the Tangible Reinforcement group (T), the Social Reinforcement group (S), and the Alternated group under the social reinforcement condition (A_S). The results appear in Table 1. There is a significant effect across trial blocks ($F = 8.01$, $df = 4, 192$, $p < .01$). Inspection of Fig. 5 shows a general increase in response to reinforcement for all groups, A, T, and A_S, with trial blocks.

No significant differences were found between reinforcement groups although it can be seen in Fig. 5 that the relative performance of T and S is in the predicted direction ($T > S$). There is no support for negative contrast effects or biphasic effects in the group comparison. However, examination of individual performance indicates the possibility of such effects in some subjects who were exposed to both social and tangible reinforcement.

In Fig. 6 the performance of 2 subjects is plotted to illustrate the possibility of contrast effects in some individual cases. Subject #48, a boy, received reinforcement on an FR20 schedule with alternations beginning on social reinforcement. Subject #54, also a boy, received reinforcement on an FR10 schedule with alternations beginning on tangible reinforcement. Both subjects show an initial rise above baseline in response to social approval comments followed by a sharp decline well below baseline. The increase

Table 1

Analysis of Variance

Alternated Social Reinforcement

Source of Variation	df	MS	F
Between subjects	59		
A (reinforcement)	2	448.10	1.69
B (density)	1	786.40	2.96
C (sex)	1	591.40	2.23
AB	2	103.30	.39
AC	2	232.80	.88
BC	1	17.90	.07
ABC	2	604.10	2.27
Subj. w. groups	48		
Within subjects	240		
D (trial blocks)	4	258.93	8.01**
AD	8	36.16	1.12
BD	4	27.10	.84
CD	4	183.43	5.68**
ABD	8	17.39	.54
ACD	8	15.19	.47
BCD	4	10.43	.32
ABCD	8	31.36	.97
Dxsubj. w. groups	192	32.32	

**$p < .01$

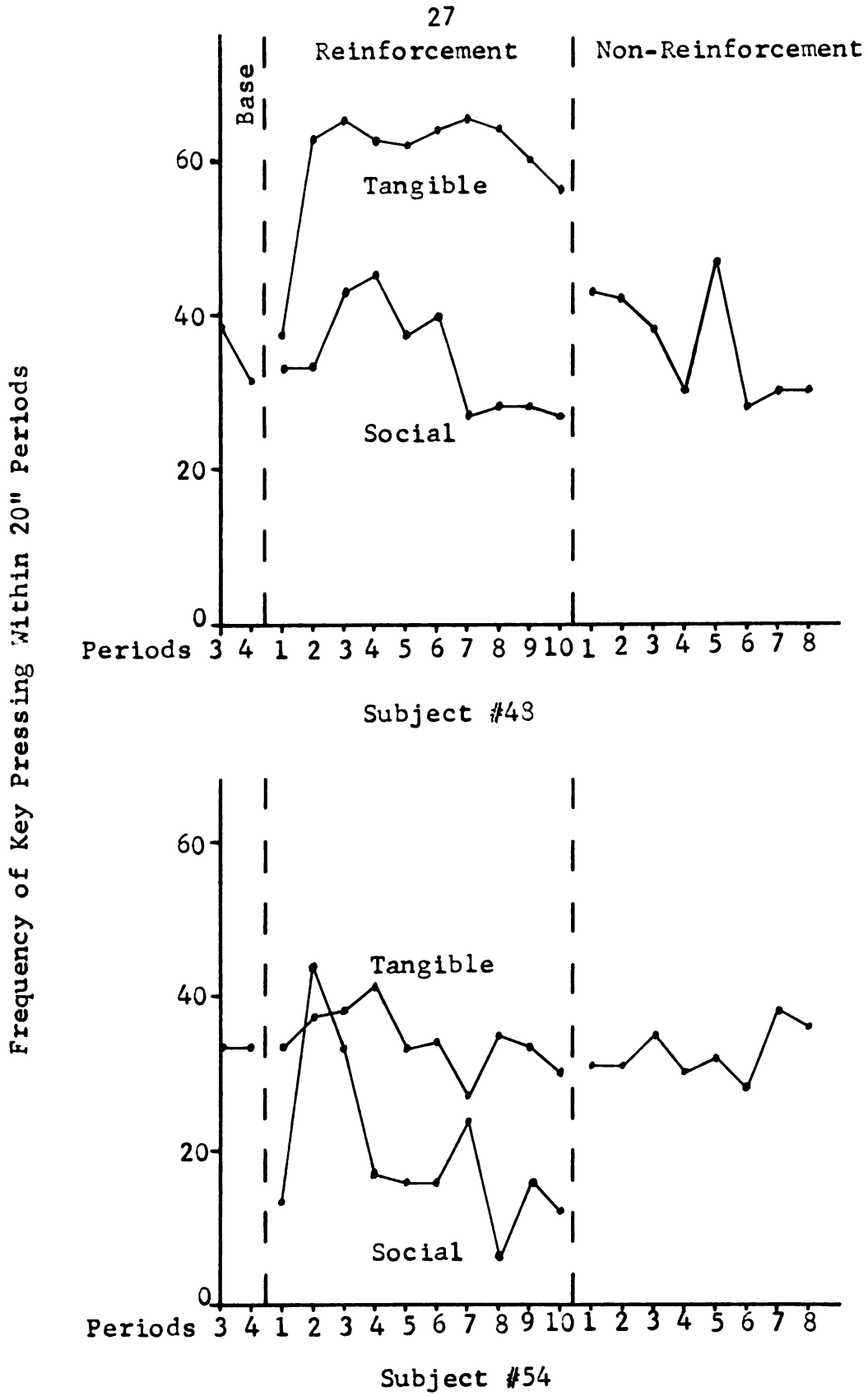

Figure 6. Performance of Two Subjects Alternated Between Tangible and Social Reinforcement

in performance from the last trial under social reinforcement to the first trials under the Non-Reinforcement Period indicates that the approval comments may have served to depress performance in later trials under social approval comments. As the group data indicates this pattern of performance was the exception and not characteristic of most subjects.

There are no significant differences due to density of reinforcement and there are no significant interactions with this variable. Although there are no significant main effects due to sex, the sex by trial interaction is significant ($F = 5.68$, $df = 4, 192$, $p < .01$). Fig. 7 illustrates a greater increase in performance over trials for girls than for boys. An individual comparison between boys and girls across trial blocks 3, 4, and 5 is significant ($F = 4.27$, $df = 1, 48$, $p < .05$) indicating that in later trials girls responded more to the conditions of reinforcement than boys.

Comparison of Tangible, Social and Alternated tangible reinforcement. An analysis of variance was performed on the difference scores under the Reinforcement Period for the Tangible Reinforcement group (T), the Social Reinforcement group (S), and the Alternated group under the tangible reinforcement condition (A_T). The results appear in Table 2.

As in the above analysis there is a significant effect across trial blocks ($F = 13.04$, $df = 4, 192$, $p < .01$) from the general increase in response to reinforcement with trial blocks (Fig. 1) for all groups.

Figure 7. Performance of Boys and Girls During the Reinforcement Period for All Groups

Table 2

Analysis of Variance

Alternated Tangible Reinforcement

Source of Variation	df	MS	F
Between subjects	59		
A (reinforcement)	2	1220.10	4.34*
B (density)	1	1038.70	3.70
C (sex)	1	218.00	.78
AB	2	46.30	.16
AC	2	40.05	.14
BC	1	38.20	.14
ABC	2	809.15	2.88
Subj. w. groups	48	281.10	
Within subjects	240		
D (trial blocks)	4	376.85	13.04**
AD	8	84.90	2.94**
BD	4	11.43	.40
CD	4	142.05	4.91**
ABD	8	17.55	.61
ACD	8	15.13	.52
BCD	4	53.70	1.86
ABCD	8	52.29	1.81
Dxsubj. w. groups	192	28.91	

*$p \leq .05$
**$p \leq .01$

In this comparison there is a significant effect between reinforcement conditions ($F = 4.34$, $df = 2, 48$, $p < .05$) and a significant interaction between trial blocks and reinforcement conditions ($F = 2.94$, $df = 8, 192$, $p < .01$). It can be seen from Fig. 5 that response to reinforcement under the A_T condition begins around the same level as the S and T groups but increases at a more rapid rate with trial blocks. Individual comparisons across trial blocks 3, 4, and 5 indicate a significant difference between the group under the A_T condition and group S ($F = 8.13$, $df = 1, 48$, $p < .01$). The comparison between the group under the A_T condition and group T ($F = 2.52$, $df = 1, 48$, n.s.) did not reach the .05 level of significance. Comparisons of the increases in performance between trial blocks 1 and 5 shows that under condition A_T there is a significantly larger increase than for group T ($F = 27.64$, $df = 1, 192$, $p < .01$) or group S ($F = 19.25$, $df = 1, 192$, $p < .01$). This gives some evidence for a positive contrast effect.

As in the first analysis there are no significant effects on interactions due to density of reinforcement. There is no significant main effect due to sex, but the sex by trials interaction is again significant ($F = 4.91$, $df = 4, 192$, $p < .01$).

Comparison of groups under Non-Reinforcement. An analysis of variance was performed on the difference scores under the Non-Reinforcement Period for the Tangible Reinforcement group (T), the Social Reinforcement group (S), and the

Alternated group (A). The results appear in Table 3. The difference between groups is significant ($F = 3.28$, $df = 2, 48$, $p < .05$). On examination of Fig. 5 it can be seen that the performance of group T relative to base rate is well below groups A and S. Individual comparisons between groups T and A ($F = 5.16$, $df = 1, 48$, $p < .05$) and groups T and S ($F = 4.67$, $df = 1, 48$, $p < .05$) indicate that T is significantly lower than the other 2 groups.

There is a significant interaction of reinforcement density with trial blocks ($F = 4.87$, $df = 1, 192$, $p < .05$). In Fig. 8 it can be seen that performance of the low density group drops with trials while the high density group rises. Individual comparisons between the groups for trial block 1 and trial block 2 did not reach the .05 level of significance.

All other effects and interactions are non-significant.

Comparison of Alternated Conditions of Reinforcement. An analysis was performed to compare differences in performance under the alternated social condition of reinforcement (A_S) and the alternated tangible condition of reinforcement (A_T). This was done by calculating the difference for each subject between his last 4 trials under tangible reinforcement and the last 4 trials under social reinforcement. Response to tangible reinforcement was higher than social reinforcement. The mean difference per trial was 7.38 responses ($N = 20$) and was significant ($t = 3.65$, $df = 19$, $p < .005$). Although response to tangible reinforcement was greater for most

Table 3

Analysis of Variance

Non - Reinforcement

Source of Variation	df	MS	F
Between subjects	59		
A (reinforcement)	2	1774.30	3.28*
B (density)	1	.10	.00
C (sex)	1	182.50	.34
AB	2	96.80	.18
AC	2	68.35	.13
BC	1	22.60	.04
ABC	2	327.80	.61
Subj. w. groups	48	541.09	
Within subjects	240		
D (trial blocks)	4	25.20	1.29
AD	8	37.15	1.90
BD	4	95.40	4.87*
CD	4	.10	.01
ABD	8	52.55	2.69
ACD	8	4.05	.21
BCD	4	6.20	.32
ABCD	8	1.25	.06
Dxsubj. w. groups	192	19.57	

*$p < .05$

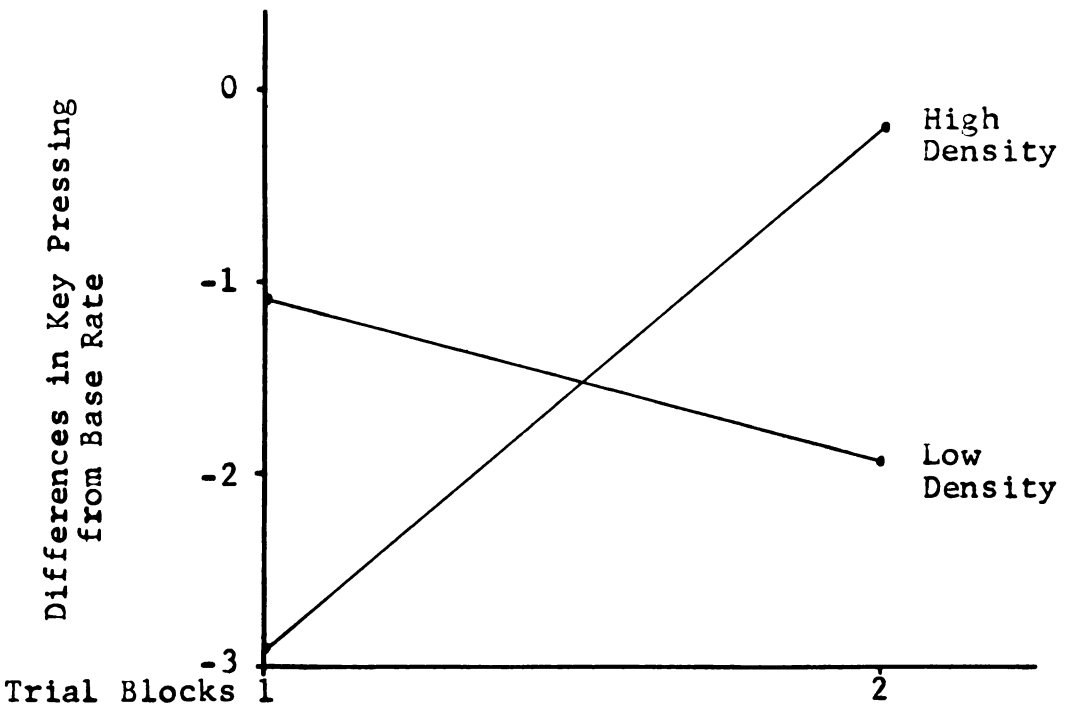

Figure 8. Performance of High and Low Density Reinforcement Groups During the Non-Reinforcement Period

subjects, examination of each individual's performance revealed two subjects who responded consistently higher to the social approval comments.

Analysis of Teacher Ratings

In one kindergarten class (N = 19) a teacher's aide provided an opportunity to test the reliability of the scale ratings. Correlations between the teacher and her aide were r = .665 ($p < .0005$) for cooperation, r = .810 ($p < .0005$) for persistence, r = .509 ($p < .01$) for response to approval comments, and r = .133 (n.s.) for response to tangible rewards. This indicates reasonable agreement on the first 3 rating categories, and poor agreement on the rating for response to tangible rewards.

Intercorrelations of the teachers' ratings (the aide's ratings were not included in these analyses) on the 60 subjects are presented in Table 4. They show a significant relationship between ratings for cooperation, persistence, and response to social approval comments. There is a significant low negative correlation between persistence and response to tangible reward and a significant low positive correlation between response to social approval comments and response to tangible reward.

Correlations between the performance of subjects on base trials 3 and 4 with teacher ratings are low but significant for cooperation (r = .293, $p < .05$), persistence (r = .258, $p < .05$) and response to tangible reinforcement (r = .259, $p < .05$) and non significant for response to

Table 4

Intercorrelations of Teacher Ratings

	Cooperation	Persistence	Response to Approval Comments	Response to Tangible Reward
Cooperation	—	.73**	.65**	-.12
Persistence	—	—	.48**	-.24*
Response to Approval Comments	—	—	—	.24*
Response to Tangible Reward	—	—	—	—

*$p \leq .05$
**$p \leq .0005$

Table 5

Correlations Between Teacher Ratings and Difference Scores

		Reinforcement Period trial blocks					Non-Reinforcement Period trial blocks	
	Teacher Ratings	1	2	3	4	5	1	2
Group T (N = 20)	Cooperation	-.101	-.008	-.062	-.097	.072	-.117	-.138
	Persistence	-.036	-.047	.023	.079	.158	-.043	.044
	Resp. to S. A. Comments	-.169	-.183	.000	-.020	.160	.013	-.072
	Resp. to T. Reward	-.393*	-.557**	-.557**	-.435*	-.434*	-.062	-.105
Group T (N = 20)	Cooperation	-.268	-.190	-.230	-.248	-.159	.000	.050
	Persistence	-.042	-.030	-.152	-.233	-.175	-.029	-.020
	Resp. to S. A. Comments	-.089	-.090	-.124	-.151	-.121	-.035	-.118
	Resp. to T. Reward	.040	-.005	.064	.142	.106	+.005	-.081

* $p \leq .05$
** $p \leq .01$

social approval comments (r = .109, n.s.).

Correlations between ratings and difference scores for both the group under tangible reinforcement (T) and the group under social reinforcement (S) are found in Table 5. The only significant relationship is between ratings for response to tangible reward and performance of group T in the Reinforcement Period and this relationship is in a negative direction. Since the rating for response to tangible rewards is so unreliable the meaning of this "significant" relationship is ambiguous.

DISCUSSION

Difference in Response to Tangible and Social Reinforcement

Although the means were in the predicted direction the group exposed to the tangible reinforcement situation did not respond in a superior manner to the group rewarded by social approval comments. The reason the differences in the means were not significant was the large variation between subjects in response to both of these two reinforcement conditions. Perhaps a difference could have been demonstrated by making the social reinforcement weaker such as Costello (1967) did by concealing her E's behind a screen or by making the tangible reinforcement stronger. In an attempt to be "fair" this author used the strongest social and tangible reinforcement he could think of for this experimental comparison. If this experiment was a fair comparison it certainly does not give much support for the general use of tangible reinforcement systems in place of social reinforcement, at least with kindergarten children.

In the group exposed to both tangible reinforcement and social approval comments response was greater to the tangible reinforcement situation, however, this difference is probably not due to the absolute value of these two kinds of reinforcement, but rather an interaction effect which will be discussed below. It is important to note that even though the response rate increased more under tangible reinforcement for most subjects in this group, this was not

true for all subjects. The most appropriate kind of reinforcement to be used in individual treatment situations can only be determined by observing that individual's response to various kinds of reinforcers.

Contrast Effects

By far the most interesting result of this experiment was the response to tangible reinforcement when this condition was alternated with contingent social approval comments. The increase in response rate over trials under this condition was more than either of the groups under tangible or social reinforcement alone. This difference is difficult to explain as a positive contrast effect, particularly since the group under tangible reinforcement did not differ significantly from the group under social reinforcement. A weak argument could be made that even though the difference between these two groups was not significant there still may be a difference in magnitude that produced a contrast effect in the alternated group. Because this difference would be so small it is doubtful if it could produce such a contrast effect, as the contrast would be even larger than the difference between magnitudes of reinforcement.

Another possible explanation is that since tangible reinforcement was alternated with social reinforcement there was less satiation under the tangible reinforcement condition. This is a weak argument because there was no difference between the high and low density schedules of reinforcement during the Reinforcement Period. If there was

satiation under tangible reinforcement the low rate schedule should have been more effective. Perhaps variety of reinforcement was the important factor, but if this was so response under alternated social reinforcement should have been superior to the response of the group under constant social reinforcement. Perhaps the strongest explanation is the one proposed in the introduction, that tangible reinforcement may be more potent because it has intrinsic value and at the same time may represent social approval. Even though approval comments were not paired with tangible reinforcement, exposure to social reinforcement by E on alternate trials may have strengthened the association of social approval and tangible reinforcement creating an additive effect.

This effect may be related to the results of two experiments employing token systems in classroom situations. Kuypers, Becker, & O'Leary (1968) found minimal effects in experimental manipulations of their token system as contrasted to quite dramatic effects reported by O'Leary et al. (1967). On examination of their failure Kuypers et al. (1968) discuss a major difference in the implementation of the two programs. The teachers in the successful program had extensive training in the application of behavioral principles emphasizing the use of contingent social reinforcement while the teachers in the minimally effective program had no such training. This suggests that in application of tangible reinforcement systems the social component may be a crucial factor.

Although there was no evidence for negative contrast or biphasic effects in the group data this does not exclude the possibility of Jekyll - Hyde effects for those individuals where there is high regard for tangible reinforcement and relatively low regard for social reinforcement. In subjects #48 and #54 it is possible that the alternating tangible reinforcement first seemed to increase responding under social reinforcement and then to depress responding under social reinforcement. The fact that both subjects' performance increased from later trials under social reinforcement to initial trials with no reinforcement may mean that in the later alternations social reinforcement had become aversive and served to depress the response rate in this condition.

Generalization to the Non-Reinforcement Situation

While the groups with an experimental history of social reinforcement remained above baseline after the shift to the non-reinforcement situation the superior response of the group under alternated tangible reinforcement was not maintained after the shift. After the shift to non-reinforcement the response of the alternated group was no different than the group that had received no tangible reinforcement.

While the group receiving tangible reinforcement was no different in response to reinforcement than the group on social reinforcement, after the shift to the non-reinforcement situation performance dropped well below baseline, and significantly below the performance of the groups which had

social reinforcement in their experimental history. A number of behaviors were observed during this period that suggested frustration in several children from the tangible reinforcement group. These behaviors included very heavy key pounding, polite requests for more tangible rewards, shouts at E that S was not being rewarded, and various attempts to open the screen covering the candy chute. These behaviors were not observed in the other groups. Why was there such a decrease in the performance of this group and not in the groups which had experienced social reinforcement?

There is a big difference in the stimulus qualities of social and tangible reinforcement. In the natural environment a good deal of human behavior is probably maintained by intermittent social reinforcement. Because of this the social reinforcement condition was not highly unlike reinforcement conditions these children experienced outside the experimental situation. In fact, the situation was quite similar to a parent or teacher giving a child a new task along with a high rate of contingent attention and then leaving the child to perform the task by himself with only occasional adult attention needed to maintain the new response. In contrast the tangible reinforcement in this experiment, like many tangible reinforcement systems employed with children, is very unlike most reinforcement systems in the natural environment. The shift from an experimental history of only tangible reinforcement to the situation of non-reinforcement was quite abrupt with less generalization than the shifts

for those children who had experienced an experimental history that had included social reinforcement. A close look at the effect of reinforcement schedules under the non-reinforcement situation gives some support for this interpretation.

A high density reinforcement schedule is less like non-reinforcement than a low density schedule. Performance of the low density group decreases gently with trials under the non-reinforcement situation as would be expected in extinction. However, performance of the high density group rises from the point at which the shift was made from reinforcement to non-reinforcement. It is quite possible that the rise is due to a decrease in a frustration effect associated with the point of shift to the non-reinforcement situation. Although this rise was not large enough to be significant, the interaction between the rise for the high density group and the drop for the low density group was significant. Since the high density reinforcement situation was more different than non-reinforcement, this group may have responded with more frustration effects on the shift to non-reinforcement.

The Dr. Jekyll - Mr. Hyde phenomenon described in the introduction may be more related to the shift from tangible reinforcement (inside the classroom) to non-reinforcement (outside the classroom door) than the alternation between tangible reinforcement and relatively high rate social reinforcement delivered in the highly structured experimental

situation. If this experimental analogy is valid, response level under tangible reinforcement situations may not generalize very well to non-reinforcement situations, indeed, it may even produce frustration effects and serve to depress response levels. Needless to say, in the LJR project we did not wait for the results of this experiment to increase the rate of contingent social reinforcement in the classroom and gradually shift the tangible reinforcement to increasingly intermittent schedules. For those children who were not entirely "weaned" from tangible reinforcement but who were ready to go back to public school classrooms we devised daily and then weekly report cards backed by long term rewards from parents to ease the transition back to consequences of the natural environment.

Sex Differences

In this study the girls' rate of increase in response to reinforcement was greater than the boys. In light of the interaction effects between sex of E and sex of S's (Gerwitz & Baer, 1958a; Stevenson, 1961) the assertion cannot be made that girls respond better than boys to reinforcement. It could be that boys would have performed better with a female E. Recent experiments and reviews of the literature in this area (Rosenbaum, 1969; Dusek, 1969) show inconsistent findings and the possibility that a number of variables are involved in sex differences in response to reinforcement situations.

The major reason sex was included as a variable in this study was to control for the possibility of confounding interactions between sex and response to the different reinforcement conditions. There were no confounding interactions.

Teacher Ratings

The intercorrelations between ratings indicates that the teachers in this study perceived strong common elements in ratings of cooperation, persistence, and response to social approval. The low negative correlation between ratings of persistence and ratings of response to tangible rewards means there is a slight tendency for teachers to perceive persistent children as responding less to tangible rewards and/or children who respond well to tangible rewards to be less persistent. The implications in this perception may be that tangible rewards are most useful for those children who are not "naturally" persistent.

Initial response to instructions from an adult during the base period was related to ratings for cooperation, persistence, and response to tangible reinforcement but the predictive value of the ratings are quite low. It is an interesting inconsistency that the one rating category that was predictive of response to the reinforcement situation was the rating on which there was almost no agreement between the teacher and her aide. The indication is that this teacher agreed more with the other three teachers on the meaning of response to tangible reinforcement than with her aide. What is surprising is that the prediction of response

to tangible rewards has a negative relationship to actual response of children to tangible reinforcement. In general, there was better agreement on teacher perception of the meanings of the ratings for their children than between teacher ratings and the actual performance of the children in the experimental situation. Teacher ratings were poor predictors of their children's performance.

Major Conclusions

The primary findings of this study are that for kindergarten children tangible rewards do not generally have more reinforcement value than social approval comments from an adult. A combination of tangible and social reinforcement may be more effective than tangible or social reinforcement alone. Response level under tangible reinforcement may not generalize to a non-reinforcement situation and under some conditions may cause more of a decrease in response level than responses previously reinforced by social reinforcement. Although there are wide variations between individual children in response to social and tangible reinforcement, teacher ratings are of little value in predicting the response of individual children.

It appears that the application of operant conditioning principles to treatment of childrens' behavior is not so simple as rewarding appropriate responses. There is wide variation in the way children respond to different kinds of rewards and much thought must be given to the manner in which appropriate responses are shaped and strengthened so

that they can eventually be maintained by natural consequences. An important guideline of the IJR project has become a rule that no artificial structure is imposed as part of the treatment program without plans for shifting control of the behavior to the natural environment.

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APPENDIX

Estimate how well you think each child would perform when asked to do a boring task like pushing a button down over and over again. Rate each child on cooperation, persistence, responsiveness to social approval and responsiveness to tangible rewards.

Cooperates With Adult Instructions

Give the most cooperative child a 7.

Give the least cooperative child a 1.

Then rate the rest of the children.

	Least Cooperative					Most Cooperative
________ 1	2	3	4	5	6	7

Name	Least Cooperative						Most Cooperative
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7

Persistence - Performs Well Throughout an Extended Period of Time

Give the most persistent child a 7.

Give the least persistent child a 1.

Then rate the rest of the children.

	Least Persistent					Most Persistent
____________ 1	2	3	4	5	6	7

____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7
____________	1	2	3	4	5	6	7

Responsiveness to Adult Approval - Performance Increases When an Adult Says Encouraging Things Like "You're Doing a Good Job;", "Very Good!", etc.

Give the child most responsive to adult approval a 7.
Give the child least responsive to adult approval a 1.
Then rate the rest of the children.

	Least Responsive						Most Responsive
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7
________	1	2	3	4	5	6	7

Responsiveness to Tangible Rewards - Performance Increases When Encouraged by Tangible Rewards, Such as Candy And Toys.

Give the child most responsive to tangible rewards a 7.
Give the child least responsive to tangible rewards a 1.
Then rate the rest of the children.

	Least Responsive					Most Responsive
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7
________________	1	2	3	4	5	6	7