THE APPLICATION OF GROUP CONTINGENT REINFORCEMENT TO RETARDED ADULTS

THESIS

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By

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Two groups of eleven retarded adults each were used as subjects. An individually consequated token economy was in effect during baseline-1 for both groups. The treatment phase of the experiment consisted of group consequation, the first group receiving a high rate of reinforcement and the second group receiving a low rate. The individual token system was reinstated for both groups during baseline-2 measures. Attending behavior and work output were measured during each phase of the experiment.

Significant differences were found between group versus individually contingent reinforcement treatments on attending behaviors, and between high and low contingency groups on performance behaviors. Differences between the high contingency and low contingency groups were found to be nonsignificant in regard to attending behaviors.
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THE APPLICATION OF GROUP CONTINGENT REINFORCEMENT TO RETARDED ADULTS

The use of reward for good behavior has long been recognized as effective in behavior control. As early as the twelfth century, prizes of sweet food were given to reward academic achievement in the teaching of the Torah (Franks and Wilson, 1973). In 1529, Erasmus advocated cherries and cakes in place of the cane in teaching children Latin and Greek (Skinner, 1966). Numerous means of reward have since been demonstrated, however, the systemized use of reward on a frequent basis has only recently been advocated. Before 1961, when token programs were developed with children (Staats, Staats, Schulz, and Wolf, 1962) and adult psychiatric patients (Ayllon and Azrin, 1968), few token programs existed.

The basic ingredients in a token reinforcement program usually include a set of instructions as to which behaviors will be reinforced, a potentially reinforcing stimulus -- a token -- which is contingent upon behavior, and a set of rules for governing the exchange of tokens for back-up reinforcers such as prizes, activities, or food. The behavior of each group member is monitored and tokens rewarded or forfeited individually according to the predetermined rules of behavior. And, also according to predetermined rules, individuals may exchange tokens for backup rewards.
Token economies have several advantages over other means of rewarding appropriate behavior. Tokens can be provided easily at the time the behavior occurs rather than using more cumbersome rewards. In addition, tokens may be accumulated like money in order to purchase rewards of varying worth. In much the same manner, the use of tokens makes it possible to offer a wider selection of rewards.

At this time, token economies are widely used with groups. High levels of accuracy and rates of study were obtained with the instatement of a token reinforcement system in a classroom of 15 retarded children by Birnbrauer, Wolf, Kiddler, and Tague (1965). When tokens were removed from the system, it was found that only four of the 15 subjects returned to levels of disruptive behavior which were noted before the token economy was established. In decreasing undesirable classroom behavior, Dietz and Repp (1973) effectively reduced "talking out" behavior in normal high school girls. Tokens were used to eliminate disruptive behavior and increase adaptive behavior in a classroom of 17 "emotionally disturbed" children (O'Leary and Becker, 1967).

In another study by Perline and Levinsky (1968) the effect of token reinforcement on the maladaptive behaviors of severely retarded children was investigated. Tokens were dispensed for not performing five specific behaviors. On the other hand, tokens were surrendered or subjects were led to a time-out period for inappropriate behavior. Although
the frequency of deviant behaviors decreased, there were no significant differences between using token reinforcement and token reinforcement with time-out. Following the conditioning period, no attempt was made to return to baseline conditions.

A modification of such a token system is group contingent reinforcement, which differs from the individually contingent token system in regard to the manner in which tokens are rewarded. Group behavior, or the behavior of individuals in a selected subgroup, is the basis upon which tokens are rewarded or forfeited. In group systems, each member typically receives the same number of tokens. Consequently, the number of tokens each member receives is only indirectly dependent upon his individual behavior. This is in contrast to the individually contingent system, in which the number of tokens each individual receives is directly dependent upon that individual's behavior. In a group contingent system, additional components, such as a set of behaviors to be reinforced, a potentially reinforcing stimulus -- a token -- which is contingent upon behavior, and rules for governing the exchange of tokens for back up reinforcers, remain essentially the same as in an individually contingent system.

The present study is an investigation of the group contingent system. This method of reinforcement has been shown to be applicable both in reducing disruptive behaviors
and in increasing adaptive behaviors. One of the earliest attempts to measure group contingent phenomena (Gallagher, Sulzbacher, and Shores, 1967) eliminated out-of-seat behavior in a classroom. "Naughty finger" behavior was eliminated using a group contingent system with reinforcement based upon the subjects' displaying the most appropriate behavior in the group (Sulzbacher and Houser, 1968). Any instance of "naughty finger" by any class member cost the entire class two minutes of play time.

Disruptive behaviors in a fourth-grade class were eliminated by having two teams compete in the "good behavior game" (Barrish, Saunders, and Wolf, 1969). In this procedure, the teacher listed several rules, which stated that during certain times the children were not to be out of their seats or to talk with their classmates without permission. Then, the class was divided into two teams and labels for each team were written on the blackboard. If any member of a team talked to his classmates or left his seat without permission, the team received a mark under their name. The team with the fewest marks would win. Further, if any team had fewer than a criterion number of marks it would win the game regardless of whether the other team had fewer marks. Through a series of experimental manipulations, the authors clearly showed that the good behavior game had a very powerful effect in reducing disruptive behavior. In addition, the game seemed relatively easy to implement in that the
teacher was not required to attend differentially to each individual student in the class with praise and/or disapproval. Also, the behavioral recording system was easily usable by the teacher for a variety of behaviors and did not necessarily require the presence of an additional classroom observer, except for reliability determinations. These positive points of the good behavior game can be generalized to various applications of group behavior modification.

The utilization of operant principles in a public school classroom was investigated by Schmidt and Ulrich (1969) using the combined behavior of a group of persons as the dependent variable. Excessive sound level intensity was selected as the target behavior. Reinforcement contingencies consisted of a two-minute addition to the class gym period and a two-minute break after maintenance of an unbroken ten-minute quiet period. The data indicated that control and suppression of sound intensity levels can be accomplished by the use of group contingencies. A second experiment demonstrated that such reinforcement contingencies can also reduce the frequency of teacher reprimands. Peer consequences in the form of threatening gestures, arm moving, and facial expressions were observed in this study, indicating an additional factor of group pressure in reducing disruptive behavior. The effect of this factor, however, was not isolated. The importance of this study is further
enhanced by the practicality and economic feasibility of employing such a technique to control an entire classroom.

An attempt to investigate the differential effects of individual versus group contingencies, as well as the involvement of personnel-student ratios and limited use of apparatus was undertaken by Axelrod (1971). Using a regular classroom setting a lack of significant difference between an individual contingency and a group contingency was found, which did not support the hypothesis that the group contingency would produce significantly fewer disruptions than the individual contingency. An explanation of the findings suggested possibilities such as negative effects of group contingencies (threats and gestures were a source of disruption themselves). The mode of reinforcement may not have been effective for all students, and it was felt that environmental control is less stringent when group contingencies are applied.

Increases in desired behavior were achieved by Packard (1970) and Willis and Crowder (1972). Both experimenters increased attending behaviors. Packard used a token system and Willis required a given amount of attending behavior, measured in terms of time. In the Willis study, a movie at the end of the day was contingent upon a minimum amount of attending behavior of all class members.

Good study behaviors and high productivity of accurate work were achieved by Long and Williams (1973). The major
The purpose of the Long and Williams (1973) study was to assess the relative effects of group versus individually contingent free time in modifying student behaviors. Eight students in an inner-city seventh-grade class of thirty-two black students served as subjects. Both group and individually contingent free time produced substantially higher levels of appropriate behavior than baseline conditions. In addition, the group reinforcement procedure appeared to be slightly more effective than individual reinforcement.

The efficacy of group contingent behavior modification in comparison to individually contingent behavior modification has, therefore, been demonstrated numerous times. Further study of the system requires examination of procedures involved in group contingent behavior modification. Group systems can be classified according to the method employed to assess group rates of reinforcement. Alternatives include variants of two procedures: (1) member are reinforced according to collective group performance (Long and Williams, 1973); (2) members are reinforced according to the behavior of a subgroup. Subgroups can be chosen randomly (Schmidt and Ulrich, 1969), or according to high or low rates of behavior (Sulzbacher and Houser, 1968; Barrish, Saunders, and Wolf, 1969; and Drabman, Spitalnik, and Spitalnik, 1974).

Examination of the different reinforcement contingencies yielded data which showed no difference between the four different methods of reinforcement in the application of
token economies. The four different methods examined were:
(1) individual reinforcement determined by individual performance, (2) group reinforcement determined by the lowest rate of performance, (3) group reinforcement determined by the highest rate of performance, and (4) group reinforcement determined by a randomly chosen performance (Drabman, et al., 1974). Results of the experiment showed a significant decrease of inappropriate behavior for the disruptive children employed as subjects and no difference between the effectiveness of the four types of token economies in producing behavior change. However, Arizpe (1974) showed some advantage of low contingency reinforcement in regard to participation, especially considering the cost of examiner time and number of tokens. If the behavior of the group was reinforced at a rate prescribed by the lowest producing members, behavior was maintained at an effectively lower cost.

The present study was an attempt to ascertain any differences in rates of behavior, specifically in regard to the different methods employed to assess group rates of reinforcement, as ascertained by subgroups. An examination of individual versus group contingent behavior modification was made in addition to the initial investigation. The null hypotheses were:
1. There would be no difference in the attending behavior of the subjects under the group and individually contingent systems of reinforcement.

2. There would be no difference in the work output of the subjects under the group and individually contingent systems of reinforcement.

Method

Subjects

Two groups of 11 subjects each were composed of mentally retarded adults currently assigned to a workshop for the retarded. All were participating in the school's ongoing prevocational program which serves as preparation for the Work Activity Center in which they were enrolled.

Apparatus

The subjects were reinforced with tokens. The tokens are small plastic discs approximately one-inch in diameter. They are ordinarily exchanged twice each week for selected items at the school Token Store; however, tokens earned during the experimental session of the subjects' workday were traded in at the end of each session for treats. A choice of treats was provided, including M&M's, saltine crackers, cheese crackers, suckers, and pieces of chocolate.

All subjects worked on a vocational-skill task which consisted of placing transistors in packaging. Two hundred
fifty transistors were placed in individually partitioned slots, with each box having 25 rows and 10 columns. For the purpose of this study, half a box, or 125 transistors, correctly placed, constituted one work unit. Transistors were placed in accordance with workshop rules, base up, with orderly placement in rows from left to right.

**Scoring**

Two aspects of the subjects' behavior were measured as independent variables. Work output was measured in terms of work units successfully completed. Attending behavior was measured at five-minute intervals during the thirty-minute work period (providing for six checks of attending behavior per class period).

A student was considered to be attending if he was working on the presented task, watching his or her work, and sitting quietly. Subjects were also considered to be attending if they were sitting quietly with hand raised, waiting to speak to the examiner, or if they were speaking to the examiner about a matter directly related to the task.

To determine the consistency with which the target behavior was measured, reliability checks were conducted by a second observer. Reliability checks were made twice each week during the five weeks of the experiment. Therefore, ten reliability checks were made during the entire course of the experiment.
Procedure

Baseline 1.--The baseline 1 condition was the standard individually contingent token system which had been in effect in the prevocational center for several months prior to the experiment. Data were taken concerning each individual's number of completed tasks and attending behaviors. Baseline 1 was in effect for one week.

Treatment.--Random assignment by the flip of a coin determined under which contingency each of the two groups were reinforced. Three members of the first group were selected from baseline 1 data as being the highest performers in that group. Accordingly, three members of the second group were selected from baseline 1 data as being the lowest performers in the second group. The three chosen in each group were labeled the contingent subgroup and each group was labeled as the high or low contingency group, thus giving rise to the labels of high contingency subgroup and low contingency subgroup for the two subgroups involved. During the treatment phase of the experiment, the members of each group received tokens uniformly as determined by the attending behavior and work output of the contingent subgroup within each group. The treatment phase of the experiment remained in effect for two weeks.
Baseline 2.—Following the application of the group contingency token system, both groups returned to the original individually consequated token system. Each subject was again rewarded tokens contingent upon his or her own work output and attending behaviors. Baseline 2 was also in effect for two weeks.

Results

Reliability

Pearson product-moment correlations were computed to assess the reliability of the observations made. For each of the ten days that data were taken by an observer, the experimenter's data was paired with the second observer's data for each subject on attending and work output measures. A Pearson \( r \) was computed for these pairings. For attending data, the correlations ranged from .926 to .954, with a mean correlation of .940. For performance behavior, pairings yielded correlations ranging from .932 to .997. The mean correlation obtained for work output observations was .965. The high correlations obtained suggest that the observed behaviors were sufficiently well defined to allow relatively accurate measurement.

Group Data

The subject of low and high contingency reinforcement rates was explored by analysis of variance with repeated
measures for equal group sizes (Winer, 1971). Differences
between the high contingency reinforcement group and the
low contingency reinforcement group were found to be nonsig-
nificant \((p > .57)\) in regard to attending behaviors, as
shown in Table I.

**TABLE I**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum. of Sq.</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>Between Subject</td>
<td>21</td>
<td>21.29</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B (Groups)</td>
<td>1</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Error B</td>
<td>20</td>
<td>20.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Within Subjects</td>
<td>88</td>
<td>26.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A (Treatments)</td>
<td>4</td>
<td>7.40</td>
<td>1.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AB (Interaction)</td>
<td>4</td>
<td>1.30</td>
<td>9.32</td>
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<tr>
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<td></td>
<td>Error W</td>
<td>80</td>
<td>17.91</td>
<td>9.22</td>
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<td></td>
<td>Total</td>
<td>109</td>
<td>47.90</td>
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*Indicates significance at the .05 level.
A significant difference ($p < .055$) was found, however, for work output between the high and low contingency reinforcement groups.

<table>
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<tr>
<th>Source of Variation</th>
<th>df</th>
<th>Sum. of Sq.</th>
<th>MS</th>
<th>F</th>
<th>P</th>
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<td>Between Subject</td>
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<td>B (Groups)</td>
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<td>11.10</td>
<td>4.18</td>
<td>0.05*</td>
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</tr>
<tr>
<td>Within Subjects</td>
<td>88</td>
<td>12.53</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A (Treatments)</td>
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<td>0.30</td>
<td>2.21</td>
<td>0.07</td>
</tr>
<tr>
<td>AB (Interaction)</td>
<td>4</td>
<td>0.62</td>
<td>0.15</td>
<td>1.15</td>
<td>0.34</td>
</tr>
<tr>
<td>Error W</td>
<td>80</td>
<td>10.73</td>
<td>0.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>109</td>
<td>76.73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates significance at the .05 level.

Treatment Data

Examination of group versus individually contingent reinforcement treatments was also undertaken employing analysis of variance. The different treatment methods were found to be different, significant at the .0001 level.
Differences between treatment methods were further examined employing Tukey's (b) tests (Winer, 1971), as seen in Table III.

TABLE III
TUKEY'S (b) TEST SUMMARY TABLE ON ATTENDING BEHAVIOR

<table>
<thead>
<tr>
<th>Week of Treatment</th>
<th>BI</th>
<th>T₁</th>
<th>T₂</th>
<th>BII₁</th>
<th>BII₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>.37</td>
<td></td>
<td></td>
<td>.40*</td>
<td>.39*</td>
</tr>
<tr>
<td>T₂</td>
<td>.34</td>
<td>.34</td>
<td></td>
<td>.39*</td>
<td>.37*</td>
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<tr>
<td>BII₁</td>
<td>.37</td>
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<td>BII₂</td>
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<td></td>
<td>.34</td>
<td></td>
<td></td>
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</tbody>
</table>

*Indicates significance at the .05 level.

Differences significant at the .05 level were obtained between week 1 of group contingent reinforcement (T₁) and the Baseline II, week 1 of individually contingent reinforcement (B II 1). Likewise, week 2 of group contingent reinforcement (T₂) was significantly different (p < .05) than Baseline II, week 2, of individually contingent reinforcement (B II 2). The initial Baseline I (BI), lasting one week and employing the individually contingent reinforcement method, was found not to be significantly different from either of the two following weeks of group reinforcement (T₁ and T₂) which
constituted the treatment phase of the experiment, or from the last two weeks of individually contingent reinforcement ($BII_1$ and $BII_2$) which was the second baseline employed.

The two methods of group and individually contingent reinforcement were not found to differ significantly in regard to performance, or in regard to work units as seen in Figure 2. Tukey's (b) tests (Winer, 1971) yielded nonsignificance in a comparison of all five weeks of data measured on performance, which involved: (1) BI -- individually contingent reinforcement; (2) $T_1$ -- group contingent reinforcement; (3) $T_2$ -- group contingent reinforcement; (4) $BII_1$ -- individually contingent reinforcement; and (5) $BII_2$ -- individually contingent reinforcement.

**Interaction**

Interaction effects between high versus low contingency reinforcement and group versus individually contingent reinforcement were found to be nonsignificant for both attending (Table I) and performance (Table II). Figures 1 and 2 depict the lack of interaction effects regarding attending and performance measures, respectively.
ATTENDING BEHAVIOR

Fig. 1--Interaction Effect

x = High Group Means
o = Low Group Means
Discussion

Results on attending behavior supported the null hypothesis that there would be no significant difference between high contingency group reinforcement and low contingency reinforcement. No statistically significant difference was found that is in support of current research. Utilizing token economies, it was found that there was no significant difference between the effectiveness of group reinforcement determined by children displaying the most disruptive behavior or the least disruptive behavior (Drabman, et al., 1974) in conjunction with present results.

Contradiction of current research (Long and Williams, 1973; Arizpe, 1973; Flynn, 1974; and Drabman, et al., 1974), however, is provided in the significant difference found between group contingent reinforcement and individually contingent reinforcement. Both weeks of group contingent reinforcement differed significantly from the two weeks of individually contingent reinforcement which constituted the period labeled BII. This recalls the previously discussed hypothesis of Axelrod (1971) that environmental control is less stringent when group reinforcement contingencies are employed. This appears to be true in relation to examiner time spent with subjects, as group reinforcement is less demanding in not only material rewards (tokens), but in the administration of social rewards. "You're doing well," spoken once,
suffices to reward on a group basis, but that phrase must be multiplied by the number of subjects in a given group when individual reinforcement is in effect. This theory of group contingencies adversely affecting environmental control may have in this case affected attending behavior, which is obviously a different type of behavior than is performance, as some subjects are able to produce at a high rate while attending little to the task at hand.

Data taken during the first week of the experiment did not differ significantly from the two weeks of group contingent reinforcement, which was the treatment phase of the experiment. This inconsistency is felt to stem from the novelty encountered during the first week of the experiment, as well as the later pairing of the examiner's social reinforcing value with the material reinforcers. The acquired socially reinforcing value of the experimenter was believed to have increased during the course of the study, confounding data to some extent.

High contingency reinforcement was found to differ significantly from low contingency reinforcement on work output, which recalls the findings of Arizpe (1973) who found that low contingency reinforcement more effectively maintained the behavior of a group than did high contingency reinforcement, especially with regard to the lower cost of such maintenance in terms of teacher time and number of tokens and backup reinforcers. The present study produced
findings in direct opposition to Arizpe's (1973), in that high rates of group contingent reinforcement appeared to be more highly effective in producing high rates of performance than did the low rates of group reinforcement. It should be noted, however, that the group reinforced at a high rate of group contingent reinforcement began the experiment at a high rate of productivity, and that the group contingent reinforcement merely maintained the original behavior. The performance of the group reinforced at a low rate of group contingent reinforcement, however, improved rather than merely remaining stable over time. Therefore, data which initially appear to be in contradiction of the current literature actually tend to support the theory that low rates of group contingent reinforcement are more effective in producing high rates of performance.

Group and individually contingent reinforcement methods did not produce significantly different levels of performance as had previously been indicated by previous research (Long and Williams, 1973; Arizpe, 1973; Drabman et al., 1974).

This finding, however, accentuates the need for further research in the area concerning types of behavior which can be successfully maintained by group contingent reinforcement, as well as the settings in which it is applied. The limited range of settings in which group contingent reinforcement has been applied experimentally is noted by Arizpe (1973), who ventured from the classroom where previous research had
been performed, to the out-of-doors and an exercise program. The workshop setting of this study differs greatly from that of the previously employed classroom and exercise settings, which points out the need for further research into the variables which may affect group and individually contingent reinforcement.

In addition, the need for further research into the differences between high and low rates of group reinforcement must be emphasized, as findings from this study conflict with the limited amount of research which is available at this time.

Summary

Twenty-two adult residents of a state school were used as subjects. The subjects had been participating for several months in a token-reinforced prevocational class. Baseline measures were taken of (1) attending behaviors of the subjects, and (2) the subjects' work output in a prevocational task with which they were familiar.

During the treatment phase, subjects were reinforced on the basis of the high performing subgroup in the first group of 11 subjects; and, in the second group of 11 subjects, reinforcement was received on the basis of the low performing subgroup. Measures were taken during treatment of the same two aspects of the subjects' behavior as were taken during the primary baseline. Following the treatment phase, the
original individually contingent system was reinstated and baseline 2 measures were taken of work output and attending behaviors.

An analysis of variance with repeated measures for equal size groups was employed to explore low and high contingency reinforcement treatments and any interaction effects. Unexpected significant differences were found between group and individually contingent reinforcement treatments of attending behaviors, as well as between high and low rates of group reinforcement of performance behaviors. Nonsignificance was the result of a comparison of performance measures under group and individually contingent reinforcement systems. Differences between high and low rates of group reinforcement of attending behaviors were found to be nonsignificant.

The supposition that environmental control is less stringent when group contingencies are employed was discussed in light of the findings. In consideration of the varying nature of the results, it was concluded that further research is needed in the areas concerning types of behavior which can successfully be maintained by group contingent reinforcement, as well as the settings in which it is applied. Further research is especially warranted in resolving the differences, if any, between the effects of high and low rates of group reinforcement.
References


