*THE INFLUENCE OF BEHAVIOR PRECEDING A REINFORCED
RESPONSE ON BEHAVIOR CHANGE IN THE CLASSROOM¹*

ALAN E. KAZDIN

THE PENNSYLVANIA STATE UNIVERSITY

The influence of behavior that immediately precedes a reinforced target response on the effectiveness of a reinforcement contingency was examined in two experiments with mentally retarded children in a special-education classroom. Two reinforcement schedules were examined in each experiment. For each schedule, a prespecified period of attentive behavior served as the target response. The schedules differed in whether inattentive or attentive behavior was required immediately to precede the target response. These schedules were examined with one child in a simultaneous treatment design using praise as the reinforcer (Experiment I), and with two children in separate reversal designs using tokens as the reinforcer (Experiment II). While attentive behavior increased under each schedule, the increase was greater when attentive rather than inattentive behavior preceded the reinforced response. The results indicated that the effect of a contingency may be determined not only by the specific response reinforced but also by the behavior that immediately precedes that response.

DESCRIPTORS: classroom behavior, simultaneous treatment design, reinforcement schedules, chains of behavior, tokens, praise, retarded children

It has been shown repeatedly that the contingent delivery of praise, feedback, and tokens increases various behaviors in educational settings (*cf.* Kazdin, 1977; Klien, Hapkiewicz, and Roden, 1973; O'Leary and O'Leary, 1972; Ulrich, Stachnik, and Mabry, 1974). Typically, attentive or on-task behavior has served as the target response in classroom investigations. Attentive behavior usually is reinforced based on a child's performance at the moment that a discriminative stimulus appears, such as the sound of a timer (*e.g.*, Schmidt and Ulrich, 1969), or on the basis of continuous performance over a particular time interval (*e.g.*, Hall, Lund, and Jackson, 1968). Once the target response is specified as part of the contingency, there is little or

no explicit statement about the behaviors that may precede the response, *i.e.*, what the child does immediately before the target response.

Occasionally, the behavior that precedes a reinforced response may be implicit in the contingency. For example, with extremely disruptive children, it is difficult to reinforce attentive behavior because the behavior occurs so infrequently. In such cases, one recommendation given to the teacher is to "catch" the child behaving appropriately (*e.g.*, Ackerman, 1972; Bushell, 1973; Clarizio, 1971; Madsen, Becker, and Thomas, 1968). This advice appears sound, particularly at the inception of a program when appropriate classroom behavior needs to be shaped. Interestingly, catching someone perform appropriate behavior suggests that appropriate behavior is immediately preceded by some inappropriate or disruptive behavior. Hence, the delivery of a reinforcer after appropriate behavior may represent reinforcement of a chain of responses, *viz.*, inappropriate behavior followed by appropriate behavior. Quite possibly the inappropriate behavior that immediately precedes per-

¹The author gratefully acknowledges the support and assistance of Gerald Robine, Nancy Silverman, Sally Geesey, Steve Macciocchi, Susan McLamb, and Joan Pulaski. Completion of portions of this report was facilitated by a grant from the National Institute of Mental Health (MH-23399). Reprints may be obtained from the author, Department of Psychology, The Pennsylvania State University, University Park, Pennsylvania 16802.

formance of a target response may influence the efficacy of the contingency. The effect of the contingency may depend on whether the target response is consistently preceded by a particular response, whether that antecedent response is incompatible with the target response, and other factors.

Although the behavior that immediately precedes a reinforced response usually is not specified as part of a contingency, it may influence the extent to which there is a change in a reinforced target response. The present investigations examined the influence of behavior that immediately precedes a reinforced target response on changes in the reinforced response. A given target response was defined and followed with reinforcing consequences. Under different experimental conditions, delivery of the reinforcer depended on the behavior that immediately preceded the target response. Specifically, a comparison was made between two schedules of reinforcing attentive behavior, depending on whether inappropriate or appropriate behavior preceded the attentive response. Two experiments were completed to increase the attentive behavior of disruptive retarded children. The experiments differed primarily in the type of experimental design (simultaneous treatment and reversal designs) and reinforcing event used (praise and tokens).

EXPERIMENT I

Experimental Design

The effects of different schedules of administering praise were evaluated on the attentive behavior of a retarded child. The interventions were evaluated in a simultaneous treatment design (Browning and Stover, 1971, McCullough, Cornell, McDaniel, and Mueller, 1974). Because the design is rarely reported in the literature, it is important to outline its general characteristics.

The design¹ begins with a baseline period. After baseline, two or more interventions are implemented concurrently to alter a single target response. The interventions are implemented in the same experimental phase but under varied

stimulus conditions. The stimulus conditions include different time periods or sessions of a given day and different experimenters or reinforcing agents. The interventions are balanced across the stimulus conditions so that their effects can be separated from the effects of these conditions. The intervention phase is continued until the response stabilizes under the separate interventions. In the final phase, the more (or most) effective intervention can be implemented across all time periods and experimenters to maximize behavior change.

In the present experiment, two interventions were evaluated and consisted of two different schedules (*S*₁ and *S*₂) of administering praise. Child behaviors were observed across two time periods (*T*₁ and *T*₂) each day. During each period, one of two reinforcing agents (*A*₁ and *A*₂) or experimenters was present. After baseline observations, the two different schedules were implemented by the agents. Each day, each schedule was administered but during different time periods by one of the agents. The schedules were balanced across time periods and agents so that these stimulus conditions were not confounded with the interventions. To balance these conditions, the agents alternated the time period in which they delivered praise each day. They alternated every two days in the schedule that they administered. The manner in which the schedules were balanced across agents and time periods is illustrated in Table 1.

Subject and Setting

An 8-yr-old boy, Sid (IQ of 75 on the Stanford Binet), was selected from a class of 15

Table 1

The administration of the two reinforcement schedules (*S*₁ and *S*₂) balanced across reinforcing agents (*A*₁ and *A*₂) and time periods (*T*₁ and *T*₂) in Experiment I.

Time Periods	Days					
	1	2	3	4	5	... <i>n</i>
<i>T</i> ₁	<i>S</i> ₁ <i>A</i> ₁	<i>S</i> ₁ <i>A</i> ₂	<i>S</i> ₂ <i>A</i> ₁	<i>S</i> ₂ <i>A</i> ₂	<i>S</i> ₁ <i>A</i> ₁	...
<i>T</i> ₂	<i>S</i> ₂ <i>A</i> ₂	<i>S</i> ₂ <i>A</i> ₁	<i>S</i> ₁ <i>A</i> ₂	<i>S</i> ₁ <i>A</i> ₁	<i>S</i> ₂ <i>A</i> ₂	...

educably retarded children at the demonstration school of The Pennsylvania State University. He was specifically selected for the project by the teacher because of his disruptive and inattentive behavior during periods of work. The investigation was conducted in the classroom. Two psychology undergraduate students (one female and one male) served as reinforcing agents and conducted the experimental interventions.

Assessment

The child and the reinforcing agents were observed daily for two separate periods beginning at 10:00 a.m. and 11:00 a.m. During each observation period, the class completed in-seat work assigned by the teacher. The reinforcing agent and Sid were observed for 50 intervals during each observation period (or 100 intervals per day) throughout the study. Each interval was divided into 10 sec of observation followed by 2 sec for recording. Thus, during each period, observations were conducted for a 10-min period (or a total of 20 min for the two periods each day). To maintain the observation schedule, observers listened through earphone jacks to a pre-recorded tape. Seven observers participated in the project. The observers sat at the opposite end of the classroom from the subject. Observer training, partially conducted in the classroom, provided an opportunity for the child to adapt to the observers' presence for several days before the study.

Reinforcing agent's behavior. The behavior of the reinforcing agent was observed concurrently with the behavior of the child. The frequency with which the agent delivered verbal approval contingent on attentive child behavior was scored. An instance of verbal approval consisted of saying one of the following statements, "Good, I like what you're doing!", "That's really good!", or "Good, you're doing nicely!". To score the agent's behavior, the observer recorded an instance of approval by making a check mark next to the interval on the child behavior scoring sheet in which approval was delivered. During the entire investigation, only those instances of

approval that were planned as part of the contingencies transpired between the agent and the subject in the observation periods.

Child behavior. The child's behavior was categorized as either attentive or inattentive (Kazdin, 1973b). To be scored for attentive behavior, the child had to be sitting in his seat, working on the assignment, or paying attention to the teacher. The child had to be attentive for the entire 10 sec of the observational interval. Behavior was scored as inattentive if the child did not meet the above requirements, played with materials inappropriate to the task, or reclined on his desk. Each day, individual in-seat work (usually working on arithmetic or writing from the board) constituted the assigned task. The type of work did not vary throughout the study.

Reliability of observations. Reliability checks were completed on 54.4% ($n = 37$) of the observation periods distributed across each reinforcing agent and each phase of the study. Reliability was computed by dividing agreements between observers by agreements plus disagreements and multiplying by 100 to calculate the percentage. For both reinforcing-agent behavior and child behavior, an agreement was defined as agreement on the occurrence of the behavior during the same interval. A disagreement was scored if one observer scored the occurrence of a behavior during an interval and the other did not. Interobserver agreement ranged from 83.3% to 100% for the reinforcing-agent's behavior (median = 100%) and 85.7% to 100% for child behavior (median = 94.1%).

Procedures

Throughout the investigation, one of the reinforcing agents was in the room and approximately 0.9 m behind the subject during each observation period. This arrangement was not awkward because of the seating arrangement, which placed the agent on the periphery of the class. The agent remained in the same location throughout the project to control for differential proximity across agents, interventions, and phases. During the intervention phases, the agent

delivered verbal approval contingent on attentive behavior. The delivery of approval was controlled by an experimenter in an observation booth separated from the classroom by a one-way mirror. The experimenter instructed the reinforcing agent when to deliver approval through a walkie talkie "bug-in-the-ear" device. The decision when to reinforce was made on the basis of a stopwatch monitored by the experimenter in the booth. When the time requirements had been met, the experimenter relayed this message to the reinforcing agent.

Experimental Conditions

A simultaneous treatment design, used to evaluate the effects of administering approval contingent on attentive behavior, consisted of three phases, including one baseline and two experimental phases. During the first experimental phase, two interventions were presented concurrently. The two interventions consisted of different schedules of delivering contingent approval. For both schedules, approval was always delivered for a constant period of attentive behavior. The difference in the schedules depended on what the subject was doing immediately before the period of attentive behavior that was reinforced. The second experimental phase presented the more effective schedule alone.

Baseline. Attentive child behavior was recorded without implementing specific contingencies to alter behavior for a period of eight days.

Approval₁. During this phase, approval was administered according to two different schedules. For each schedule, a 10-sec period of attentive behavior was praised by the reinforcing agent. For Schedule 1, 10 sec of attentive behavior was praised only if this response was preceded by 20 sec of inattentive behavior. For Schedule 2, 10 sec of attentive behavior was praised only if it was preceded by 20 sec of attentive behavior. Under each schedule, the maximum instances of approval available during a given period was constant (*i.e.*, one instance of approval every 30 sec or a maximum of approximately 16 instances of approval for every 50

intervals). After several days of the experimental phase, the second schedule was associated with a slightly greater frequency of approval because attentive behavior was increasing at a more rapid rate under this schedule. To remove differences in the amount of approval across schedules, an adjustment was made halfway through this phase (Day 18 of the study). For Schedule 1, the maximum instances of approval remained the same; for Schedule 2, the maximum was one instance of approval for each 50 sec (or 10 sec of attentive behavior preceded by 40 sec of attentive behavior).

As noted earlier, the two schedules were administered daily by the two reinforcing agents across two time periods. Each schedule was administered across each time period and each reinforcing agent approximately an equal number of times. Thus, the effect of the different schedules was not confounded by the time period in which it was delivered, the agent who administered the schedule, or the interaction of these variables. This phase lasted 19 days.

Approval₂. The final phase was designed to implement the schedule that was shown to be more effective in the previous phase. Schedule 2 was more effective and implemented as originally designed (10 sec of attentive behavior preceded by 20 sec of attentive behavior). This phase lasted seven days.

RESULTS AND DISCUSSION

Overall Effects

The effect of the interventions was evaluated from the percentage of intervals in which the subject was scored at attentive. The percentages are presented in Figure 1. The upper portion of the figure presents the combined data across reinforcement schedules, observations periods, and reinforcing agents. These data indicate that during baseline, Sid was attentive for a mean of 21.9% of the intervals. Attentive behavior rose to a mean of 67.2% when the two interventions were implemented in the second phase. Finally, the mean increased in the final phase to 84.0%

Fig. 1. Attentive behavior of Sid across experimental conditions. Baseline—no experimental intervention. Approval₁—implementation of Schedule 1 (approval delivered for attentive behavior preceded by inattentive behavior) and Schedule 2 (approval delivered for attentive behavior preceded by attentive behavior). These schedules were administered each day across different reinforcing agents and time periods. Approval₂—implementation of Schedule 2 across both agents and time periods. The upper panel presents the overall data collapsed across schedules, agents, and time periods. The lower panel presents the data according to the varied conditions under which the two schedules were administered, *i.e.*, across agents and time periods, although the different schedules themselves were administered only in the first approval phase.

when the more effective intervention (Schedule 2) was in effect across both observation periods.

Schedule Effects

The major question was whether the two schedules of administering praise differentially affected behavior. The effects of the schedules can be seen in the first Approval phase (lower portion of Figure 1) in which data are collapsed across time period and reinforcing agent. (The data are collapsed in an identical fashion across all phases, even though the two schedules were not presented in baseline and the final Approval phase.)

For Schedule 1, praise was delivered for an at-

tentive response only if that response was preceded by a period of inattentive behavior. For Schedule 2, praise was delivered for attentive response only if that response was preceded by attentive behavior. For Schedules 1 and 2, Sid received a daily mean of 6.95 and 7.42 instances of praise, respectively. Frequency of praise was approximately equal across both schedules. On 47.4% of the days, the frequency of praise was greater under Schedule 1, on 42.1% of the days, the frequency was greater under Schedule 2, and on 10.5% of the days, the frequency was identical under each schedule.

Although attentive behavior was praised under each schedule, the level of attentive behavior

differed across schedules. When the reinforced response was immediately preceded by inattentive behavior, mean attentive behavior was 52.8%. When the reinforced response was immediately preceded by attentive behavior, mean attentive behavior was 81.6%. The effect of the different schedules also is apparent in the second Approval phase in which Schedule 2 was implemented for both observation periods. The data indicated that performance during the periods in which the less effective schedule had been in effect increased to 82.0% during the final phase from a previous level of 52.8%.

The results suggest that the behavior immediately preceding a reinforced response influenced the extent of behavior change. Yet, the generality of the present results might be quite limited, given that a single subject was focused on with one type of reinforcer. Also, the experimental design may have contributed to the results (*cf.* Kazdin, 1973*a*). In the simultaneous treatment design, the two interventions were administered concurrently (in the same phase). Possibly the effect of one schedule on behavior was influenced by the concurrent administration of another schedule. While this does not affect the internal validity of the demonstration, it may affect the external validity or generality of the findings. The concurrent use of two treatments is one form of multiple treatment interference and may yield different results from those achieved without concurrent administration of the treatments.

EXPERIMENT II

Overview

This experiment examined the generality of the effects of the reinforcement schedules evaluated in the previous experiment. In Experiment II, the experimental design, reinforcer, and agent who administered the contingencies were altered. Specifically, two children were exposed to each of the different reinforcement schedules in separate reversal designs. The order in which the schedules were presented was balanced across

subjects. Tokens and approval, rather than approval alone, served as the positive reinforcer. Also, the classroom teacher, rather than extraneous reinforcing agents introduced into the situation, administered the contingencies.

Subjects and Teacher

Two moderately retarded children selected from the same class as the child in Experiment I served. Mel, age 8, had an IQ of 73 on the Stanford Binet. Fran, age 9, had a full scale IQ of 68 on the Wechsler Intelligence Scale for Children. The teacher who administered the interventions was a 26-yr-old female who had experience in conducting classroom behavior-modification programs.

Assessment

Each child was observed once each morning for 50 intervals (10-sec observe, 2-sec record) as they performed assigned seat work (from arithmetic and reading Distar Level I workbooks). For each child, the observations and interventions were conducted at separate times. Each day, Mel was observed for the first observation period (beginning at approximately 10:30 a.m.) and Fran was observed for the second period (beginning at approximately 10:45 a.m.). Teacher behavior was observed concurrently with child behavior in these periods.

The teacher behavior that was scored consisted of the simultaneous delivery of a token (a check mark placed on a card on the child's desk) and approval. Approval consisted of one of the statements listed in the previous experiment and was paired with token delivery. Each child was observed for intervals of attentive and inattentive behavior. The methods of scoring teacher and child behavior were identical with those of Experiment I. Eight observers participated in the project.

Reliability of observations. Reliability checks were completed on 59% ($n = 36$) of the observation periods distributed across both subjects and all phases of the experiment. Occurrence reliability, computed according to the method de-

scribed in Experiment I, ranged from 80% to 100% for teacher behavior (median = 100%) and 81.8% to 100% for child behavior (median = 90.9%).

Procedures

Throughout the experiment, the teacher administered all contingencies. During the experimental phases, the teacher administered tokens and approval according to different reinforcement schedules. To adhere to each schedule, the teacher was cued by an experimenter (who monitored behavior with a stopwatch through a bug-in-the-ear device). Each day of an experimental phase, the teacher explained to the child that (s)he would receive tokens for working. The child was informed that the tokens earned could be exchanged for a variety of backup events at the end of the day. The backup events included pencils, erasers, candy, prizes from a treasure chest, and extra recess.

Experimental Conditions

Each child was exposed to the schedules in a reversal design. The design differed for each child in three ways. First, each child received both schedules but in different order across phases of the study. Second, the experiments for each child began at different times, in part to minimize the work of the teacher. Thus, the experiment began for Mel several days before it began for Fran. Third, some changes in the phases were made in response to data patterns idiosyncratic to a given child, as described below. The conditions to which subjects were exposed were:

Baseline and reversal. Attentive behavior was recorded for each child without specific contingencies designed to alter behavior at the beginning of the project and during reversal phases.

Tokens (Schedule 1). During this phase, tokens and approval were delivered by the teacher contingent on 10 sec of attentive behavior only if the child performed inattentively for 20 sec immediately before the attentive response. Mel received tokens under this schedule for one

phase; Fran received tokens under this schedule for two phases of the investigation.

Tokens (Schedule 2). During this phase, tokens and approval were contingent on 10 sec of attentive behavior only if the child performed attentively immediately before the attentive response. Because of the different levels of attentive behavior, the schedules differed slightly for Mel and Fran. Mel was required to engage in a total of 40 sec of attentive behavior (30 sec, plus the 10 sec of attentive responding). Fran was required to engage in a total of 30 sec of attentive behavior (20 sec, plus 10 sec of attentive responding). Mel received tokens under this schedule for two phases; Fran received tokens for only one phase.

For both reinforcement schedules, minor adjustments were made in the amount of time required for the behavior (inattentive or attentive) that immediately preceded the 10-sec attentive response that was reinforced. These adjustments were made to equalize the frequency with which tokens were delivered across the different schedules and to shape behavior gradually under a given schedule. During Schedule 1, Mel received tokens for a four-day period (Days 21 to 24) for attentive behavior preceded by 10 sec rather than the usual 20 sec of inattentive behavior. For the remainder of this condition, the 20-sec requirement was employed. Similarly, during Schedule 2 for Fran, tokens were delivered for a three-day period (Days 14 to 16) for 10 sec of attentive behavior preceded by 10 sec rather than 20 sec of attentive behavior.

RESULTS AND DISCUSSION

The effect of the intervention was evaluated on the percentage of intervals of attentive behavior. The data for Mel are presented in Figure 2. The daily mean frequency of token delivery across each phase appears in Table 2. Mel's baseline rate of attentive behavior was 30.3%. When he received tokens and praise for an attentive response that was immediately preceded by attentive behavior (Schedule 2), his attentive behavior increased to a mean of 72.0%. During a

Fig. 2. Attentive behavior of Mel across experimental conditions. Baseline and reversal—no experimental intervention. Schedule 2—tokens delivered after attentive behavior preceded by attentive behavior. Schedule 1—tokens delivered after attentive behavior preceded by inattentive behavior. (Means for each phase are represented by dotted lines.)

reversal phase, when tokens and praise were no longer delivered, Mel's attentive behavior decreased to a mean of 34.0%. When Mel received tokens for an attentive response that was immediately preceded by inattentive behavior (Schedule 1), his attentive behavior increased to 52.3%. This rate was increased further to a mean of 77.2% in the final phase when Schedule 2 was re-instated.

The data for Fran are similar to those of Mel (see Figure 3 and Table 2). During baseline, Fran's mean attentive behavior was 16.6%. When she received tokens for an attentive response preceded by inattentive behavior (Schedule 1), there was a temporary increase in at-

tentive behavior. However, this level quickly decreased for an overall mean of 21.0%. Because this schedule appeared to have no consistent effect, and behavior returned to baseline levels during the intervention, no reversal phase was implemented. In the next phase, Fran received tokens for an attentive response preceded by attentive behavior. This was associated with an increase in attentive behavior to a mean of 43.0%. In a reversal phase when all consequences for performance were withdrawn, her rate of attentive behavior decreased to a mean of 16.0%. In the final phase, tokens were delivered for an attentive response preceded by inattentive behavior, which resulted in a mean

Table 2
Mean Daily Frequency of Token and Approval Delivery in Each Phase of Experiment II

	Base	Sched ₂	Rev	Sched ₁	Sched ₂	Overall mean	
						Sched ₁	Sched ₂
Mel	0	6.86	0	7.13	6.80	7.13	6.83
Fran	0	6.67	6.17	0	5.60	6.18	6.17

Fig. 3. Attentive behavior of Fran across experimental conditions. Baseline and reversal—no experimental intervention. Schedule 1—tokens delivered after attentive behavior preceded by inattentive behavior. Schedule 2—tokens delivered after attentive behavior preceded by attentive behavior. (Means for each phase are represented by dotted lines.)

attentive behavior of 23.6%. As with Mel, Fran's attentive behavior was lower when tokens and approval were provided for an attentive response that was immediately preceded by inattentive rather than by attentive behavior.

Overall, the data for both children suggest that the effects of providing reinforcing consequences for attentive behavior depended partially on the behavior immediately preceding the reinforced response. Reinforcing attentive behavior immediately preceded by inattentive behavior (Schedule 1) led to lower levels of attentive behavior than did reinforcing attentive behavior preceded by attentive behavior (Schedule 2). The effects appeared to be independent of the order in which the schedules were presented. Also, the effects did not appear to result from differential amounts of tokens and approval during the different schedules administered to a given subject. (Table 2 reveals similar mean daily rates of token delivery under each schedule.) Although the patterns of data were similar

for Mel and Fran, these children responded somewhat differently. Mel tended to show a systematic change under each schedule, whereas Fran tended to show little or no change under the less effective schedule.

GENERAL DISCUSSION

The results indicated that reinforcing an attentive response improved performance more if that response was preceded by attentive rather than by inattentive behavior. The influence of behavior that preceded the target response on the effect of the reinforcement contingency was demonstrated across different reinforcers (praise and tokens), experimental designs (simultaneous treatment and reversal designs), reinforcing agents (extraneous experimenters introduced into the classroom and the teacher), and children.

The schedules examined in the present experiments were designed to determine the influence of reinforcing attentive behavior preceded either by

attentive or inattentive behavior. This was an attempt, in part, to study antecedents of a reinforced response and their influence on behavior change. Also, one of the schedules was an attempt to operationalize the recommendation given to teachers to "catch a child being good" by looking at appropriate behavior preceded by inappropriate behavior. Catching a child being good (similar to Schedule 1 in the present experiments) might limit the efficacy of reinforcing appropriate behavior, because the reinforced response includes as part of a response chain the occurrence of an inappropriate response. The present results demonstrated that reinforcing an attentive response preceded by inattentive behavior was not as effective as reinforcing attentive behavior preceded by attentive behavior. Although the different schedules led to consistent differences, the notion that different chains of behavior were reinforced is only one interpretation that can be given.

A second interpretation of the findings could be based on reinforcing differential rates of responding. Reinforcing attentive behavior preceded by either inattentive or attentive behavior might be viewed as responses with different inter-response times (IRT) (Morse, 1966). The reinforcer was provided in the present experiments only if a particular IRT passed (*i.e.*, a period in which the attentive response was not performed). This time varied across the two schedules investigated. Inattentive behavior preceding the attentive response might be viewed as the inter-response interval. For Schedule 1 (in which attentive behavior preceded by inattentive behavior was reinforced), delivery of the reinforcer depended on a specific interval of nonresponding (*i.e.*, inattentive behavior). For Schedule 2 (in which attentive behavior preceded by attentive behavior was reinforced), delivery of the reinforcer did not depend on any period of inattentive behavior. Essentially, Schedule 1 is similar to the differential reinforcement of low rates (DRL) because an IRT was required for reinforcement. Schedule 2 was similar to differential reinforcement of high rates (DRH) because no

IRT was required for reinforcement. Viewed in this light, the different schedules investigated in the present experiments would be expected to produce different levels of attentive behavior.

A third interpretation of the results might be made in terms of the specific response units studied. The two schedules differed in the duration of attentive behavior that was reinforced. In Schedule 2, reinforcing consequences were provided for a longer attentive response than in Schedule 1. Thus, the two schedules might be explained by the different response durations (of continuous attentive behavior) that were reinforced. Reinforcing a longer period of attentive behavior would be expected to result in greater attentive behavior than reinforcing a shorter period, at least if the longer response is already in the repertoire of the subject.

The above interpretations do not exhaust all plausible alternatives. Part of the ambiguity of the interpretations stems from defining the non-occurrence of the target response as a discrete response that preceded the target response (attentive behavior). Thus, the time period separating the occurrences of the target response cannot be separated from the specific behaviors that were occurring. Subsequent research might look at the role of specific discrete behaviors that precede an independent or otherwise unrelated target response.

Regardless of the specific interpretations of the result, the present experiments consistently suggested the importance of responding immediately before the reinforced response on the overall effect of the contingency. Despite the consistency of the results, there might be important limitations to the generality of the findings. Initially, the investigations were restricted to the attentive behavior of retarded children in a classroom situation. The different schedule effects could be restricted to the behavior, population, and setting or some combination of these factors.

There are more subtle features of the behaviors focused on that may limit the generality of the findings. One feature is the duration of the target response utilized in the present study. The

target response was defined as 10 sec of continuous attentive behavior. The brevity of this reinforced response may make those behaviors performed immediately before that response especially relevant to the effect of the contingency. If the attentive response were of greater duration, the immediately preceding response may not have been influenced by the reinforcing event. Presumably, in the general case, every response has some antecedent behavior. Whether or not that antecedent behavior is part of a chain of responses influenced by the delivery of a reinforcer after the target response may depend on the duration of the target response. The present results need to be examined with target responses of varying durations to determine the extent to which behaviors that immediately precede these responses contribute to behavior change.

Another feature of the behavior that may have influenced the results is the definition of the behavior that immediately preceded the target response. A child's behavior was defined as attentive or inattentive before the target response. Essentially, the antecedent response consisted of either the occurrence or nonoccurrence of the same behavior as the target response. On an applied level, there might be different effects of reinforcing attentive behavior depending on the precise behavior that immediately precedes the attentive response. Reinforcing an attentive response preceded by being out of one's seat or by merely looking around while working, not distinguished in the present study, may lead to important differences in behavior change. Behavior preceding a reinforced response may or may not be inappropriate in relation to or incompatible with the target response. Additional research might look more carefully at the precise behavior that precedes a reinforced response and at whether the effect of reinforcement is differentially influenced as a function of that response.

The above limitations outline some of the areas that warrant investigation before assessing the generality of the present results. In advance of additional research, it is useful to mention briefly possible practical implications of the

present findings in the classroom. The results suggest that the behavior that immediately precedes a target response may influence the effect of reinforcing that target response. In the beginning of a reinforcement program, it may be useful to reinforce appropriate behavior whenever it occurs, even if preceded by a disruptive response. However, continuation of this practice might limit the efficacy of the reinforcement contingency. Reinforcing appropriate behavior preceded by disruptive behavior may place limits on the extent to which appropriate behavior can be increased. While any appropriate behavior might be reinforced at the inception of a program, the response requirements for reinforcer delivery should be increased either in duration of the specific target response or in the behaviors that immediately precede a given response.

In the present experiments, the characteristics of the preceding response were controlled and defined as brief periods. Thus, the results need to be evaluated in completely naturalistic classroom arrangements to assess the effects of teachers catching students behaving appropriately. Presumably, teachers who reinforce appropriate behavior when it occurs are not necessarily responding to the topographical or temporal characteristics of antecedent behaviors. The present results suggest that in some circumstances these characteristics might well influence the overall effects of the contingency.

REFERENCES

- Ackerman, J. M. *Operant conditioning techniques for the classroom teacher*. Glenview, Illinois: Scott, Foresman, and Company, 1972.
- Browning, R. M. and Stover, D. O. *Behavior modification in child treatment: An experimental and clinical approach*. Chicago: Aldine-Atherton, 1971.
- Bushell, D. *Classroom behavior: A little book for teachers*. Englewood Cliffs, New Jersey: Prentice-Hall, 1973.
- Clarizio, H. F. *Toward positive classroom discipline*. New York: Wiley, 1971.
- Hall, R. V., Lund, D., and Jackson, D. Effects of teacher attention on study behavior. *Journal of Applied Behavior Analysis*, 1968, 1, 1-12.

- Kazdin, A. E. Methodological and assessment considerations in evaluating reinforcement programs in applied settings. *Journal of Applied Behavior Analysis*, 1973, **6**, 517-531. (a)
- Kazdin, A. E. Role of instructions and reinforcement in behavior changes in token reinforcement programs. *Journal of Educational Psychology*, 1973, **64**, 63-71. (b)
- Kazdin, A. E. *The token economy: a review and evaluation*. New York: Plenum Press, 1977.
- Klein, R. D., Hapiewicz, W. G., and Roden, A. H. (Eds). *Behavior modification in educational settings*. Springfield, Illinois: Charles C Thomas, 1973.
- Madsen, C. H., Becker, W. C., and Thomas, D. R. Rules, praise and ignoring: elements of elementary classroom control. *Journal of Applied Behavior Analysis*, 1968, **1**, 139-150.
- McCullough, J. P., Cornell, J. E., McDaniel, M. H., and Mueller, R. K. Utilization of the simultaneous treatment design to improve student behavior in a first-grade classroom. *Journal of Consulting and Clinical Psychology*, 1974, **42**, 288-292.
- Morse, W. H. Intermittent reinforcement. In W. K. Honig (Ed), *Operant behavior: areas of research and application*, New York: Appleton-Century-Crofts, 1966. Pp. 52-108.
- O'Leary, K. D. and O'Leary, S. G. (Eds). *Classroom management: The successful use of behavior modification*. New York: Pergamon, 1972.
- Schmidt, G. W. and Ulrich, R. E. Effects of group contingent events upon classroom noise. *Journal of Applied Behavior Analysis*, 1969, **2**, 171-179.
- Ulrich, R., Stachnik, T., and Mabry, J. (Eds) *Control of human behavior. Vol. III*. Glenview, Illinois: Scott, Foresman, and Company, 1974.

Received 19 January 1976.

(Final acceptance 28 June 1976.)