EFFECTS OF MIXED REINFORCEMENT CONTINGENCIES ON ADULTS' CONTROL OF CHILDREN'S BEHAVIOR¹

WILLIAM H. REDD²

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Two severely retarded boys, each a member of a different play group, experienced three regimes of reinforcement from adults [contingent, noncontingent, and mixed (contingent and noncontingent)]. The agent of contingent reinforcement acquired stimulus control of the subjects' behavior; the noncontingent agent did not. The agent of the mixed schedule of reinforcement did not gain control, but aspects of his behavior came to function as cues. The mixed adult's withholding reinforcement in the absence of the target behavior (cooperative play) evoked cooperative play, whereas his presenting free reinforcement resulted in the subjects' remaining in their inactive, baseline positions.

The effectiveness of contingent social reinforcement in the modification of children's behavior in a group situation has been demonstrated in numerous experiments (Harris, Wolf, and Baer, 1964; Harris, Johnston, Kelley, and Wolf, 1964; Hall and Broden, 1967; Becker, Madsen, Arnold, and Thomas, 1967; and Madsen, Becker, and Thomas, 1968). Hart, Reynolds, Baer, Brawley, and Harris (1968) have further shown that the reinforcement contingencies are crucial in the modification of behavior. They found that social reinforcement from adults contingent upon cooperative play of a 5-yr-old girl resulted in a significant increase in the rate of cooperative play. Moreover, noncontingent reinforcement (delivery of praise and attention independently of the child's behavior) did not affect the child's play behavior. Using severely retarded children as subjects, Redd and Birnbrauer (1969) found that an adult, through being paired with contingent reinforcement, acquired discriminative properties and functioned as a discriminative stimulus. That is, an adult who dispensed reinforcers contingent

upon a particular response came to control the behavior of the child, such that the child's behavior changed with the onset of the discriminative stimulus (the entrance of the adult into the situation). Another adult who dispensed candy and praise without regard to the children's behavior (noncontingently) did not acquire such control. The children discriminated between the adults in accordance with the way in which the adults had reinforced their behavior in the past.

In the Redd and Birnbrauer experiment, the contingent adult was a reliable signal that reinforcement was contingent. The aim of the present study was to determine whether an adult who does not follow one particular schedule of reinforcement acquires stimulus control of the children's behavior. Specifically, would an adult who has been paired with both contingent and noncontingent reinforcement within the same experimental session acquire discriminative properties? Such an agent of reinforcement might be described as unpredictable. This problem is analogous to an inexperienced teacher or therapist who occasionally reinforces undesired behavior by not carefully following a regime of contingent reinforcement. Thus, a person who is training or caring for a child may actually be following an unplanned schedule of contingent and noncontingent reinforcement. In order to investigate the effects of a mixed schedule of reinforcement of an adult's control of a child's behavior, three adults employed different schedules of reinforcement [contingent, non-

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²The author is now at the Massachusetts General Hospital and Harvard University. Reprints may be obtained from the author, The Shriver Center, Box C, Waverley, Massachusetts 02179.

contingent, and mixed (contingent and non-contingent)].

METHOD

Subjects

Two severely retarded boys, residents of Murdoch Center, Butner, North Carolina, were chosen as target subjects for individual analysis. Subject S1 was a 12-yr-old boy diagnosed as mentally retarded; his Stanford-Binet IQ was 18. He spent most of the day sitting in the corner of the dayroom of the ward. During preliminary baseline observations in the playroom, S1 was never observed to engage in cooperative play with any of the children. During the first conditioning session it was discovered that S1 would not take the "M & M" candies from the experimenter's hand, but would eat them if they were placed on the table. S1 was described as a timid and quiet child who did not interact with other children or adults.

Subject S2 was a 16-yr-old boy diagnosed as mentally retarded. He scored an IQ of 20 on the Stanford-Binet and an MA of 2 yr 1 month on the Peabody Picture Vocabulary Test. This child showed poor muscular coordination and an inability to engage in any type of vigorous physical activity. S2 spent most of his time in the playroom during preliminary baseline observation sitting on the floor and engaging in solitary play with one of the toys.

These subjects, members of different play groups of five boys each, were selected because they showed low frequencies of cooperative play in the playroom during preliminary observation periods.

Setting and Procedure

The experiment was conducted in a 16 by 25 ft (5 by 7.5 m) playroom that was equipped with balls, blocks, skate boards, and trucks. An observer, stationed behind a one-way vision screen of a small observation booth in the corner of the room, continuously recorded the behavior of the target subject. The target subject's behavior was coded by means of the observer's depression of keys, which operated a Gerbrands' six-pen event recorder. The observer recorded the entrance and exit of an adult, the occurrence of cooperative play (defined as the manipulation of a toy while in

physical contact with another child), and the delivery of a reinforcer (the adult's dispensing praise and "M & M" candies). In order for a target child's behavior to be coded as cooperative play, the behavior had to be initiated by the target subject. The most frequent instance of cooperative play was the target subject's pushing another child on a skate board. The other children rarely initiated play and usually sat quietly on the floor and played alone. Four measures of observer agreement were conducted during the study. Calculations were based on time $\times$ time comparison of the occurrence of cooperative play and 92% was the lowest agreement obtained.

Table 1 presents an outline of the experimental procedure. Five times a week the target subject and four other boys from his unit were escorted to the playroom by the experimenter. They were left in the playroom with no adult present for 3 min. This was referred to as a baseline period. Then, one of the three adults entered and followed his prescribed routine for 5 min. In order to control for sequence effects, the order in which the adults entered the room was varied. Each adult who entered was equipped with a stopwatch, which was used to schedule reinforcement. The adults also carried a paper cup containing "M & M" candies.

Adult II, the contingent adult, dispensed reinforcers contingent upon the occurrence of cooperative play. During the first nine sessions, in the case of S1, and seven sessions, in the case of S2, the contingent adult prompted and reinforced approximations of cooperative play. First the candy was placed on a toy; then, as soon as S1 made contact with the candy and toy, the adult gave him another "M & M". After the child began to move immediately to the toy when the candy was placed on it, the procedure was discontinued and the only candy that S1 received was that dispensed by an adult. This step (training the child to accept candy from an adult) was not necessary in the case of S2. For this child, play within 3 ft of another child was differentially reinforced during the initial shaping sessions. After the target behavior was established, the interval between reinforcements was lengthened until a 45-sec interval was reached.

Adult III, the noncontingent adult, dispensed candy and praise without regard to the subjects' behavior. The noncontingent adult

Table 1
Outline of Procedure for Experimental Sessions

<i>Period</i>	<i>Procedure</i>	<i>Minutes</i>
Baseline	Five subjects in the playroom with no adult	3
Contingent	Adult II dispensed reinforcers contingent upon the subjects' behavior every 45 sec with a limited hold of 15 sec	5
Baseline	Five subjects present with no adult	2
Noncontingent	Adult III dispensed reinforcers once every 60 sec without regard to the subjects' behavior	5
Baseline	Five subjects present with no adult	2
Mixed	Adult I dispensed reinforcers on a mixed schedule of contingent and noncontingent reinforcement	5
Baseline	Five subjects present with no adult	2
Contingent	Adult II dispensed reinforcers contingent upon the subjects' behavior every 45 sec with a limited hold of 15 sec	5
Baseline	Five subjects present with no adult	2
Noncontingent	Adult III dispensed reinforcers once every 60 sec without regard to the subjects' behavior	5
Baseline	Five subjects present with no adult	2
Mixed	Adult I dispensed reinforcers on a mixed schedule of contingent and noncontingent reinforcement	5
Baseline	Five subjects present with no adult	3

dispensed reinforcers on a fixed interval scheduled that was response independent. This time interval was determined before each noncontingent period and involved the noncontingent adult's matching the number of reinforcers dispensed by the contingent adult during the preceding contingent period.

Adult I, the adult who presented a mixed schedule of reinforcement, dispensed reinforcers contingently one-half of the time and noncontingently the other half. Thus, this adult followed a mixed schedule of contingent and noncontingent reinforcement. These conditions were scheduled alternately, with the order within each session being randomly determined. During every 5-min mixed period, reinforcers were dispensed contingently for 2.5 min and noncontingently for 2.5 min. During the shaping phase of the experiment, the mixed adult prompted and reinforced approximations of cooperative play only during the contingent part of the mixed period. That is, for 2.5 min the target subject received candy

and praise freely, independent of his behavior, and for the other 2.5 min he was reinforced contingent upon his behavior. During the contingent part of the mixed period, the adult behaved just like the contingent adult and like the noncontingent adult during the noncontingent part. Without providing any cues or signals, the mixed adult would simply switch from one schedule of reinforcement to another halfway through each mixed period.

In order to control for density of reinforcement, the number of reinforcers dispensed during each period of the experimental session was matched. If the contingent adult was scheduled to enter the playroom first, then the mixed and noncontingent adults dispensed the same number of reinforcers as the contingent adult. The mixed adult's reinforcers were distributed equally between the two conditions. During those shaping sessions in which the mixed adult matched the number of reinforcers dispensed by the contingent adult, shaping was restricted. The mixed adult was

limited in the number of reinforcers he was permitted to dispense. The contingent adult was likewise restricted during those sessions in which the mixed adult entered the playroom first. When the noncontingent adult was scheduled to enter first, his allotment of reinforcers was determined by the number dispensed in the last contingent period of the previous session. In this situation, the second adult (be he contingent or mixed) established the limits for that session. This matching procedure was necessary only during the shaping phase of the experiment (for the first nine sessions for S1, and for seven sessions for S2). When the contingent adult had reached the 45-sec interval, reinforcement was scheduled once every 60 sec in each condition. That is, the contingent adult reinforced on a fixed-interval 45-sec schedule with a limited hold of 15 sec, the noncontingent adult dispensed reinforcers noncontingently at the end of each minute, and the mixed adult reinforced on a fixed-interval 45-sec schedule with a 15-sec limited hold for 2.5 min and on a fixed-interval noncontingent schedule for 2.5 min.

The four buffer subjects in each play group received candy and praise noncontingently from all adults who entered the room. That is, they received reinforcers independent of their behavior. The target subject was always given reinforcers first; the other subjects were reinforced immediately after the target subject's 15-sec limited hold, regardless of the target subject's behavior. That is, the buffer sub-

jects received free reinforcement regardless of whether the target subject had received reinforcement.

RESULTS AND DISCUSSION

Figure 1 shows a graph representing the data from the observation of S1 in the playroom with four other boys. Cumulative time-units of cooperative play are plotted across periods of the session. The time-units were computed by integrating the event recorder curve. The dotted line represents the first conditioning session; the solid line represents the twelfth. Here, after 12 sessions, S1 had reached the criterion of stimulus control in the contingent reinforcement condition. Stimulus control was considered established when three requirements had been met. The first was that the target subject emit the target response (cooperative play) within 45 sec after the entrance of the contingent adult. The second was that the subject stop emitting the response within 45 sec after the departure of the contingent adult. The third requirement was that the above conditions be met for three successive sessions. The criterion was met by S1 throughout the remaining sessions of the experiment. The entrance of the noncontingent adult did not affect responding. The entrance of the mixed adult did not consistently evoke cooperative play.

In Fig. 2, data from the observation of S2 are shown. After 14 sessions, S2 reached the

Fig. 1. Summary data for S1.

Fig. 2. Summary data for S2.

stimulus control criterion. The entrance of the contingent adult occasioned cooperative play within 45 sec; the entrance of the noncontingent adult did not evoke the target behavior. The patterns of responding of the target subjects in the contingent and in the noncontingent conditions replicated the results of the Redd and Birnbrauer (1969) experiment. It was not possible to distinguish between re-

sponding during the baseline and noncontingent periods for either subject. As with S1, the entrance of the mixed adult did not have any consistent effect. Even after 45 sessions the stimulus control criterion had not been met during the mixed period.

Figures 3 and 4 present graphs representing each subject's cooperative behavior during the last three sessions of the experiment. In both

Fig. 3. Mixed periods of the last three sessions of the experiment for S1.

Fig. 4. Mixed periods of the last three sessions of the experiment for S2.

cases there had been no marked change in the pattern of responding in at least 20 sessions. The entrance of the contingent adult evoked cooperative play within 45 sec; the entrances of the noncontingent and mixed adults did not. Figure 3 shows Sessions 40, 41, and 42 for S1. Cumulative time-units of cooperative play are plotted across minutes of the mixed periods. Circles indicate reinforcement. When the mixed adult entered, the target subject typically remained in his passive, non-play position. If he received a free reinforcer after 1 min (which was the case when noncontingent reinforcement was scheduled first) he remained inactive. If, however, he failed to receive a free reinforcer after 1 min (which was the case when contingent reinforcement was scheduled first), he moved to another child and began cooperative play. Once cooperative play was initiated, it continued through the period.

Figure 4 shows the mixed periods for Sessions 32, 33, and 34 for S2. Cumulative time units of cooperative play are plotted across minutes of the period. In four of six periods the target behavior was not emitted until after an interval in which no reinforcers were dispensed. Although the presence of the mixed adult did disrupt baseline behavior, it did not immediately evoke cooperative play, as did the presence of the contingent adult. Rather than the presence of the mixed adult functioning as a discriminative stimulus, the mixed adult's withholding of reinforcement served as a cue controlling the cooperative play behavior of the subjects. The subjects appear to have been employing aspects of the mixed adult's behavior (*i.e.*, the presentation and withholding of candy and praise) as a cue or signal as to which contingencies were in effect.

The results of this experiment suggest that children react to adults in a manner consistent with how these adults have reinforced their behavior in the past. The entrance of the contingent adult controlled the cooperative play behavior of the two target children, whereas the presence of the non-contingent adult had no effect. The presence of the mixed adult, while not meeting the stimulus control criterion, did disrupt baseline behavior and result in high and steady terminal rates of cooperative play behavior.

The cues that were crucial for the child's discriminating between the contingent and noncontingent reinforcement during the mixed periods, were the adult's dispensing or withholding reinforcement. These behaviors on the part of the mixed adult consistently preceded different reinforcement contingencies and thereby acquired discriminative properties. To use Skinner's (1953) words, the stimulus (the mixed adult's withholding candy and praise) was the occasion upon which a response (cooperative play) was followed by reinforcement (delivery of candy and praise), whereas the free presentation of candy and praise by the mixed adult was not the occasion upon which a particular response was followed by reinforcement. Rather, noncontingent reinforcement had been followed by additional noncontingent reinforcement. Thus, the mere presence of the mixed adult was not discriminative because it had not been consistently paired with contingent reinforcement.

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