*REINFORCER VARIATION: IMPLICATIONS FOR
MOTIVATING DEVELOPMENTALLY DISABLED CHILDREN*

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Motivating developmentally disabled children to participate in educational activities can be very difficult. This is especially true for children diagnosed autistic. Because there is some evidence to suggest that stimulus variation may influence motivation, the present study investigated the effects of constant vs. varied reinforcer presentation on correct responding and on-task behavior. Results from a reversal design showed declining trends in both correct responding and on-task behavior when the same reinforcer was consistently presented, whereas, varying the reinforcers produced significantly improved and stable responding. The results are discussed in relation to the literature on stimulus variation and its effects on responsivity.

DESCRIPTORS: motivation, reinforcement, on-task behavior, satiation, autistic children, developmentally disabled children

Motivating developmentally disabled children is typically a very difficult task. These children are often described as unresponsive or unmotivated to respond in educational activities (e.g., Koegel & Egel, 1979; MacMillian, 1971, 1975; Rincover & Koegel, 1977; Rutter, 1966). Many researchers have noted that this lack of responsivity or motivation is particularly apparent in children diagnosed autistic (e.g., Dunlap & Egel, in press), and has been shown to interfere significantly with teaching efforts (Dunlap & Koegel, 1980; Koegel & Egel, 1979; Devany & Rincover, Note 1).

Recently, investigators have begun to examine the effects of *stimulus* (antecedent and consequent) *variation* and novelty on the responsivity of autistic children. Such efforts have grown from a substantial body of literature documenting the effectiveness of stimulus variation and novelty in motivating other populations (e.g., Berlyne, 1960; Bilsky & Heal, 1969; Fantz, 1964; Wilson, 1974). Although only a few studies have examined the effects of stimulus variation with autistic children, the results tend to support the findings discussed above (e.g., Dunlap & Koegel, 1980; Egel, 1980; Young, 1969). For example, Egel (1980) conducted an investigation in which autistic children's bar pressing responses and the inter-response intervals were examined under conditions of constant vs. varied reinforcer presentation. A detailed analysis of the results clearly demonstrated that the children made significantly more and faster responses when the reinforcer presentation was varied as opposed to constant.

Although the Egel (1980) study documented the effectiveness of edible reinforcer variation in a laboratory setting with bar pressing as the response, additional research in a more "applied" setting is clearly needed. The present investigation was designed to address this issue. Specifi-

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cally, this investigation sought to determine the differential effects of constant vs. varied reinforcer presentation on the behavior of autistic and other developmentally disabled children in a classroom setting.

METHOD

Participants

Three boys were chosen to participate in the study because their teachers had reported that they were unresponsive in structured learning situations.

Child 1 was 6 yr 8 mo old at the time of this study and was developmentally disabled. He was primarily nonverbal, exhibited moderate to low levels of self-stimulation (e.g., toe walking, repetitive vocalizations, and clicking), engaged in low levels of appropriate play and social behavior, was often non-compliant, and had frequent tantrums. Administration of the Leiter International Performance Scale yielded a nonverbal IQ of 50.

Child 2 was 7 yr 6 mo old when this study was conducted and had received a primary diagnosis of autism by an independent agency using the diagnostic criteria of the National Society for Autistic Children (NSAC) (Ritvo & Freeman, 1978). He engaged in moderate amounts of self-stimulatory behavior (e.g., finger flipping, spinning objects, gazing, and rocking), had frequent tantrums, and engaged in little appropriate play or social behavior. His speech was primarily echolalic, although he had developed a small (50-100 words) functional vocabulary. His responses on verbal IQ tests were too inconsistent to give meaningful results. Administration of the Leiter International Performance Scale yielded a nonverbal IQ of 65.

Child 3 was 7 yr 8 mo old and had also been diagnosed autistic by an independent agency according to the NSAC criteria. He exhibited moderate amounts of self-stimulation (e.g., finger flipping; repetitive rubbing, and rocking), had occasional tantrums, and was functioning considerably below his age level in such areas as

social behavior and appropriate play. He was beginning to develop functional speech as part of his school program, although he still engaged in low rates of echolalia. He achieved an IQ score of 65 on the Wechsler Intelligence Scale for Children and a nonverbal IQ of 80 of the Leiter International Performance Scale.

Setting

Sessions with Child 1 were conducted approximately 2 to 3 times per week in a 3.5 m × 3.5 m clinic room at the University of California, Santa Barbara Autism Project. The room contained a small table and several chairs, with the teacher and child seated directly across from each other. The teacher was an advanced undergraduate student with several years' experience in the use of behavior modification.

Sessions for Child 2 and 3 were conducted by their classroom teachers approximately 2 to 3 times per week in their special education classrooms. Four other developmentally disabled children and a variety of child-sized tables, chairs, and toys were also present in the classroom. In each case, the teacher and child were seated at a small table directly across from each other. The teachers, who were naive to the experimental hypothesis, had had several years' experience in the use of behavior modification.

Session length for each child was determined according to when a child met one of the two ending criteria (see below for definition of the criteria). Thus Child 1 received 7 sessions (6 constant and 1 varied), whereas Child 2 and 3 each participated in 8 sessions (6 constant and 2 varied).

Reinforcer Selection

Three reinforcers, specific to each child, were selected in advance from lists of previously functional, edible reinforcers. A reinforcer was considered functional if it had previously been used to establish and maintain other behaviors, and included edibles such as grapes, potato chips, raisins, M & M's, and ice cream. The same three reinforcers initially chosen for

each child were used throughout the investigation.

Design

The differential effects of constant ("B") vs. varied ("C") reinforcer presentation on correct responding and on-task behavior were assessed within a BCBC design (Children 2 and 3) and a BCB design (Child 1).

Treatment procedures used in both conditions of this investigation were based on the guidelines suggested by Koegel, Russo, & Rincover (1977) and Schreibman and Koegel (1981). Specifically, the teachers waited until the child was quiet and attending before they delivered an instruction (see "target behaviors" below). Correct responses were followed with edible reinforcers, whereas incorrect responses (incorrect discrimination or no response) were followed by either a verbal reprimand (e.g., "no") or a 3- to 5-sec removal of teacher attention.

Constant Reinforcer Condition

In this condition, the same reinforcer was presented for each correct response until the child's correct responding average 80% or better over 125 consecutive trials or until the child had not responded for three consecutive trials. These criteria were chosen for two major reasons. The 125 correct responses were chosen as a criterion in order to overtrain the discriminations used in this investigation, because previous research has demonstrated that overtraining is an important variable in reducing stimulus overselectivity in autistic children (e.g., Koegel, Schreibman, Britten, & Laitinen, 1979; Schover & Newsom, 1976). The other criterion, failure to respond for three consecutive trials, was used to indicate the occurrence of satiation, because previous work with these children on other tasks indicated that initial failures to respond preceded cessation of responding. Following the presentation of the first reinforcer (and the occurrence of one of the above criteria), a second reinforcer was delivered until one of the above criteria was met, at which time a third reinforcer was introduced.

Varied Reinforcer Condition

The varied reinforcer condition was conducted in exactly the same manner as the constant condition (i.e., there were no systematic teaching differences) except that following approximately every third correct response, the child received a different one of the three reinforcers used in the constant condition. The specific order of presentation was randomly determined; however, a child never received less than two or more than four of the same reinforcer in succession.

Target Behaviors

The target behaviors were selected from the children's ongoing school curriculum. In each case the teachers reported that the children's motivation to perform similar tasks was extremely low. The specific target behaviors are described in detail below. The same tasks and stimuli were used throughout the investigation.

Child 1 was taught to identify receptively the one different picture from a set of three. Specifically, three pictures, two of which were the same (e.g., two cats and a dog), were placed on the table in front of the child and the teacher presented the instruction, "Give me different." The child was then required to give the teacher the appropriate picture within 5 sec.

Child 2 was taught a task that required him to identify receptively pictures of action verbs (e.g., people running, sitting, and eating). Two pictures were presented to the child and the teacher gave the instruction, "Give me boy running (eating, etc.)." The child was then required to respond appropriately within 5 sec.

Child 3 was taught a task that consisted of the discrimination of more vs. less. Specifically the teacher placed two sets of objects (e.g., pencils) on a table and presented the instruction, "Which has more (less)?" The child was then required to point to the set containing more or less objects within 5 sec.

Data Recording and Reliability

The teachers recorded the children's responses as correct, incorrect, or no response for every

trial. Observers also recorded whether or not a child was "on task" using an interval sampling procedure in which they observed for 5 sec; with alternating 3-sec intervals for recording data. A child was considered on task if, at the beginning of the trial, he established eye contact with the teacher, had his hands folded on the table, completed the task and returned to the initial attending position without engaging in any non-task-related behavior such as tantrums, inappropriate vocalizations, self-stimulatory behavior, or noncompliance. In other words, if at any time during the 5-sec period the child was not attending or working on the task, the child was considered off task. Reliability measures were obtained for 75% of the total trials by an independent observer who was naive with respect to the experimental hypothesis. Percent agreement for both dependent measures (occurrence and non-occurrence) was calculated by dividing the total number of agreements by the total number of

agreements plus disagreements in each session and multiplying by 100. Percent agreement between observers for correct responding was 98% (range: 95% to 100%) and 83% (range: 75% to 95%) for on-task behavior.

RESULTS

The effects of constant vs. varied reinforcer presentation on correct responding and on-task behavior are presented in Figure 1.

In all cases the first constant presentation condition produced decreasing trends in correct responding and on-task behavior, and rapid satiation. In marked contrast, the varied presentation condition produced high levels of correct responding and on-task behavior, and no satiation throughout the 125 trials. When conditions were reversed, correct responding and on-task behavior again showed decreasing trends, with satiation occurring after relatively few trials. Re-

Fig. 1. The effects of constant vs. varied reinforcer conditions on correct responding and on-task behavior. The ordinate shows percent correct responding and on-task behavior and the abscissa shows blocks of 8 trials (as the number of trials per condition was not always divisible by 8, the last data point in any given condition reflects 5 to 8 trials).

instatement of the varied presentation condition (Child 2 and Child 3) resulted in high levels of correct responding and on-task behavior and no satiation throughout the 125 trials.

DISCUSSION

Innovative teachers have recognized the possibility that children might be more motivated in situations that contain change, variation, and novelty. However, there has been little empirical evidence documenting the effects of such manipulations. The data from this investigation provide empirical documentation demonstrating that edible reinforcer variation substantially improved the correct responding and on-task behavior of children in this study.

It is quite possible that the opposite trends found during the constant and varied conditions were a function of the children's motivation. A close examination of trends during the constant condition, for example, shows that there were typically one or more points reflecting high correct responding and on-task behavior, followed by a rapid decrease throughout the rest of the condition. These data suggest that the children may have previously acquired the task and the overall low levels of correct responding and on-task behavior may have been a function of satiation. This is also reflected by the finding that satiation only occurred when the reinforcer presentation was constant. By contrast, correct responding and on-task behavior showed substantial and sustained improvement (for 125 trials) in every session of the varied presentation condition, suggesting that the children may have been more motivated.

Several investigators, in their discussions of antecedent and/or consequent variation, have noted that presenting the same stimuli in a repetitious, unchanging manner may result in satiation and that this can be reduced by varying the sensory stimulation (Berlyne, 1960; Fowler, 1971; Glanzer, 1958; Myers & Miller, 1954; White, 1965; Bijou, Note 2). Wilson (1974) and Fowler (1963) have suggested further that

stimulus change or variation can function as a relatively powerful reinforcer, and may delay satiation that occurs with continued exposure to an unchanging consequent stimulus.

The results of the present study are consistent with the preceding interpretation. It seems quite possible that the consistent presentation of reinforcers in the constant condition resulted in satiation, and consequently, the children's motivation to continue the task rapidly decreased. The effectiveness of the varied presentation was conceivably due to the changing sensory input the children received. In other words, the children would have been less likely to satiate on a particular reinforcer, with the result that high rates of correct responding and on-task behavior would be maintained. Similar results have also been found for sensory reinforcers. Rincover, Newsom, Lovaas, and Koegel (1977) found, in part, that over time, autistic children would satiate on a particular sensory event (e.g., auditory stimulation produced by a song), and that high rates of responding could be renewed by making minor changes in the sensory event (changing the song).

The present study is significant not only because it identifies a relatively simple procedure for increasing the effectiveness of edible reinforcers, but also because it provides further documentation of the importance of providing variation within a teaching situation. The effectiveness of reinforcer variation is probably not limited to edible reinforcers. All edible reinforcers, despite their variety, will lose their effectiveness when a child is no longer hungry. Future research should examine the effectiveness of varying different kinds of reinforcers (e.g., edible, visual, and auditory) to reduce further the problems of satiation and low levels of motivation.

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