

INCREASING THE INDEPENDENT RESPONDING OF AUTISTIC CHILDREN WITH UNPREDICTABLE SUPERVISION

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We investigated the role of predictable versus unpredictable supervision on the independent task responding of three autistic children. In a predictable supervision condition, the therapist was present in the setting for a regular period of time and then was absent for the remainder of the session. In an unpredictable supervision condition, the therapist's presence was scheduled on a random, intermittent, and unpredictable basis throughout the session. The multiple baseline analysis showed that the unpredictable supervision produced much higher levels of on-task responding during the therapist's absence for all three children. Analysis of work completed during the therapist's absence also favored the unpredictable supervision condition. The results are discussed in relation to the literature on generalization and educational practice.

DESCRIPTORS: generalization, independent responding, unpredictable supervision, autistic children

Although substantial gains have occurred in the establishment of productive responding by autistic children in structured educational settings (De-Myer, Hingtgen, & Jackson, 1981; Dunlap, Koegel, & O'Neill, 1985; Koegel, Rincover, & Egel, 1982), progress continues to be hampered by a lack of knowledge about generalization (Egel, 1982). This problem is particularly apparent when autistic (and other developmentally disabled) children are left to engage in unsupervised activity. Typically, the removal of close supervision, whether it be in individualized or group contexts, leads quickly to a reappearance of stereotypic and other off-task behaviors and a decline in appropriate, productive responding (cf. Marholin & Steinman, 1977). This phenomenon has produced major problems for the management of behavior in classrooms, homes, and other community settings in which continuous supervision is not practical, feasible, or desirable.

The failure of appropriate responding to generalize has been related to the strict stimulus control that is ordinarily established by structured training conditions. As a function of the specialized contingencies applied in the process of behavioral training, the conditions under which the contingencies are applied acquire powerful discriminative characteristics. In particular, training personnel or distinguishable treatment settings can come to occasion appropriate behavior because such stimuli may be regularly associated with reinforcement for these desirable responses (Koegel & Rincover, 1977). Conversely, the absence of such stimuli may serve analogous functions and signal a child to cease engaging in appropriate behavior because controlling contingencies are predictably not in effect (Corte, Wolf, & Locke, 1971; Marholin & Steinman, 1977; Risley, 1968). Thus, autistic children may be especially likely to display off-task responding when a teacher or therapist's departure indicates that no contingencies will be applied for a period of time.

Due to these stimulus control considerations, a number of researchers have begun to explore ways in which indistinguishable or unpredictable contingencies can facilitate generalization (Corte et al., 1971; Risley, 1968; Stokes & Baer, 1977; Tanner & Zeiler, 1975). By blurring the discriminability of contingent and noncontingent settings, it has been suggested that appropriate responding need

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not be restricted to the presence of specific discriminative stimuli. Several techniques for reducing discriminability have been reported including the use of variable and intermittent reinforcement schedules (Kazdin & Polster, 1973; Koegel, Egel, & Williams, 1980; Koegel & Rincover, 1977) and delayed contingencies (Dunlap, Koegel, Johnson, & O'Neill, 1983; Fowler & Baer, 1981; Mayhew & Anderson, 1980; Schwarz & Hawkins, 1970; Sluyter & Hawkins, 1972).

The purpose of our study was to extend the logic of unpredictable contingencies to the independent, unsupervised responding of autistic children. In this case, the discriminability of a generalization context was manipulated with a variable and intermittent schedule of supervision. In a predictable supervision condition, a therapist was present for a specific and continuous period of time before leaving the child to work independently. In an unpredictable supervision condition, the therapist was present according to an intermittent and random supervision schedule. The literature on stimulus control and unpredictable contingencies suggests that the latter condition would likely produce higher levels of on-task, productive responding during the times when the therapist was not present in the immediate environment.

METHOD

Children

Three children were selected for participation in this investigation from the clinic population of the Autism Research Center at the University of California, Santa Barbara. The children were selected on the basis of clinician referrals and informal observations indicating substantial discrepancies between levels of on-task behavior when the children were directly supervised as opposed to when they were left unattended. Each child had been diagnosed as autistic by at least two independent diagnosticians according to DSM-III (American Psychiatric Association, 1980) and National Society for Autistic Children (Ritvo & Freeman, 1978) criteria. All the children lived at home with their natural families and attended public school special

education programs for the developmentally disabled. In addition, the children and their families were participants in an experimental clinic and training program conducted by the University of California at Santa Barbara.

Child 1 was a boy (age 5 years, 3 months) who had just begun treatment but was making rapid progress in areas of communicative, social, and academic functioning. He displayed moderate amounts of stereotypic behavior and occasional tantrums in instructional activities. He was beginning to acquire some functional language; however, his speech was still characterized by immediate and delayed echolalia. His overall level of functioning was estimated with the Vineland Social Maturity Scale (VSMS) to be at approximately the 3-year level.

Child 2 was a girl (age 12 years, 9 months) who had evidenced rather slow progress despite several years in a variety of educational and treatment programs. She was functionally nonverbal, although she had learned to imitate a few phonemes and could express some simple requests with manual signs. She displayed high levels of stereotypic behavior, frequent tantrums, and occasional aggression. Her level of functioning (VSMS) was estimated to be at the 3.4-year level.

Child 3, a boy aged 6 years, 11 months, had been in intensive treatment for 2½ years and was displaying gains in many areas. He was functioning at grade level in several academic areas; however, his speech was still characterized by immediate and delayed echolalia. He displayed moderate levels of self-stimulatory behaviors that were consistently associated with a lack of responsivity to external events. His level of functioning (VSMS) was estimated to be at the 3.0-year level.

Setting

All sessions were conducted in a 3 m × 3 m clinic room containing a table, chairs, and appropriate task materials. A door led to the hallway of the clinic facility. In the corner of the room was a permanently mounted video camera. A microphone was attached to the ceiling. Recording

equipment and a video monitor were located in and controlled from an adjoining room.

Tasks

Each child worked on an educational task that was considered appropriate to his or her instructional curriculum and level of functioning and that could be completed independently. Prior to the experiment, the children were exposed to the specific requirements of their respective tasks and were provided at least 5 minutes of supervised training. The specific task characteristics are described below.

Child 1. This child worked on a "Lauri Brand" puzzle that consisted of 26 uppercase letters, which could be fitted into corresponding spaces on the puzzle template. The letters were about 3 cm each and the template was 20 cm × 30 cm. At the beginning of each session, the letters were removed and the child was instructed to "Put the letters in the puzzle."

Child 2. This child worked on an assembly task that involved fitting together the five components of a ball-point pen. Prior to each session, five trays containing the two sections of the pen bodies, the middle rings, the interior springs, and the plastic ink cartridges were placed on the table. The child was required to place the spring on the ink cartridge, insert the cartridge into the first pen body section, put the ring on the body, and then screw the final body section onto the first. The assembled pen was then placed in a sixth tray and the process was begun again.

Child 3. The task for Child 3 was independent reading of first-grade level books. At the beginning of each session, a book was selected and the boy was asked to "Read the book."

Procedure

In the predictable supervision condition, the therapist was present in the room during the first portion of each session and absent during the latter portion. In the unpredictable supervision condition, the therapist followed a random and intermittent schedule of entering and leaving the room.

One female and one male therapist served as

experimenters. Both therapists had at least 5 years of training and experience in the behavioral treatment of autistic children. To control for the possibility of differential therapist effects, the female therapist conducted all the sessions in both conditions for Children 2 and 3.

Sessions for Children 1 and 2 averaged 10 minutes in length and sessions for Child 3 averaged 15 minutes. The number of sessions conducted per day ranged from two to five and was balanced across conditions. The therapist was in the room for an equivalent percentage of time in sessions of each condition. Whenever the therapist was present she or he provided contingent reinforcement for on-task behavior and successful responding, firm reprimands for self-stimulatory and other off-task behaviors, and guidance when repeated attempts to respond were unsuccessful (Koegel & Schreibman, 1982). These procedures were used in the same manner throughout all phases of the experiment.

In the predictable supervision condition, the therapist began each session by sitting next to the child and asking him or her to work on the designated task. On-task responding was rewarded by social praise and occasional edibles, on a VI 15-s schedule. When a child was on task but responded incorrectly, he or she was verbally, and if necessary manually prompted to respond correctly. Off-task responses were followed with a verbal reprimand (e.g., "No") and a prompt or instruction to resume working. After approximately 40% of the session had elapsed the therapist left the room while giving an instruction to the child to keep working to complete the task. At the end of the session, the therapist returned to the room and said "OK, time for a break." No contingencies were applied to behavior that occurred while the therapist was outside the room.

Sessions in the unpredictable supervision condition also began with the therapist and child entering the room and the therapist instructing the child to work on the assigned task. The therapist remained in the room for 1–2 minutes providing rewards, reprimands, and corrective feedback according to the same schedule and procedures that

occurred in the previous condition. The therapist then left the room while giving an instruction to the child to keep working on the task. After a variable period of absence, the therapist returned to the room. To ensure that the child's behavior did not influence the scheduling of the therapist's return, the exact times of reentry during two of the five unpredictable supervision conditions were specified before each session began. During the other three conditions, the therapist was instructed to schedule his or her return without reference to the child's responding and to be in the room for only a total of 40% of each session. Upon reentry, the therapist delivered positive or negative consequences depending on the child's behavior at that time. The therapist entered the room an average of six times per session and typically remained in the room for a period of 30–60 seconds. The actual percentage of the session during which the therapist was in the room was approximately 40% (averaging between 34% and 44%). As in the previous condition, there were no contingencies for behavior that occurred while the therapist had been absent.

In summary, the only difference between the two experimental conditions was that in the predictable supervision condition, the therapist's presence (and contingent supervision) and absence was scheduled to occur in a continuous and consistent pattern. In the unpredictable supervision condition, the therapist's presence and absence were intermittent and random, and not related to the child's behavior. In this latter condition, there was no basis on which the child could reliably predict when contingent supervision would be forthcoming.

Design

The two supervision schedules—predictable and unpredictable supervision—were compared within the context of a multiple baseline design across children. The children were exposed first to a predetermined and staggered number of predictable supervision sessions (three sessions for Child 1, five for Child 2, and seven for Child 3) and then they began sessions under conditions of unpredictable

supervision. Also, to control for possible order effects, at least one reversal of conditions was conducted for each child.

Dependent Variables

Two dependent variables were considered in this experiment. On-task behavior was defined as any response that involved appropriate manipulation of task materials or visual orientation to the task. Prolonged gazing at task materials or repetitive stereotypic manipulation of task materials (longer than 5 seconds) were not considered on task unless accompanied by other on-task behaviors (such as labeling a puzzle piece).

Data were also collected on the number of task responses completed by each child. Task responses were defined individually for each child's task. For the alphabet puzzle task, a task response was counted each time the child put a piece into the puzzle. For the pen assembly task, a task response was defined as the manipulation of one of the component pieces and its successful incorporation into the pen being assembled. For the reading task, a task response was counted as reading a page from the book. The response began with the first word read from the page and ended when the page was completed. As this child typically read aloud or mouthed each word, counting these responses did not present the difficulties that might have been present with more advanced, silent reading.

Measurement and Reliability

The data in this experiment were recorded by seven undergraduate students in speech or psychology. Each had completed lecture and practicum coursework in behavioral measurement techniques and behavior modification with autistic children. To control for potential bias in the data recording, five of the observers were not informed of the experimental hypothesis, the experimental conditions, or the assignment of sessions to conditions. The recorders were given response definitions for either on-task or task response data. Throughout the experiment a total of 89% of the sessions were videotaped, which allowed for fully

independent observation of these sessions by naive recorders after all sessions had been conducted.

On-task data for each child were recorded by one or two observers on-line from the videomonitor (which was located in a room adjoining the experimental clinic room). In addition, on-task data for at least four sessions in each condition were collected by naive recorders from videotapes. The data were recorded in continuous 10-second intervals. An interval was scored as "+" if the child displayed on-task behavior for at least 5 continuous seconds of the 10-second interval. Off-task intervals were scored as "-." In addition, the observers indicated on their data sheets whether or not the therapist was in the room. This permitted the data to be analyzed separately for supervised and unsupervised responding.

Task response data were collected from videotapes by recorders who were naive with respect to all aspects of the experiment. They were given task response definitions and were asked to count the number of responses completed during each videotaped session. They did this by viewing each session and counting each task response exhibited and noting whether or not the therapist was present at the time of the response.

For 49% of the sessions throughout the experiment, on-task data were recorded independently by two observers. Reliability of these observations was evaluated on an interval-by-interval basis. Agreements were counted when an interval was scored in an identical manner by the two independent observers. Reliability was assessed by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100%. The average reliability across the experiment was 93.5%, with reliability per session ranging from 74% to 100%. Reliability on occurrences of on-task responding averaged 97.8% (86%–100%); reliability on nonoccurrences averaged 88.7% (67%–100%).

A total of 42% of sessions throughout the experiment were scored for task responses by two independent observers. Reliability of these data was calculated by dividing the smaller total by the larger and multiplying by 100%. Average reliability

across the experiment was 89% with a range across children and conditions of 71% to 100%.

RESULTS

Figure 1 shows the results for on-task behavior. Solid data points depict the levels of on-task behavior in the intervals during which the therapist was absent; open data points show the levels of on-task behavior when the therapist was present and providing supervision. The former functions, which show unsupervised responding, are the data of principal interest in this investigation.

Unsupervised (i.e., independent) responding during the first predictable supervision condition was uniformly low. When the conditions were changed to unpredictable supervision, levels of on-task behavior for each of the three children immediately increased. Although the percentage of change was variable across children, the pattern of responding was very similar. The data for Child 2, a relatively low functioning child, show a clear increase in independent responding from nearly 0% to over 30% during the unpredictable supervision condition. The data for Child 3, a higher functioning child, illustrate an even greater jump to levels that closely paralleled those observed when the therapist was present.

Figure 1 also depicts the reversals of conditions for each child. Child 1 and Child 3 participated in one reversal (a return to the predictable supervision condition), whereas an ABAB was conducted for Child 2. These results illustrate clear control by the independent variable for Children 1 and 2. Reversal from unpredictable to predictable supervision produced immediate decreases in unsupervised on-task responding. For Child 2, a subsequent reinstatement of unpredictable supervision conditions again produced increases in unsupervised on-task responding. For Child 3, on-task behavior remained at relatively high levels even when the predictable supervision condition was reinstated in the reversal, although there is some indication of a decreasing trend toward the end of the sessions in this condition.

The task response data are presented in Figure

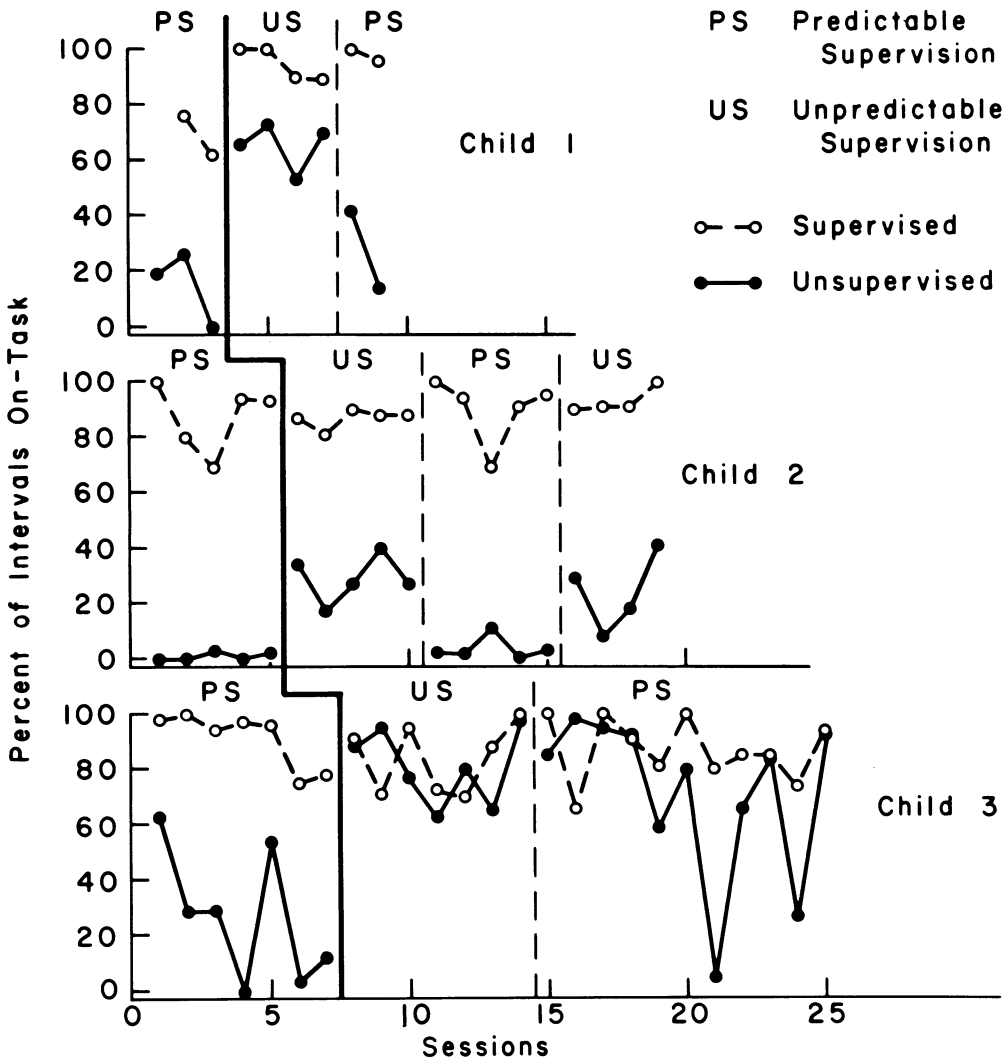


Figure 1. Percentage of 10-second intervals with on-task responding in all conditions of the experiment. Open data points depict levels of on-task behavior when the therapist was present in the setting; solid data points represent on-task responding when the therapist was absent. Data were not collected when the therapist was present during Child 1's first session.

2. Rates were calculated by dividing the number of task responses completed by the number of minutes. As in Figure 1, the functions for supervised and unsupervised responding are shown separately. The results for response completion closely parallel those for on task. Unsupervised productivity (solid data points) was uniformly low during the predictable supervision condition, and each child showed a measurable increase when the conditions were changed to unpredictable supervision. The

amount of change again varies across children; however, the pattern of change is again clearly demonstrated.

DISCUSSION

Overall, the results of this study show that the unsupervised behavior of these severely handicapped children could be influenced by the "predictability" of supervision. When supervision was

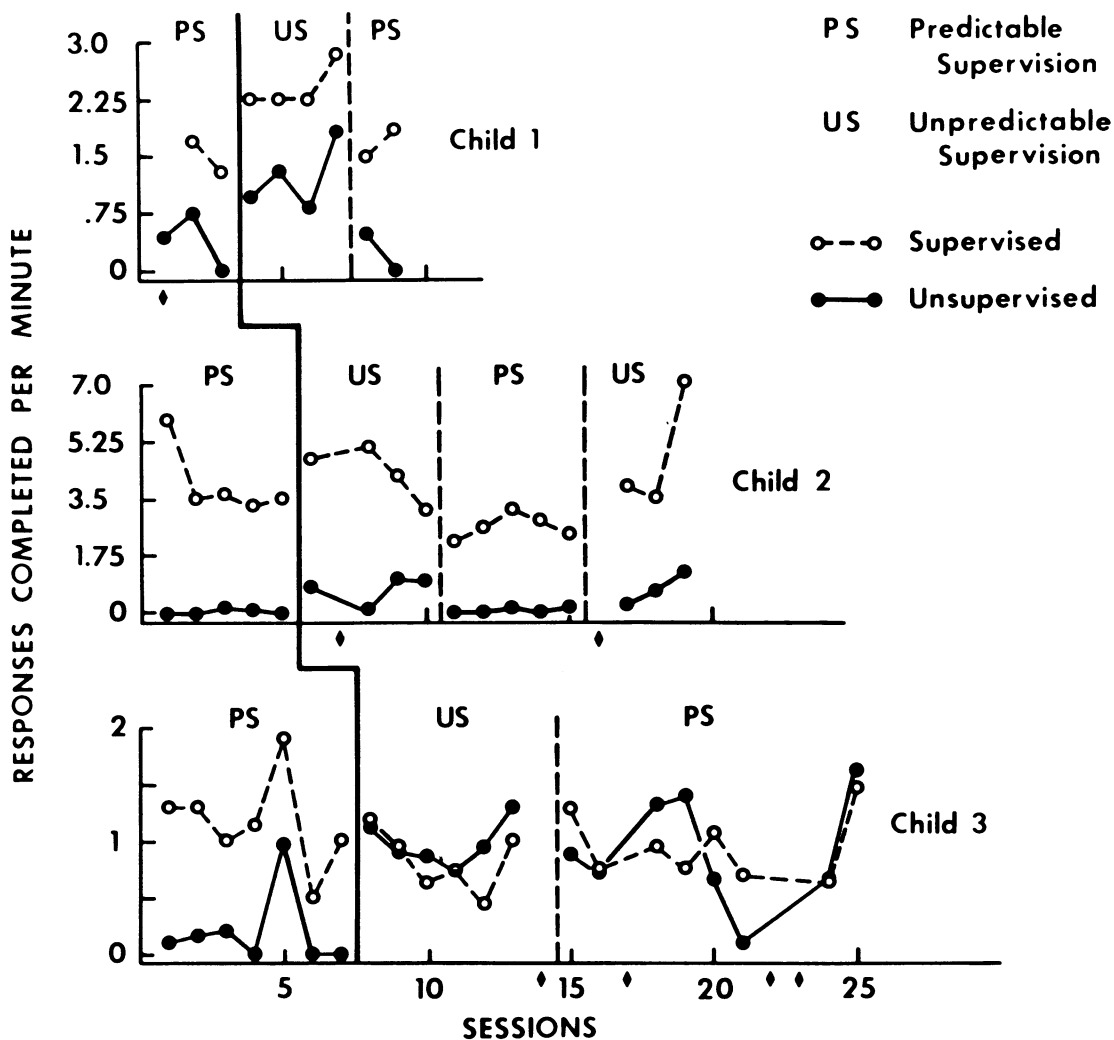


Figure 2. Responses completed per minute in each experimental condition. Sessions that were not videotaped are denoted by diamonds on the abscissa. Open data points depict rates of task completion when the therapist was present; solid points represent rates when the therapist was absent from the setting.

scheduled to occur in a regular and predictable manner, the children displayed low levels of on-task responding and little productivity during unsupervised periods. When supervision was scheduled on a random, intermittent and unpredictable basis, on-task behavior and task completion were increased substantially.

The data reported in this study can be related to large literatures on discrimination and generalization. For example, numerous articles have documented discriminated performances when contin-

gencies are present in supervised training contexts versus when they are absent in unsupervised or nontraining contexts (Fowler & Baer, 1981; Garcia, 1974; Kazdin & Bootzin, 1972; Koegel et al., 1980; Peterson, Merwin, Moyer, & Whitehurst, 1971; Wahler, 1969). This lack of generalization has been reported to be especially problematic with children diagnosed as autistic (Carr, 1980; Egel, 1982). The data obtained during the first, predictable supervision condition for each child clearly replicate this phenomenon. When the therapist was

present and providing contingent reinforcers and reprimands, rates of on-task responding were uniformly high. However, appropriate and productive responding declined markedly when the therapist left the room.

The change to the unpredictable supervision condition served, in all cases, to increase independent on-task behavior dramatically (Figure 1) as well as completion of the assigned tasks (Figure 2). Other procedures have also served to facilitate appropriate behavior in contexts that lack optimal contingencies. Koegel and Rincover (1977) thinned the schedule of reinforcers in training settings to promote generalization. Fowler and Baer (1981), working with preschool children, used contingent reinforcers that were delivered after substantial delays. Dunlap et al. (1983), in a study with autistic clients, also used delayed contingencies to promote desirable behavior in settings that lacked adequate supervision.

In addition to the principal findings of this experiment, some characteristics of the data may be of sufficient interest to warrant further study. In Figure 2, for example, there is some suggestion that, at least for one child, the unpredictable supervision condition may have facilitated productive responding not only during the therapist's absence, but also when the therapist was present. Although this is not a consistent result and there is no ready explanation for it, these data possibly indicate a generalized increase in productivity accruing from the more consistent response pattern generated by the unpredictable supervision condition. Also of potential interest is the unsupervised responding of Child 3 during the return to predictable supervision. Although variable, these data in Figures 1 and 2 do not show the clear reversals illustrated by the other children. Anecdotal observations suggest that this task may have become intrinsically reinforcing, helping to maintain on-task productive responding. Further investigations will be required to explain these phenomena as well as to explore further the influence of child and task characteristics.

In one of the few previous experiments to examine independent responding (i.e., in a setting

without any supervisor), Marholin and Steinman (1977) found that when a teacher left the classroom, the performance of behavior-problem fifth and sixth graders declined dramatically. Those authors increased the amount of time spent working and the accuracy of work completed by providing reinforcement based on the products of responding during the teacher's absence. Under these conditions, the teacher's departure no longer functioned as a signal that reinforcement contingencies would be discontinued. Although contingencies in our study were never based on products of responding that occurred during the therapist's absence, the unpredictable supervision condition produced results that are similar to those of Marholin and Steinman.

Our findings may best be interpreted from the perspective of stimulus control and research on un-signaled contingencies. In contrast to the predictable supervision condition, the therapist's presence (and contingencies) in the unpredictable condition occurred in a random, intermittent, and un-signaled manner. The participating children had no way to know in advance when the therapist would reenter the room. This method has similarities to the research of Sidman and others on avoidance behavior with and without a warning signal. When warning cues are present, a pattern of discriminated avoidance (cf. Hoffman, 1966) is exhibited that is analogous to the predictable supervision results. In contrast, Sidman (1953) found that when no exteroceptive cue was available to signal the onset of shock, avoidance behavior could be produced at a relatively steady rate throughout the experimental session. This effect is reflected in the unpredictable supervision results.

Alternative explanations are also available. For example, it may be possible to view the positive results of unpredictable supervision in terms of intermittent reinforcement (Kazdin & Polster, 1973). However, this perspective may be more difficult to support because the schedule of reinforcement in effect during the therapist's presence was identical in both conditions. Nevertheless, it is conceivable that the spacing and frequency of supervision may be related to the analogous findings of the rein-

forcement schedule literature (Ferster & Skinner, 1957). Additional interpretations derived from studies of superstitious responding and adventitious reinforcement are also possible. Further research will be required to establish these or other conceptualizations.

From the perspective of clinical and educational practice, the effects of unpredictable supervision are encouraging. The data indicate, first of all, that autistic children who had not demonstrated independent task responding in previous contexts could do so under alternative conditions of supervision. The data also suggest the possibility of increased efficiency in conducting clinical activities or supervision or both. The therapists in this study could have implemented productive clinical activities simultaneously for at least two children, if the supervision was scheduled in an unpredictable manner. As some authors have suggested (e.g., Paine, Radicchi, Rosellini, Deutchman, & Darch, 1983), unpredictable scheduling of supervision may be equally effective in classrooms. However, at this time, the documented effectiveness of unpredictable supervision in additional contexts remains a topic for further investigation.

Further research may also improve on the present procedures to yield even higher levels of independent responding by autistic children. One approach might be to thin the schedule of reinforcement during the periods of supervised activity (Koegel & Rincover, 1977). If the current VI 15-s schedule had been extended, it is possible that the children might have become less dependent on adult supervision. By combining manipulations of reinforcement schedules and reinforcement delays (Dunlap et al., 1983; Fowler & Baer, 1981) with unpredictable supervision, it is likely that lengthy periods of independent responding could be produced. Such outcomes would be of benefit to those concerned with the education and integration of autistic and other handicapped individuals.

In summary, we have shown that the condition of unpredictable supervision can produce increased levels of on-task behavior and task completion when autistic children are left to respond independently. These findings contribute to the study of

generalization and suggest practical strategies for educational and clinical intervention.

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