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MOTIVATING AUTISTIC CHILDREN THROUGH STIMULUS VARIATION

GLEN DUNLAP AND ROBERT L. KOEGEL

UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

This study evaluated the differential effectiveness of two methods of presenting discrimination tasks when teaching autistic children. In a *constant task* condition, the common method of presenting a single task throughout a session was used. In a *varied task* condition, the same task was interspersed with a variety of other tasks from the children's clinic curricula. Results showed declining trends in correct responding during the constant task condition, with substantially improved and stable responding during the varied task condition. In addition, naive observers judged the children to be more enthusiastic, interested, happier, and better behaved during the varied task sessions. These results suggest that "boredom" may be a particularly important variable to control in the treatment of autistic children, and that particular care may be necessary when defining criteria for task acquisition. The results are discussed in relation to the literature on increased responsivity to stimulus novelty and variation.

DESCRIPTORS: motivation, maintenance, stimulus control, happiness, emotion, autistic children

Recent research has begun to manipulate antecedent stimuli in efforts to improve autistic children's motivation and generally low level of responsivity to educational instructions (e.g., Carr, Newsom, & Binkoff, 1976; Koegel, Dunlap, & Dyer, 1980). In a related area, the experimental literature on stimulus novelty and variation (e.g., Faw & Nunnally, 1968; Panyan & Hall, 1978; White, 1966; Zeaman, House, & Orlando, 1968) suggests that the introduction of stimulus variation may serve to heighten responsivity to such antecedent stimuli. Therefore, the present study was designed to evaluate the effects of varying tasks on the discrimination performance of autistic children. Specifically, two methods of stimulus presentation were compared: A *constant task* condition, which used the common method of presenting a single discrimination task throughout a training session, and a *varied task* condition, in which the target task was interspersed among a variety of other tasks.

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METHOD

Subjects

The children who participated in this experiment were diagnosed as autistic by two independent diagnosticians, each using the U.S. National Society for Autistic Children criteria (Ritvo & Freeman, 1978). The children lived at home and attended public school special education classes at the time of this experiment.

Child 1 was 7 yrs, 3 mos old at the time of the study. She was primarily echolalic but had developed a small repertoire of functional speech. She had moderate to large amounts of self-stimulatory behaviors (head shaking, tongue

clicking, gazing) and occasionally had tantrums. Although she continued to display numerous autistic behaviors, teachers and psychologists estimated this child to be functioning at about the 4-yr level.

Child 2 was 5 yrs, 3 mos old and was severely autistic at the time this study was conducted. She was completely nonverbal, displayed many self-stimulatory behaviors, and was unresponsive to most environmental events. Her overall level of functioning was estimated to be below the 2-yr level.

Setting

The experiment was conducted in two small clinic rooms each containing a small table, three or four chairs, and a variety of educational materials. All sessions for Child 1 were videotaped with an unobtrusive, permanently mounted system. Sessions for a particular task were conducted either once or twice per day, with a minimum of 30 min and a maximum of 2 days between sessions.

One clinician and one observer were present during each experimental session. In order to prevent experimenter bias, a clinician who was naive to the experiment worked with the children during 19 randomly selected sessions (with a minimum of two such sessions occurring in each condition for each child). All of the clinicians were university students who were well trained in the behavior modification treatment of autistic children.

Design

In this experiment, two approaches to task presentation were compared in the context of a multiple-baseline design across behaviors. To assess the possibility of order effects, a brief reversal of conditions was also included for one of Child 1's behaviors.

Constant task condition. In this condition, no changes were made in the regular teaching procedures. That is, repeated presentations of a single experimental task (randomly selected from the children's clinic curricula and listed in Table 1) were delivered throughout a given session. Within a particular session, no responses other than the specified target behavior were taught. Standard reinforcement (using rewards which appeared functional for these specific children) and prompting procedures, which are widely used and have been described in numerous publications (e.g., Koegel, Egel, & Dunlap, 1980; Koegel, Russo, & Rincover, 1977; Lovaas & Newsom, 1976; Schreibman & Koegel, in press), were employed. The constant task condition was continued for 64, 105, and 148 trials for Child 1, and 68 and 101 trials for Child 2. According to the multiple-baseline design, each target behavior was then introduced sequentially, at a predetermined time, to the varied task condition.

Varied task condition. The varied task condition was identical to the constant condition (i.e., there were no systematic teaching differences) except that therapists presented the target behavior instructions in the context of a number of other tasks (also listed in Table 1). Thus, a variety of tasks from a child's prescribed curriculum were all presented within a single session. A particular task was never presented more than two trials in succession (with the exception of one brief 5-trial run, introduced to provide a brief "reversal" for Child 1—see Figure 1) and averaged about one presentation out of every seven total trials.

Because the varied task condition had numerous tasks, individual sessions were typically longer in that condition. However, in order to prevent the length of any given session from systematically influencing the results, the exact number of target behavior instructions per session and the total number of instructions of any kind (target plus interspersed instructions) were varied from session to session. There were some long and some short sessions in each of the two conditions (varied vs. constant), and in general, Child 2's sessions were all relatively short and Child 1's sessions were relatively long.

Table 1

A list of all of the tasks employed in this experiment. Target tasks are indicated in the table as Task 1, Task 2, or Task 3. The other tasks are those that were interspersed throughout the varied task condition.

CHILD 1	CHILD 2
– Counting objects (e.g., "How many fingers?")	– Vocal imitation: "*P*" vs. blowing
– Identification of facial expressions (e.g., angry, happy, sad)	– Receptive identification of objects: soap vs. brush
Task 2 – Identifying the "first" of a sequence of two actions	Task 1 – Nonverbal imitation: move tongue forward
– Color identification (e.g., "What color is this?")	– Receptive identification of objects: cup vs. toothbrush
– Identification of objects and body parts by function (e.g., "What do you see with?")	Task 2 – Matching alphabet letters
Task 3 – "Touch your right (*body part*), your left (*body part*)"	– Motor coordination: building block towers
– Memory development: identification of an object missing from an established set	– Following instructions: "Sit down."
Task 1 – Use of possessive pronouns (e.g., "Whose nose is this?")	– Following instructions: "Touch tummy."
– Yes/no questions of affirmation (e.g., "Is there a dog in the room?")	– Following instructions: Touch legs."
– Picture labeling (e.g., "What is this?")	– Nonverbal imitation: e.g., touch head
– Temporal discriminations with stimulus cards	– Nonverbal identification of musical instruments from auditory (musical) stimuli
– Sight reading of words	– Coloring geometric shapes

Dependent Variables

The primary dependent variable in this experiment was percent correct unprompted responses. All unprompted trials throughout the experiment were scored according to the child's response as "correct," "incorrect," or "no response."

In an attempt to assess some of the more general effects that may have been produced, ratings (from impressions of experimentally naive observers) of Child 1's affect were obtained from videotapes of all of Child 1's sessions. These videotapes were divided into 3-min segments and then transferred in a random order onto new videotapes. These segments were then viewed independently by two observers who were naive with respect to all aspects of the experiment. Both observers were sophomores majoring in child development but with no previous exposure to autism or behavior modification. The observers scored each 3-min segment on four 6-point scales, including enthusiasm, interest, happiness, and general behavior. The enthusiasm scale was identical to that described by Koegel and Egel (1979). The interest, happiness, and general behavior scales are shown in Table 2.

Reliability

Two observers independently recorded the children's responses in vivo or from videotapes as correct, incorrect, or no response for 785 randomly selected trials in this experiment. An agreement was counted when both observers scored a particular trial in an identical manner. Reliability was calculated on a trial-by-trial basis using the formula, number of agreements divided by number of agreements plus disagreements times 100. The percent agreement for correct responses was 98.4%; for incorrect responses, 95.2%; and for no responses, 92.2%. For the rating scale data pertaining to child af-

Table 2

Rating Scales For Child Affect (Interest and Happiness) and General Behavior

INTEREST		
Disinterested	*Neutral Interest*	*Interested*
Child looks bored, noninvolved, not curious or eager to continue activity. May yawn or attempt to avoid (or escape) situation. Spends much time looking around and little time attending to task. When child does respond, there may be a long response latency (score 0 or 1, depending on extent of disinterest).	Neither particularly interested nor disinterested. Child seems to passively accept situation. Does not rebel but is not obviously eager to continue (score 2 or 3, depending on extent of interest).	Attends readily to task: responds readily and willingly. Child is alert and involved in activity (score 4 or 5, depending on level of alertness and involvement).
HAPPINESS		
Unhappy	*Neutral*	*Happy*
Cries, pouts, tantrums, appears to be sad, angry, or frustrated. Child seems not to be enjoying self (score 0 or 1, depending on extent of unhappiness).	Does not appear to be decidedly happy or particularly unhappy. May smile or frown occasionally but, overall, seems rather neutral in this situation (score 2 or 3, depending on extent of happiness).	Smiles, laughs appropriately, seems to be enjoying self (score 4 or 5 depending on extent of enjoyment).
GENERAL BEHAVIOR		
Poorly Behaved	*Neutral Behavior*	*Well Behaved*
Child is disruptive—may tantrum, attempt to leave chair or room, interrupt teacher's instructions and/or show aggression towards teacher, self or objects. Child is generally off task—may fidget and squirm, show inappropriate vocal behavior (e.g., off-task laughter and noises) or motor behavior unrelated to task. Shows little attention to task, and may be noncompliant (score 0 or 1, depending on extent of disruptiveness).	Child is neither very disruptive nor exceptionally attentive. Child may fidget and appear inattentive, but is not aggressive or rebellious. Generally complies with instructions, but may not do so readily (score 2 or 3, depending on extent of attentiveness).	Child sits quietly, attends to teacher and to task. Responds to instructions; is compliant and appears to try to perform successfully. May laugh or show other emotional behavior under appropriate circumstances (score 4 or 5, depending on extent of attention and compliance).

fect and general behavior, two experimentally naive observers independently rated 66 randomly selected 3-min segments from the videotapes. Agreements were scored when two observers' scores for a given 3-min segment were in the identical category (positive, neutral, or negative). The percent agreement for overall affect, calculated on a segment-by-segment basis, was 77%. Most of the disagreements were on the borders of categories, with the raters frequently differing by as little as .25 on the 6-point scale.

RESULTS

Figure 1 shows the trends in correct responding for both children on all five tasks. These data show generally declining trends for both children during all of the constant task conditions. Introduction of the varied task condition then produced substantial gains in correct responding and these gains were maintained regardless of the number of trials or sessions conducted. As described above, the varied task condition included several nontarget tasks (see

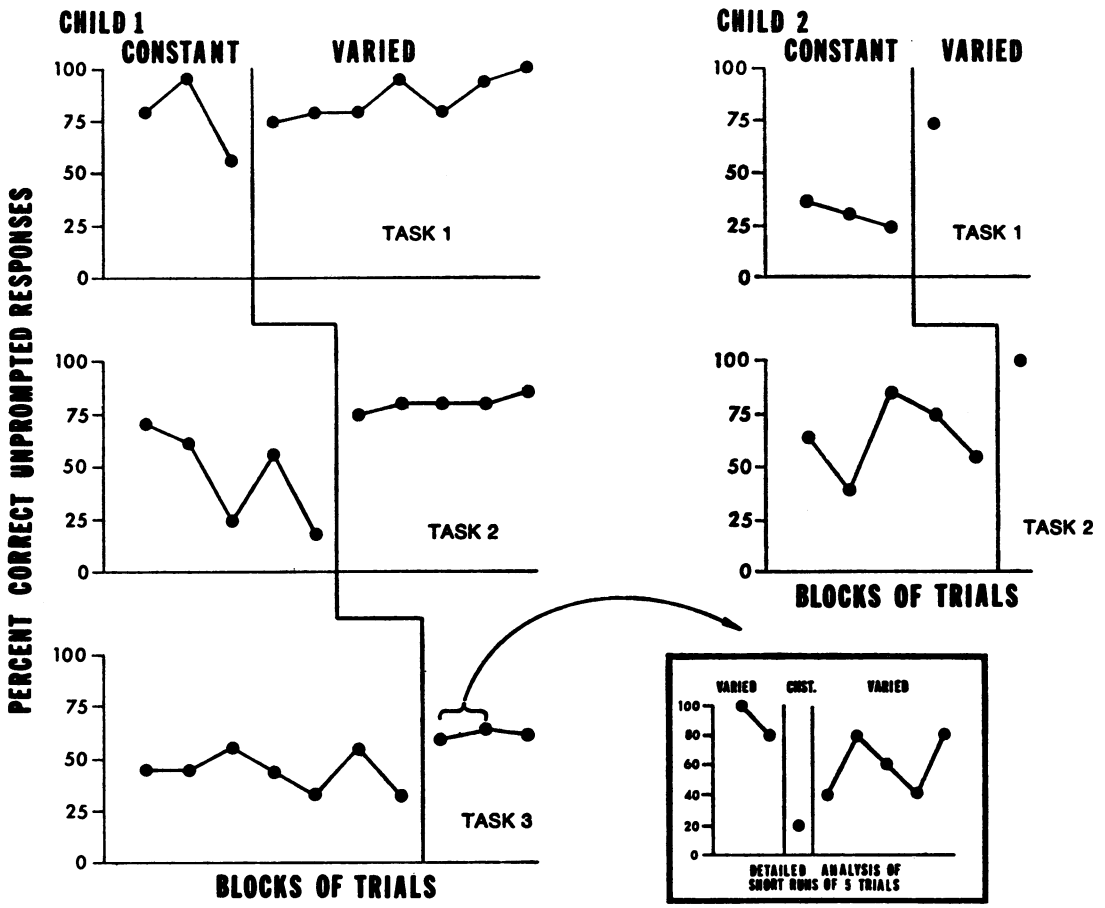

Fig. 1. Differences in responding in the constant versus varied task conditions. The ordinate shows percent correct unprompted responses and the abscissa shows blocks of 20 trials. (As the number of trials per condition was not always evenly divisible by 20, the last data point in any given condition reflects 20 ± 10 trials.) The inset in the lower right hand portion of the figure shows a brief "reversal" of 5 consecutive trials of the same task during the varied task condition for Task 3 (see text).

Table 1). Although no baseline measures were taken on these tasks, it is interesting to note that (like the target tasks) they all showed stable or increasing trends in correct responding in the varied task condition of the experiment.

The inset in Figure 1 shows a brief, 5-trial "reversal" of conditions which was introduced within one of the varied task sessions for Child 1 (Task 3). These data show a marked decrement in correct responding when the constant task condition was reintroduced. The trends described above were identical for both the experimentally naive and the informed clinicians.

Detailed Analyses for Each Child

The characteristics of the design (long sessions for Child 1) and the exact nature of responding for Child 2 permitted additional and more detailed analyses. First, for Child 1, where we presented relatively large numbers of trials per session, we were able to examine within session trends. Figure 2 shows that each individual constant task session replicated the declining trends in correct responding (indicated by the minus signs). In contrast, every session in the varied task condition showed an increasing trend or

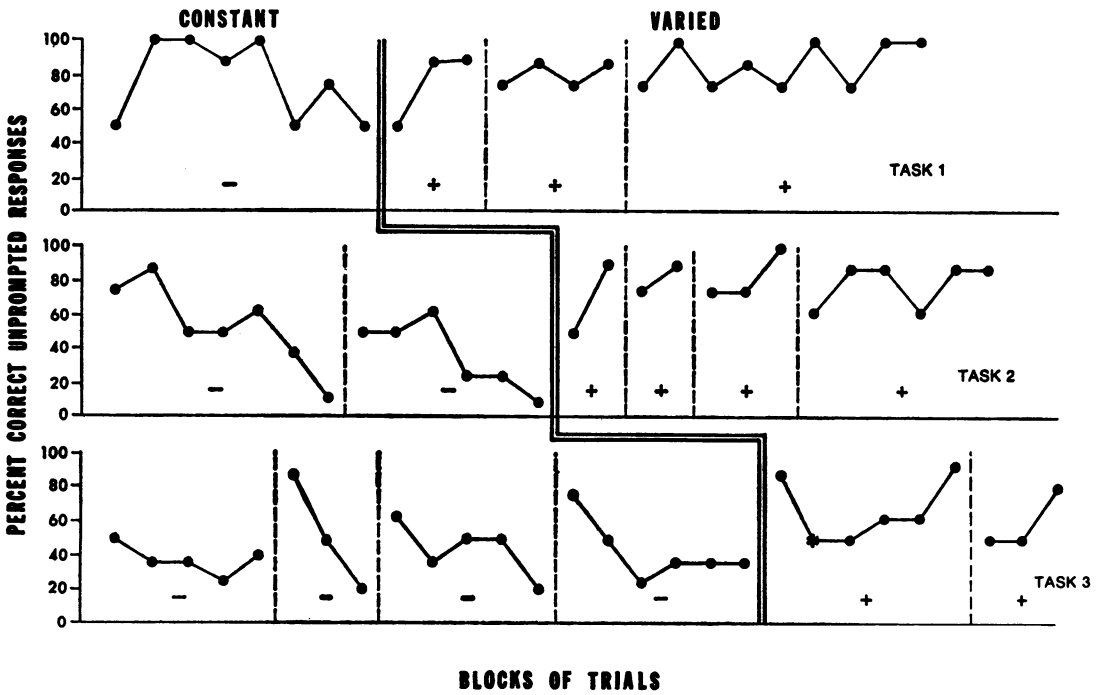

Fig. 2. Detailed within-session trends for Child 1. The heavy solid lines divide the varied vs. constant task conditions (in the multiple-baseline design) and the dashed lines separate individual sessions within conditions. The ordinate shows percent correct unprompted responses and the abscissa shows blocks of 8 trials (the last block of trials in any given session reflects 8 ± 3 trials). The asterisk indicates the block of trials during which the brief reversal occurred. The minus (−) and positive (+) signs indicate, respectively, declining trends and either increasing or constant trends in correct responding within a session.

continuously high percentage of correct responding (indicated by the plus signs). (Note: The asterisk by the dip in the first varied task session for Task 3 reflects the brief 5-trial reversal noted above in Figure 1).

The second detailed analysis pertained to the fact that Child 2 frequently failed to respond at all. While Child 1 almost always responded (correctly or incorrectly) to instructions, the results for Child 2 included a large number of trials when no responding took place at all. Figure 3 shows that the number of "no responses" per block of trials increased throughout the constant task condition. However, when the varied task condition was introduced, the number of "no responses" was virtually eliminated. That is, the child began to give a response of some sort on almost every trial.

Ratings of Child Affect

The videotapes for Child 1 were scored by experimentally naive observers on four dimensions: enthusiasm, interest, happiness, and general behavior. Because each dimension showed a very similar function, an average was taken for each 3-min segment to form composite ratings. In Figure 4, a rating of 3.3 to 5 indicates a positive score (i.e., very enthusiastic, very interested, very happy, and very well behaved); 1.71 to 3.29 indicates neutral affect; and 0 to 1.7 indicates a negative score. The data show that there was a decline in the ratings throughout each session in the constant task conditions. In contrast, ratings from the varied task conditions were relatively high and quite stable, typically ranging between 3 (high neutral) and 5 (high positive).

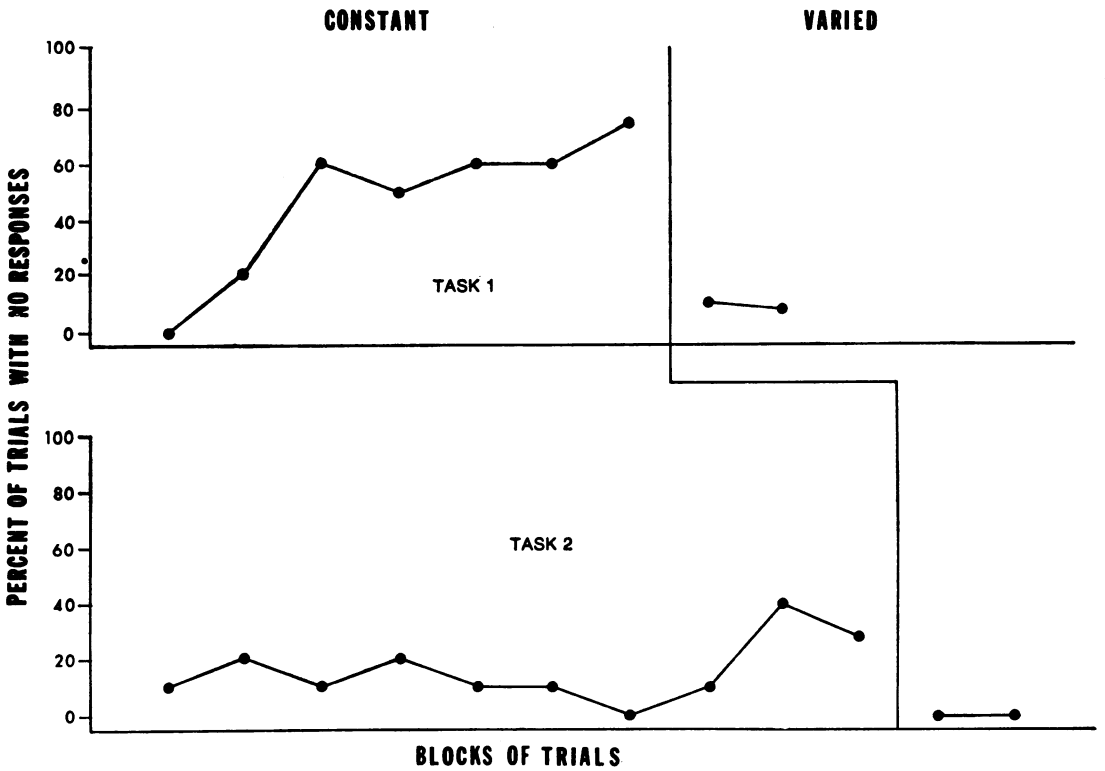

Fig. 3. The percentage of trials during which Child 2 gave no response to the task instruction. The percentage of trials with no response are shown on the ordinate and blocks of 10 trials are plotted on the abscissa. (The last point in each condition is 10 ± 4 trials).

(Note: The asterisks in the dip in the Task 3 ratings indicate the segments which contained the brief 5-trial reversal noted in Figure 1.) Regardless of the number of trials, number of sessions, or length of the sessions, the ratings produced by the varied task condition were consistently higher than those of the constant task condition.

DISCUSSION

Although the varied task approach produced clearly superior performances on these discrimination tasks, the relative effectiveness of the constant versus varied task conditions during the process of response *acquisition* is less clear. In every case, high levels of correct responding during the early trials of the constant task condition suggest that some of the responses may have been learned during an early phase of the experiment (see Figure 2). As autistic children are known to respond with marked inconsistency, it is also possible that these target behaviors may have been previously acquired, despite the absence of behavioral evidence at the start of this study. Thus, it is possible that the procedures of varying tasks may have been influencing the children's *motivation* to respond to these tasks, rather than their ability to learn the tasks in the first place.

This possibility suggests that the present results may relate primarily to *maintenance* of behaviors acquired very early in the process of training. The fact that teachers typically require an acquisition criterion of a lengthy string of correct responses may be imposing a constant task condition that falsely suggests that the children are not learning. This may account for the

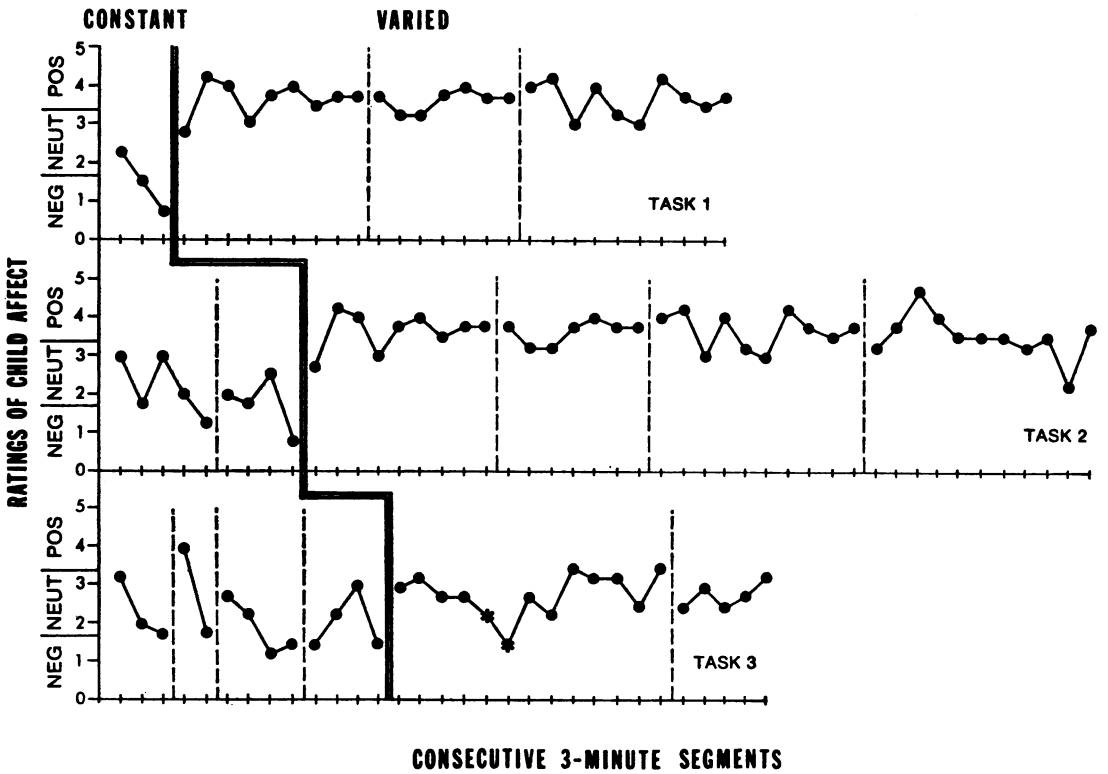

Fig. 4. The composite ratings by experimentally naive observers of Child 1's affect and general behavior. The ordinate shows the composite scale with 5 being very happy, very interested, very enthusiastic, and very well-behaved and 0 being extremely unhappy, disinterested, unenthusiastic, and poorly behaved. Consecutive 3-min segments are shown on the abscissa. The heavy solid lines divide the constant vs. varied task conditions (in the multiple-baseline design) and the dashed lines separate individual sessions. The asterisks indicate the 3-min segments that contained the brief reversal of conditions.

fact that teachers are often puzzled by autistic children appearing very intelligent, yet also giving the appearance of being unable to learn relatively simple tasks (Rimland, 1978).

It is plausible to speculate that the children may have been "bored" during the constant task conditions (Ross, 1977). As Berlyne (1960) has noted, "Boredom is particularly likely when stimuli lack short-term novelty, i.e., when a stimulus is repeated many times in immediate succession" (p. 187). The introduction of task variation during the second condition served to restore the children's responsiveness, produce high levels of correct responding and, perhaps, delay the adverse effects of boredom.

In this regard, a substantial literature has documented increases in responsitivity (measured by visual attention or response latencies) as a function of stimulus novelty and variation (e.g., Bilsky & Heal, 1969; Cantor & Cantor, 1964; Fantz, 1964; Hutt, 1975). Varying the instructions from trial to trial may also have served to positively reinforce (with relatively novel stimuli) responsivity. Related to this interpretation is a study by Egel (in press) showing that autistic children produced more responses with shorter latencies when edible reinforcers were varied as opposed to when they were held constant.

The results of this study suggest that other methods of introducing stimulus variation might also be useful in motivating autistic children (see Dunlap & Koegel, 1980; Granzin & Carnine, 1977; Schroeder & Baer, 1972). They

also suggest further research may be needed to clarify the effects on acquisition versus maintenance tasks, the assignments of appropriate performance criteria and the development of additional methods for detecting task acquisition.

REFERENCES

Berlyne, D. E. *Conflict, arousal, & curiosity.* New York: McGraw-Hill, 1960.

Bilsky, L., & Heal, L. W. Cue novelty and training level in the discrimination shift performance of retardates. *Journal of Experimental Child Psychology,* 1969, **8,** 503-511.

Cantor, J. H., & Cantor, G. N. Observing behavior in children as a function of stimulus novelty. *Child Development,* 1964, **35,** 119-128.

Carr, E. G., Newsom, C. D., & Binkoff, J. A. Stimulus control of self-destructive behavior in a psychotic child. *Journal of Abnormal Child Psychology,* 1976, **4,** 139-153.

Dunlap, G., & Koegel, R. L. Programming the delivery of instructions for autistic children. In B. Wilcox & A. Thompson (Eds.), *Critical Issues in Educating Autistic Children and Youth.* Publication of the Department of Education: Office of Special Education. Washington, D.C., 1980.

Egel, A. L. The effects of constant vs. varied reinforcer presentation on responding by autistic children. *Journal of Experimental Child Psychology,* in press.

Fantz, R. L. Visual experience in infants: Decreased attention to familiar patterns relative to novel ones. *Science,* 1964, **146,** 668-670.

Faw, T. T., & Nunnally, J. C. The influence of stimulus complexity, novelty, and affective value on children's visual fixations. *Journal of Experimental Child Psychology,* 1968, **6,** 141-153.

Granzin, A. C., & Carnine, D. W. Child performance on discrimination tasks: Effects of amount of stimulus variation. *Journal of Experimental Child Psychology,* 1977, **24,** 332-342.

Hutt, C. Degrees of novelty and their effects on children's attention and preference. *British Journal of Psychology,* 1975, **66,** 487-492.

Koegel, R. L., Dunlap, G., & Dyer, K. Intertrial interval duration and learning in autistic children. *Journal of Applied Behavior Analysis,* 1980, **13,** 91-99.

Koegel, R. L., & Egel, A. L. Motivating autistic children. *Journal of Abnormal Psychology,* 1979, **88,** 418-426.

Koegel, R. L., Egel, A. L., & Dunlap, G. Learning characteristics of autistic children. In W. S. Sailor, B. Wilcox, & L. J. Brown (Eds.), *Methods of instruction with severely handicapped students.* Baltimore: Brookes Publishers, 1980.

Koegel, R. L., Russo, D. C., & Rincover, A. Assessing and training teachers in the generalized use of behavior modification with autistic children. *Journal of Applied Behavior Analysis,* 1977, **10,** 197-205.

Lovaas, O. I., & Newsom, C. D. Behavior modification with psychotic children. In H. Leitenberg (Ed.), *Handbook of behavior modification and behavior therapy.* Englewood Cliffs, N.J.: Prentice Hall, 1976.

Panyan, M. C., & Hall, R. V. Effects of serial versus concurrent task sequencing on acquisition, maintenance and generalization. *Journal of Applied Behavior Analysis,* 1978, **11,** 67-74.

Rimland, B. Inside the mind of an autistic savant. *Psychology Today,* 1978, **12,** 68-80.

Ritvo, E. R., & Freeman, B. J. National Society for Autistic Children definition of the syndrome of autism. *Journal of Autism and Childhood Schizophrenia,* 1978, **8,** 162-167.

Ross, A. O. *Learning disability: The unrealized potential.* New York: McGraw-Hill, 1977.

Schreibman, L., & Koegel, R. L. A guideline for planning behavior modification programs for autistic children. In S. M. Turner, K. S. Calhoun, & H. E. Adams (Eds.), *Handbook of clinical behavior therapy.* New York: John Wiley & Sons, in press.

Schroeder, G. L., & Baer, D. M. Effects of concurrent and serial training on generalized vocal imitation in retarded children. *Developmental Psychology,* 1972, **6,** 293-301.

White, S. M. Age differences in reaction to stimulus variation. In O. J. Harvey (Ed.), *Experience, structure, and adaptability.* New York: Springer Publishing Co., 1966.

Zeaman, D., House, B. J., & Orlando, R. Use of special training conditions in visual discrimination learning with imbeciles. *American Journal of Mental Deficiency,* 1968, **63,** 453-459.

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