GENERALIZATION BY AUTISTIC-TYPE CHILDREN OF VERBAL RESPONSES ACROSS SETTINGS

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Generalization of verbal behavior by autistic-type children across physically different settings was assessed. Four boys learned responses to common questions in two settings at school and were probed to determine transfer of learning to home. Three of the children demonstrated little generalization to home when trained in a cubicle. Greater generalization was indicated when they received training at varied locations. The fourth child generalized most responses to his home regardless of training setting. Simple manipulations of the school environment to more closely simulate home conditions may facilitate transfer of training to the natural environment.

DESCRIPTORS: generalization to natural environment and to home, language training, autistic children

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Generalization of behavior has been suggested as a criterion for assessing the success of language intervention (Garcia & DeHaven, 1974). Although the necessity for generalization of treatment gains is widely accepted, this generalization does not automatically occur simply because behavior change has been accomplished (Stokes, Baer, & Jackson, 1974). Generalization may be considered in two categories: stimulus generalization and response generalization. In the first instance, subjects may be bound to the specific physical elements of a stimulus situation and unable to transfer learning from one situation to another (Hamilton, 1966; Rincover & Koegel, 1975). This form of generalization has been relatively neglected in contrast to response generalization where research has shown that the use of reinforcement and modeling may effectively establish various verbal response classes in children with language deficiencies (Baer & Guess, 1971; Fygetakis & Gray, 1970; Garcia,

Guess & Byrnes, 1973; Guess, Sailor, Rutherford, & Baer, 1968; Hart & Risley, 1968).

Harris (1975) states, "Once language has been established within the training situation, the next step is the extension of functional speech to other people in addition to the trainer and to other settings beyond the therapy room" (p. 573). A few investigators have established viable techniques such as using more than one trainer for programming generalization of verbal behavior across experimenters (Garcia, 1974; Kale, Kaye, Whelan, & Hopkins, 1968). Limited research on programming extrasetting generalization has shown some success by training in more than one setting (Griffiths & Craighead, 1972; Jackson & Wallace, 1974).

Most empirical investigations of child behavior therapy have focused on a single setting, often the school or clinic. Although a few authors suggest that successful treatment in a clinical setting is no guarantee that behavior will transfer to other environments such as the natural setting (Birnbrauer, 1968; Nordquist & Wahler, 1973; Wahler, 1969), this critical problem has received little experimental attention (Harris, 1975). Attempts to extend speech and language training into a child's everyday environment have been described by Risley and

Wolf (1967) and Lovaas (1968). Results of these limited attempts have been reported as successful, but few data have been presented nor has success been functionally evaluated (Garcia & DeHaven, 1974).

Griffiths and Craighead (1972) found that extrasetting generalization could be facilitated within a clinic by training in a variety of settings. The present study attempted to analyze the effects of training in single versus variable settings on the generalization of a language behavior to the child's home when trained in the school. Two conditions were compared: (a) training responses to common questions in a restricted setting, specifically one-to-one interactions in a cubicle of the school; and (b) training such responses in a multiple-natural setting, utilizing various locations in the school. The multiple-natural setting was an attempt to approximate the school environment with respect to the home to possibly minimize stimulus control.

METHOD

Subjects

Subjects were four boys, ages 6 to 7 yr, enrolled in the Douglass Developmental Disabilities Center of Rutgers University. All were described as "autistic" by various agencies. The children demonstrated language deficits in addition to disturbed interpersonal relationships. That is, the children could produce and imitate sounds and words but did not use language as a spontaneous interpersonal communication skill. Their verbal behavior was frequently characterized by situationally specific responses in addition to defects such as pronoun reversal and delayed echolalia. Limited spontaneous eye contact and minimal initiation of personal contact marked their interpersonal interactions. All the boys demonstrated some self-stimulatory behavior and displayed resistance to environmental change. In all cases, cognitive potential could not be assessed. The children were selected for the study because of their inability to answer a selected set of common questions and similar inabilities with speech imitation. Formal parental consent was obtained, and parents were assured that withdrawal of a child from the study would not influence participation in other aspects of the Center's program.

Experimenters

Undergraduate psychology, speech, and special education majors worked as tutors for individual children. Tutors were assigned to a particular child each day of the school week, and the same five students instructed the child in both conditions throughout the study. The Center's professional staff closely supervised them. Additional undergraduates working at the Center were responsible for collecting reliability data. Mothers administered home probes to the children. All parents had received training in basic child-management techniques, such as attending and social and language training, and were aware of the research component of the school program. All individuals involved with the study were naive regarding specific predictions.

Settings

Table 1 describes the experimental settings used in the study. The Douglass Developmental Disabilities Center is a university-based clinic employing broad behavioral techniques designed to focus on language and social development of children described as "autistic." Two physical settings were used within the Center: restricted—a cubicle, 1.52 m by 2.13 m, with a one-way mirror and sound monitoring equipment; and multiple-natural—along a mapped route throughout the Center. Locations of the route consisted of: in child's classroom, in tutor lounge, by coat cubbies, outside central bathrooms, by front door, and by office of annex. The boys' homes were used for generalization probes. Probes occurred in two settings: restricted—in the kitchen where the child and his mother sat opposite each other; and multiple-natural—along a mapped route of various locations throughout the house. Locations of the route consisted of: in kitchen, outside

Table 1

Experimental Conditions

	Restricted		Multiple-natural	
	School training	Home probe	School training	Home probe
Experimenter	Tutor	Mother	Tutor	Mother
Location(s)	Cubicle	Kitchen	Child's classroom	Child's bedroom
			Tutor lounge	Parent's bedroom
			Coat cubbies	Family television
			Central bathrooms	Bathroom
			Front door	Front door
			Office	Kitchen
Mode of presentation	Sitting opposite each other	Sitting opposite each other	Standing at location	Standing at location

bathroom, in child's bedroom, in parent's bedroom, by family television, and by front door.

Design

Table 2 presents the experimental design for the study. A multiple-baseline design across sets of questions and a counterbalanced design across training conditions were used. The sets of questions were presented to all the youngsters in the same order regardless of treatment sequence.

The four boys were first tested on all sets of questions in both the restricted and multiple-natural training and probe settings. Following this baseline, Vic and Alan were randomly assigned Treatment Sequence I. In this sequence, the boys were first trained in the restricted setting on Training Set A. On reaching criterion, they were tested first in the multiple-natural and then in the restricted home setting. Vic and Alan

were then trained in the multiple-natural school setting on Training Set B. On reaching criterion, they were tested first in the multiple- natural and then in the restricted home setting. This entire sequence was replicated two additional times with Training Sets C, D, E, and F.

Ken and Brian were assigned Treatment Sequence II. This was identical to Sequence I except that they were trained first in the multiple-natural setting on Training Set A and given home probes first in the restricted and then in the multiple-natural settings. This sequence was replicated two additional times.

Pretest

Tutors and the mothers of the children tested the boys on all sets of questions in both the restricted and multiple-natural training and probe settings before training. On establishing eye con-

Table 2

Experimental Design

TREATMENT SEQUENCE I (Vic & Alan)							
Pretest$_M$	Pretest$_R$	A$_R$	Probe$_M$	Probe$_R$	B$_M$	Probe$_M$	Probe$_R$
		C$_R$	Probe$_M$	Probe$_R$	D$_M$	Probe$_M$	Probe$_R$
		E$_R$	Probe$_M$	Probe$_R$	F$_M$	Probe$_M$	Probe$_R$
TREATMENT SEQUENCE II (Ken & Brian)							
Pretest$_R$	Pretest$_M$	A$_M$	Probe$_R$	Probe$_M$	B$_R$	Probe$_R$	Probe$_M$
		C$_M$	Probe$_R$	Probe$_M$	D$_R$	Probe$_R$	Probe$_M$
		E$_M$	Probe$_R$	Probe$_M$	F$_R$	Probe$_R$	Probe$_M$

Note. $_R$ = Restricted, $_M$ = Multiple-natural, A through F = Training Sets.

Table 3

Examples of training sets. The figures separated by a slash indicate the number of syllables in the stimulus and the response, respectively.

5/1	What do you smell with? (nose)	5/1	What do you chew with? (teeth)
5/1	What color is grass? (green)	5/1	What color is snow? (white)
5/1	What do you sit on? (chair)	5/1	What do you sleep on? (bed)
6/2	Where do you take a bath? (bathtub)	6/2	Where do you hang your clothes? (closet)
4/1	What do fish do? (swim)	4/1	What do you lock? (door)

tact with the child, each question was presented once and there were no consequences for the boys' responses. Results of these pretests indicated that the children did not respond appropriately to the questions selected for training in any of the settings at the beginning of the study.

Thirty questions involving common objects and actions (e.g., "How many hands do you have?" "What do you see with?") were divided into six training sets, each controlled for the number of syllables in both the stimulus and the response. In Table 3, two examples of training sets are presented. Some sets varied slightly across children due to the extreme difficulty of finding 30 questions unknown to all children.

Training

Restricted. Training occurred in the cubicle with the tutor and child facing each other. The tutor first ensured that the child was attending and not engaging in competing behaviors. If the child did not establish eye contact or engage in self-stimulatory behavior, the tutor prompted the attending response by lightly touching the child's chin and/or hands. The tutor then asked a question from the training set. If the child responded correctly, he was reinforced with praise and food. If he responded inappropriately or did not respond within 10 sec, the tutor said "no" and supplied the appropriate one word response. This statement by the tutor terminated the trial. Each of the 5 training questions in the set were presented 4 times according to a randomized list resulting in 20 training trials for 1 training session. The child received 3 training sessions per day.

Multiple-natural. Tutor and child followed

the same sequence as during restricted training except that each trial was presented while the tutor stood opposite the child at a different location of the mapped route. Locations were randomized for each training session. The child received 3 sessions of 20 trials each per day.

Home Probes

The restricted probe took place in the boy's home with his mother sitting opposite him in the kitchen. The probe occurred the day he achieved the criterion of 75% correct on 2 consecutive sessions on the training set at school. The boy's mother first requested the child to look at her, then asked him the common questions, randomly arranged for each probe, from all training sets and presented each question 1 time for a total of 30 trials. If the child did not establish eye contact, his mother prompted the response by lightly touching the chin. There were no consequences for the boys' responses, and the mothers were requested not to rehearse the questions between probes. In addition, mothers were unaware of the conditions under which any of the questions were trained.

During the multiple-natural probe, mother and child followed the same sequence as during the restricted probe except that each trial was presented while the boy's mother stood opposite her son at a different location of the mapped route. Locations were randomized for each probe session.

Recording and Reliability

The tutor and independent reliability rater recorded a plus or minus for appropriate or inappropriate responses for each trial in the train-

ing sessions. During home probes, both the boy's mother and the reliability judge rated each response. Correct responding was defined as a minimum of a 1-word correct response (e.g., "soap," "pencil") given within 10 sec. Silence or incorrect responses were considered inappropriate.

Reliability assessments of the child's responses were taken by an independent observer in at least one of the daily training sessions and during all probe sessions. Raters were present during all training sessions and randomly selected one session to score. Number of agreements divided by number of agreements plus disagreements, multiplied by 100, was computed to provide a total percentage of correct and incorrect responding. Reliability observations for training sessions were taken from behind the one-way mirror during the restricted setting and out of sight but within audible range of tutor and child during the multiple-natural setting. Reliability observations for probe sessions were taken out of sight but within audible range of mother and child during both restricted and multiple-natural settings. All probe sessions were tape recorded to provide an additional reliability measure.

RESULTS

Reliability

Reliability ratings computed with respect to training across subjects ranged from .97 to 1.0 ($\bar{x} = .99$). Those computed for probe sessions by the raters ranged from .90 to 1.0 ($\bar{x} = .97$). Ratings based on the tape recordings of probe sessions ranged from .89 to 1.0 ($\bar{x} = .96$).

Response Acquisition

None of the youngsters responded correctly to any of the questions before training. This was consistently demonstrated by 0% responding for each probe conducted before individual set instruction.

Figure 1 compares the number of trials presented before the children reached criterion on the various training sets. Trials to criterion for the four boys varied with, Vic's range of 100 to 340 trials, Alan's 160 to 720 trials, Ken's 100 to 1,740 trials, and Brian's 280 to 1,280 trials. With the exception of Kenneth's and Brian's relatively higher number of trials to criterion on the first set of questions trained in the multiple-natural setting, there was no apparent relationship between trials to criterion and training settings.

Whereas Vic, Alan, and Ken demonstrated fairly steady upward learning for each set of questions trained, Brian presented a pattern of response acquisition characterized by an apparent fixation at a level below criterion which was immediately followed by mastery. All the children attended readily to their tutors and mothers. The cue, "look at me," and an occasional touch on the chin were sufficient to establish eye contact and suppress any competing behaviors.

Table 4 presents the percentages of correct responding during the various probe sessions. Although each set of questions was probed a total of six times in each condition, the number of pre- and posttraining probes was variable according to where in the sequence the set was trained. With the exception of Vic, responding was maintained after training of the various sets of questions. Alan, Kenneth, and Brian demonstrated slight variability with no discernible effects of type of training noted with respect to response maintenance. Some extinction occurred after training for Brian; however, responding was maintained at high levels. Unlike the other boys, the results for Vic were variable. There was some evidence of extinction, primarily during multiple-natural probes, with no discernible effects of type of training noted.

Results for Vic, Alan, and Ken

There were striking similarities in the performances of Vic, Alan, and Ken. Scores obtained on the first probe conducted after training indicated that greater generalization resulted from training these children in the multiple-natural setting and less for restricted training (Table 4). In addition, the mean of the initial
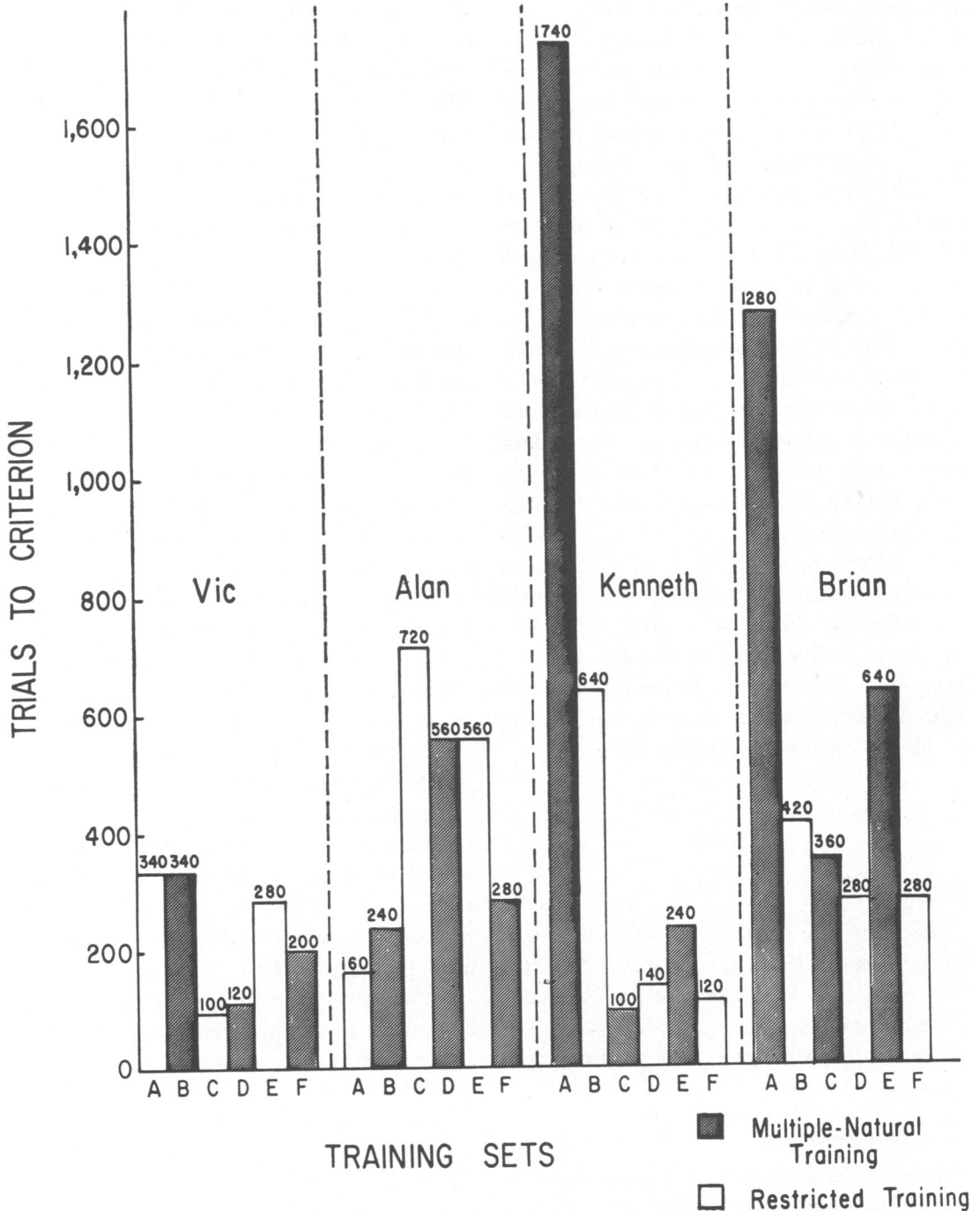
Fig. 1. Comparison of trials to criterion for training sets.

scores for both restricted and multiple-natural probes were computed per training set for each child and compared with respect to the training setting (Figure 2). Results for the three boys indicated that each set of questions trained in the multiple-natural setting resulted in greater transfer of learning to their homes than did training in the restricted setting.

Table 4

Generalization from Training to Probe Setting

	Restricted Training							Multiple-natural Training					
	Multiple-natural probes			Restricted probes				Multiple-natural probes			Restricted probes		
Set	Pre	Initial	Post	Pre	Initial	Post	Set	Pre	Initial	Post	Pre	Initial	Post
VIC													
A	0 0	40	20 20 40 0 40	0 0	40	40 40 40 20 40	B	0	40	20 40 0 20	0	60	20 40 40 20
C	0 0 0 0	0	20 0 0	0 0 0 0	40	40 20 0	D	0 0 0	40	0 0	0 0 0	40	0 0
E		0	0		20	20	F	0 0 0 0 0	60		0 0 0 0 0	40	
X̄		13			33				47			47	
ALAN													
A	0 0	40	20 20 20 20 20	0 0	20	20 20 20 20	B	0	60	60 60 60 60	0	60	60 60 40 60
C	0 0 0 0	40	40 20 40	0 0 0 0	40	40 40 40	D	0 0 0	60	60 60	0 0 0	60	60 60
E		40	40		40	40	F	0 0 0 0 0	80		0 0 0 0 0	80	
X̄		40			33				67			67	
KEN													
B	0	20	20 20 0 20	0	20	20 20 20 20	A	0 0	40	20 40 40 40	0 0	40	20 40 40 40 40
D	0 0 0	40	40 40	0 0 0	40	40 40	C	0 0 0 0	60	40 60 60	0 0 0 0	80	80 60 80
F	0 0 0 0 0	0		0 0 0 0 0	20		E		60	60		60	60
X̄		20			27				53			60	
BRIAN													
B	0	100	60 80 60 60	0	100	60 60 60 60	A	0 0	100	60 80 80 60 60	0 0	100	60 80 80 60 60
D	0 0 0	80	60 60	0 0 0	100	60 60	C	0 0 0 0	60	60 60 60	0 0 0 0	60	40 60 60
F	0 0 0 0 0	100		0 0 0 0 0	100		E		100	80		100	80
X̄		93			100				87			87	

Note. Figures represent percentages of correct responding on the initial probe after training and the various pre- and posttraining probes. While each set of questions was probed a total of six times in each condition, the number of pre- and posttraining probes was variable according to where in the sequence the set was trained. The percentages are based on one presentation of the five questions per training set.
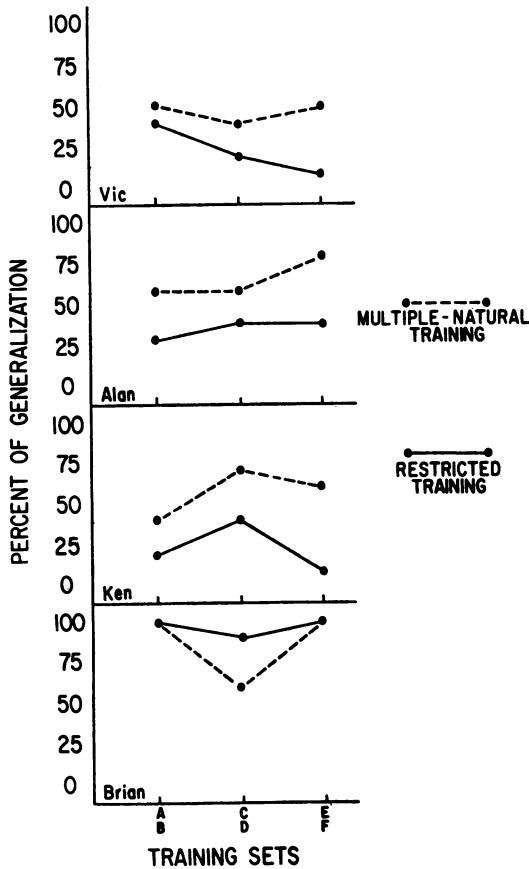
Fig. 2. Comparison of training settings. Based on the mean of initial restricted and multiple-natural probes conducted for each training set.

Results for Brian

Unlike the other boys, Brian displayed a much higher rate of generalized responding in the home, with greater generalization obtained when he received restricted training (Table 4). The mean of the scores for both restricted ($\bar{x}$ = 93%) and multiple-natural ($\bar{x}$ = 87%) probes computed for each training set showed higher rates (Figure 2).

Examination of the relationship of training and probe setting indicated minimal influence for Brian. Restricted training resulted in somewhat greater transfer of learning to the restricted probe ($\bar{x}$ = 100%) than did multiple-natural training ($\bar{x}$ = 87%). Brian completely generalized the verbal responses to the restricted home setting when trained in the restricted school set-

ting. His results were consistent with those of Vic and Alan in that no differential effects of generalization were noted in terms of multiple-natural training. The means for both the restricted and multiple-natural probes across sets of questions trained in the multiple-natural setting were the same ($\bar{x}$ = 87%). In contrast with Vic and Alan's results, the means were less than those for restricted training regardless of probe ($\bar{x}$ = 100% and 93%).

DISCUSSION

The two hypotheses presented for this study were supported by three of the four children. Vic, Alan, and Ken demonstrated that training responses to common questions in a restricted setting resulted in little transfer of learning to the home, whereas multiple-natural training yielded somewhat greater generalization. In contrast to the results of the others, Brian exhibited greater generalization than the other boys, regardless of the type of training. While the effects of the study were not large, training at varied locations may be one factor in a total program to facilitate generalization. A statistical analysis would have made conclusions stronger; however, such an analysis was not possible because too few trials were presented during probe sessions.

Analysis of trials to criterion revealed similar patterns for all of the boys. The number of trials necessary for mastery of the questions varied between training sets. Although the sets of questions selected for training were controlled for the number of syllables in both the stimulus and response, some of the questions may have been conceptually more difficult. This may have been responsible for variations in the rates of acquisition. In spite of this possible bias, results supporting the hypotheses were found in each replication of the type of training, suggesting that the differences did not affect the type of generalization investigated. The novelty of the relatively rich stimulation of the multiple-natural setting may have been responsible for Ken and Brian's initial higher number of trials to criterion. The

substantial differences may have been reduced by exposing the youngsters to the conditions before training.

The durability of responding evidenced by Alan, Kenneth, and Brian possibly suggests that generalization of particular verbal responses to a child's natural environment may be somewhat resistant to extinction. However, since most sets of questions were presented only a few times after the initial probe and some were not presented at all, the maintenance data presented are not that conclusive.

Wahler (1969) attributed the lack of generalization between school and home of deviant and appropriate nonverbal behaviors to the fact that those settings were not members of a common stimulus class. Rincover and Koegel (1975) found that generalization could be facilitated within a clinic by approximating training and nontraining settings, thus reducing the effects of stimulus control as suggested by such authors as Hamilton (1966) and Rincover and Koegel (1975). The present study suggests that by making the school somewhat more like home, generalization may be facilitated with some children. The restricted training setting, characterized by a cubicle containing only two chairs, differed substantially from the rich visual stimulation of the children's homes. Training responses to questions at varied locations, a characteristic of the home setting, resulted in greater transfer of learning than did training in the cubicle.

The generalization of the findings of this study is limited because of the small sample size. Nevertheless, the performance of three children, indicating the facilitation of generalization by training at varied locations and the possible durability of gross setting generalization, warrants both consideration and further investigation.

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