

THE UNIVERSITY OF MANITOBA

A COMPARISON OF THE EFFECTS OF THREE MODES OF
TRAINING STIMULI UPON GENERALIZATION
TO THE NATURAL ENVIRONMENT IN A NAMING TASK
WITH RETARDED CHILDREN

by

STEVEN J. WELCH

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ABSTRACT

Picture-cards, photographs, and real objects were compared in order to determine which best facilitated the generalization of newly trained naming responses to real objects found in the natural environments of four retarded children. The amount of transfer which occurred across the three stimulus modes and the rate of name acquisition for each stimulus mode was also assessed. Three of the four children displayed considerably more generalization to the real objects in the natural environment when they were trained with real objects. The fourth child displayed a high degree of generalization regardless of the training stimulus mode. The extent to which naming responses transferred from the training stimulus mode to the remaining modes was variable and unsystematic, as were name acquisition rates. Thus it appears that no particular mode clearly facilitated the acquisition of naming responses or the transfer of naming responses to other modes, but training with real objects clearly resulted in more generalization to the real objects in the children's natural environments. The results of two supplementary procedures conducted with one child suggests that: (1) testing in several environments facilitates generalization to the real objects in the natural environment when real objects are used as training stimuli, and (2) transfer from picture-cards to real objects may be accomplished by concurrently training a picture-card and the real object portrayed by the picture-card. Several exemplars may be required before the child begins to generalize from other picture-cards to the corresponding real objects.

CHAPTER I

Introduction

Many of the procedures which have been used to train articulation, autoclitics, and sentences with the mentally retarded have employed picture-cards as training stimuli (e.g., Baer & Guess, 1973; Bennett, 1974; Bennett & Ling, 1972; Costello & Bosler, 1976; Lutzker & Sherman, 1974; Martin, 1975; Powell & McReynolds, 1969; Stevens-Long & Rasmussen, 1974). Moreover, picture-naming procedures have been used extensively in language training research programs with the retarded (e.g., Biberdorf & Pear, 1977; Kircher, Pear & Martin, 1971; Olenick & Pear, (in press); Stephens, Pear, Wray, & Jackson, 1975). A question which arises from such research is whether learning to name picture-cards in the classroom enables a child to name the object represented by those picture-cards when they encounter them in their natural environment. Since the objects portrayed by picture-cards often differ somewhat from actual objects along a number of dimensions (e.g., form, color, size), they may not facilitate the transfer of responses learned in the classroom to naturally occurring stimuli. In fact, several well known investigators have stated, "We strongly discourage substituting pictures for the actual items because this decreases the authenticity of the training environment and reduces the probability that students will apply their new learning elsewhere" (Guess, Sailor, & Baer, 1976, p.4). However, no empirical

investigations have been conducted to confirm this suspicion. One investigator did compare objects, slides, and pictures and found that previously non-verbal children learned naming responses at a significantly faster rate when objects were used as training stimuli but that naming responses generalized from slides to the remaining two stimulus modes significantly better than when either of the other two modes were used (Cutting, 1973). Unfortunately, this investigator did not examine generalization from the classroom to the real objects in the natural environment.

Since picture-cards are often much more convenient to use as training stimuli than are real objects, it is unlikely that teachers in applied settings would want to discontinue the use of picture-cards unless there were considerable evidence that using real objects was more effective than using picture cards in facilitating generalization to the natural environment. Consequently, the purpose of this research was to compare several modes of training stimuli to determine which mode best facilitated the generalization of naming responses trained in the classroom to the real objects found in the natural environment. Photographs were included in the comparison since like picture-cards they would be convenient to use, but they would retain more of the stimulus dimensions characteristic of the real objects. Thus, in a sense, they were a compromise between the other two training stimulus modalities.

The importance of research on stimuli used in training extends from the fact that training procedures are of little value if the behaviors they produce fail to generalize beyond the situation in which they were trained. This research then, represents a step away from the traditional "train and hope" attitude towards generalization, and a step towards a means of actively programming for generalization, as has been advocated by Stokes and Baer (1977).

For those readers who are interested in a more comprehensive review of the literature pertaining to the generalization of verbal behavior in retarded children, refer to Appendix D.

Chapter II

Method

Subjects

Four mentally retarded children participated in this research. All were residents of the St. Amant Centre in Winnipeg.

Normand was a 9 year old boy with a diagnosis of Down's Syndrome. He was first admitted to the Centre at 1 year of age and lived in a self-contained cottage-style unit attached to the Centre. A recent developmental assessment had found him to be functioning at the 2 to 2½ year level. Normand's vocal behavior consisted primarily of single syllable imitations, a number of picture-card names, and several short phrases. (e.g., "No", "Go away", "Bye-bye, see you").

Clayton was a 6 year old boy with a diagnosis of "mental retardation and seizure disorder". He was first admitted to the Centre at 3 years of age and, like Normand, lived in a cottage-style residence. A recent developmental assessment had found him to be functioning at the 3 to 3½ year level. Clayton's vocal behavior was similar to Normand's except that he emitted no utterances longer than a single word (e.g., "Hi", "No", "Yeah").

Janice was a 14 year old girl with a diagnosis of cerebral palsy and spastic quadriplegia. She was first admitted to the Centre at 1 year of age and lived on a special ward for non-ambulatory children. A recent

developmental assessment had found her to be functioning at the 2½ to 3 year level. Janice had no vocal behavior but she could reliably imitate a pointing response with her right arm and had received limited training in Bliss-symbolic Communication (see Appendix A). However, she could not reliably name any stimuli at the beginning of the experiment.

Sherri was a 5 year old girl with a diagnosis of Down's Syndrome. She was first admitted to the Centre at 1 year of age and lived on a ward for younger children. A recent developmental assessment had found her to be functioning at the 2½ to 3 year level. Sherri's vocal behavior consisted of several single syllable imitations. However, since her voice was raspy and often inaudible, she was taught to make sign language words rather than vocal words. Sherri could not name any stimuli at the beginning of the experiment.

Experimental Design

In order to determine the relative effectiveness of each stimulus mode (i.e., picture-cards, photographs, real objects) in promoting the generalization of naming responses to objects in the natural environment, three retarded children (Normand, Clayton, and Janice) were trained with each of the three modes in a sequential fashion. The order of training was partially counterbalanced across the three children to control for possible order of presentation effects. After a child had been trained with each of the three stimulus modes, an intrasubject replication was:

conducted. Thus the basic design consisted of six successive phases per child in an A-B-C-A-B-C general format. Later, a fourth child (Sherri) entered the study. This child, who was trained with two stimulus modes only (picture-cards and real objects), served to replicate and confirm the basic findings which were obtained with the first three children. A summary of the design depicting the phases in partially counterbalanced order is presented in Table 1.

In each of the phases, five randomly selected stimuli were trained to a pre-specified criterion with one of the three stimulus modes. Tests for generalization took place at the end of each phase.

Setting and Apparatus

Training sessions and generalization tests were conducted in a small classroom within the specially designed research section of the psychology department at the St. Amant Centre. The classroom contained a single child-sized table and two chairs, an electric timer, an audio-recorder, and a one-way window. A child sat facing the experimenter.

Generalization tests were also conducted in the children's natural environments (see Appendix B for details). With Normand and Clayton, the tests were conducted in the bedroom, bathroom, and kitchen areas of their cottage. Vocal responses were recorded with an audio-recorder carried by the experimenter. With Janice and Sherri, the tests took place in the bedrooms of their respective wards. The

TABLE 1
Summary of Experimental Design

Subjects	Phases					
	I	II	III	IV	V	VI
	Training Stimuli					
Normand	O	P	C	O	P	C
Clayton	C	O	P	C	O	P
Janice	P	C	O	P	O*	C*
Sherri	O	C	O	C	-	-

O = real objects, P = photographs, C = picture-cards

* With Janice, the sequence in Phases IV, V, and VI was different from that of Phases I, II, and III in order to permit the examination of certain variables described at the end of the Results section.

experimenter and a second observer independently recorded the relevant motor responses on a data-sheet.

Training Stimuli

Three modes of training stimuli were compared in this research: (1) picture-cards, (2) objects, and (3) photographs.

Picture-cards were obtained from kits of Peabody Picture Vocabulary Cards and Peabody Articulation Cards. The experimenter and two observers independently rated a selection of 110 picture-cards according to whether or not they represented an "object" as defined by a written criterion which basically stated that a picture-card represented an object if it depicted something other than a person, animal, food item, or symbol, and if it could be easily transported into the training room by the experimenter. The 58 picture-cards so rated by the experimenter became eligible to serve as training stimuli. The inter-observer reliability coefficients (agreements divided by agreements plus disagreements for those picture-cards the experimenter selected as representing objects were .98 and 1.00 for observers 1 and 2 respectively. The coefficients for those picture-cards the experimenter rejected were .98 and .98 for observers 1 and 2 respectively.

The experimenter acquired objects which he judged to be representative of the objects portrayed by the 58 picture-cards according to a written criterion which basically said that an object was representative of it

was similar in color and form to the object portrayed by the picture-card (with differences in fine detail excluded). Those objects then became eligible to serve as training stimuli. For 18 of the picture-cards a second object was acquired which the experimenter judged to be non-representative. Two independent observers then judged the 76 objects according to the written criterion. The inter-observer reliability coefficients for those objects that the experimenter judged as being representative of the objects portrayed by the picture-cards were .98 and 1.00 for observers 1 and 2 respectively. The coefficients for those objects the experimenter judged as being non-representative were .89 and .89 for observers 1 and 2 respectively.

Standard 9 x 12 $\frac{1}{2}$ cm color photographs were made of the 58 objects. Each print depicted an object at an angle similar to the angle depicted by the picture-card. Photographs were not enlarged to picture-card size because the prohibitive cost would lessen the applied value of the training stimulus.

For further detail on the selection of training stimuli, including the written criteria referred to above, see Appendix C.

Reinforcers

Edible reinforcers for Normand, Clayton, and Sherri were chosen on the basis of: (1) the rate at which a child would press a lever in order to receive a particular reinforcer, and (2) nutritional considerations. The reinforcers:

chosen were pureed peaches (one teaspoon per reinforcement), applesauce (one teaspoon per reinforcement), and ice cream (one-half teaspoon per reinforcement) for Normand, Clayton, and Sherri respectively.

Janice was on a calorie restricted diet and consequently her reinforcer was small bites of her evening meal. After a session Janice always received that portion of her meal which had not been consumed.

Preliminary Procedures

The children were familiarized with the classroom and the experimenter before the research was conducted. During this time they were taught to sit in their chairs and disruptive behaviors were extinguished with procedures similar to those employed by Kent (1972) and Martin, England, Kaprowy, Kilgour, and Pilek (1968).

Following the selection of the 58 objects described in the section headed Training Stimuli, an imitative baseline was conducted with Normand, Clayton, and Sherri. This consisted of a series of trials during which a child was instructed to imitate the experimenter as the latter pronounced (or signed) the names of the 58 training stimuli. The actual stimuli were not present. A trial consisted of the experimenter saying, "Say (name of stimulus)!" or "Do this (sign)!" and then writing down the child's response. The list of 58 stimuli was presented to the child three times. The first time the list was presented the experimenter spoke (signed) the entire word before waiting for the child's response (e.g., "Say FORK!"). If the child could not imitate the entire word, the experimenter

broke the word up into several syllables (e.g., "Say F (child imitates), OR (child imitates), K (child imitates)!"). If the child could not pronounce a particular syllable, the experimenter accepted an approximation to the correct pronunciation (e.g., F-OR-T instead of F-OR-K). The second and third time the tests were presented, the experimenter spoke the word as it had been pronounced most clearly before. This was to ensure that the child could emit the particular imitative response reliably. During this baseline, imitative response were reinforced with primary reinforcement on a variable-ratio five schedule, while social reinforcement (e.g., "Good!") followed every imitative response. Responses were recorded on audio-tape for future reference. The purpose of the imitative baseline was to provide a criterion for determining whether or not a vocal response was correct during training (described later). This is important because the training procedure was designed to develop stimulus control over naming responses but not to shape imitation. No imitative baseline was required with Janice since her naming response was of a non-vocal nature.

Clayton and Normand had both previously participated in research programs where they had learned to emit visual observing responses to picture-card training stimuli. However, preliminary testing with Janice has revealed an apparent tendency to visually fixate on the Bliss symbols located on her tray without first observing the training stimulus presented to her by the experimenter. Consequently,

this impaired the establishment of stimulus control by the training stimulus. Basic research on the matching-to-sample behavior of pigeons has found that fewer training sessions are required to establish matching, and that matching accuracy is higher, when an explicit observing response is required to the sample stimulus (Eckerman, Lanson, & Cumming, 1968). Therefore, during a preliminary training phase where Janice was taught to name three colors displayed on picture-cards, she was prompted to touch the card for 5 seconds before pointing to a Bliss symbol. This procedure continued until she discriminated between the three randomly alternating cards with approximately 70 percent accuracy.

Finally, during this preliminary phase all three children were assessed to determine which of a variety of simple instructions they could reliably follow (e.g., "Show me your nose", "Stand up", "Sit down", "Touch your hair"). A list of instructions was presented to each child three times and any instruction correctly followed all three times was retained. Eight instructions were retained for Janice and Normand, and nine instructions were retained for Clayton. The function of these instructions will be explained in a following section.

Overview of General Procedures

At the beginning of each phase in the research, seven stimuli of the appropriate stimulus mode were randomly selected from the pool of 58 described earlier. Five of

the seven stimuli were randomly selected to serve as experimental stimuli while the remaining two served as control stimuli which were not taught but which served to estimate the degree of "training" which might be expected to result from uncontrolled sources (e.g., home, school).

In each phase of the research, four types of procedures were used. First, a baseline was conducted in both the classroom and in the child's natural environment to ensure that none of the stimuli to be used in that phase were known prior to training. In the classroom, all three stimulus modes were baselined, while in the natural environment only the real objects were baselined. Second, training took place in the classroom with one of the three stimulus modes. Third, a post-training test was conducted in the classroom with the newly trained stimuli in order to estimate the strength of the naming responses. Fourth, a test for generalization was conducted in the classroom to determine if generalization occurred to the two untrained modes, and in the natural environment to determine if generalization across settings to the real objects had occurred.

The baseline in the classroom and the baseline in the natural environment were conducted on two separate, successive week days. Training was carried out on successive week days until each stimulus was learned to a preset criterion. The post-training test, the test in the classroom, and the test in the natural environment followed training on the next three successive week days respectively.

Each of these four procedures will now be considered in more detail.

Baselines

Those aspects of the baseline procedure common to both the baseline conducted in the classroom and the baseline conducted in the natural environment will be described first.

A child was presented with a series of 14 simple instructions which he or she was known to reliably follow (see section headed Preliminary Training). A probe instruction, "What's this!" was interspersed among the 14 non-probe instructions seven times; once for each of the five experimental stimuli and once for each of the two control stimuli. Thus the entire series consisted of 21 instructions, seven of which instructed the child to name a stimulus which was presented to him or her. While the non-probe instructions varied across children, the general format of the series was constant and is depicted in Figure 1.

Social reinforcement (e.g., "Good boy!") followed every correct response to a non-probe instruction, and the astericks in the figure indicate where primary reinforcement occurred within the series. Correct responses to probe instructions, were never reinforced. Each probe and non-probe instruction followed the response to the preceding probe or non-probe instruction immediately. If no correct response occurred to the probe instruction (which was typically the case during baselines), the experimenter

1. instruction (e.g., "Show me your nose!")
- * 2. instruction
3. instruction
4. What's this? (the child is presented with a stimulus to name)
5. instruction
6. instruction
7. What's this?
- * 8. instruction
9. instruction
10. instruction
- *11. instruction
12. What's this?
13. instruction
14. What's this?
15. instruction
16. What's this?
- *17. instruction
18. instruction
19. What's this?
20. instruction
21. What's this?

Figure 1. General format of the instruction following series used during baselines.

waited for a 10-second interval (15 seconds with Janice) and then proceeded to the next non-probe instruction. The rationale for this paradigm will be discussed in a following section.

Classroom baseline. During this baseline the seven stimuli selected for a phase were presented to the child in the instruction-following format described above three times per stimulus mode for a total of nine times. The order in which the modes were presented was randomized with the stipulation that no particular mode occur more than twice consecutively. If a child correctly identified an experimental stimulus even once by any of the three modes, that stimulus was considered known and one of the two control stimuli was randomly selected and substituted for the known stimulus. If more than two stimuli were correctly identified, new stimuli were randomly selected and the baseline was done again. An exception to this general procedure had to be made with Janice. Since there was a certain probability that Janice might point to the correct Bliss symbol by chance alone, the number of correct responses which occurred during the baseline were simply recorded and compared to the number of correct responses which occurred during the following test for generalization.

Natural environment baseline. During this baseline the seven stimuli were presented to the child in the instruction following format described above, but only in the real-object mode. This occurred three times. Each object was situated in a standardized location in the child's natural

environment, and the experimenter and the child walked from one location to the next before each probe instruction (see Appendix B for more detail). Correct responses were dealt with in the same manner described for the baseline in the classroom.

Training

To facilitate reading, the rather complex training procedure which was employed in this research is presented in two sections. The first section describes session and trial parameters, while the second section describes the actual training procedure.

Sessions and trials. Two 20 minute sessions were conducted with each child daily, separated by a 10-minute break. The experimenter began a session by: (1) activating a session timer, (2) pressing a foot-switch to activate a trial timer, and (3) presenting a training stimulus and a verbal stimulus to the child. A trial terminated when: (1) the child emitted any vocal response in the case of Clayton and Normand, or emitted a recognizable sign in the case of Sherri, or pointed to a Bliss symbol in the case of Janice; or (2) when the trial timer indicated with a light that the specified trial time limit had elapsed. Thus both correct and incorrect responses shortened the trial time relative to trials in which no response occurred. An inter-trial interval of a specified duration followed each trial and during this time the experimenter recorded the child's response on a data sheet and delivered reinforcement when

scheduled. In addition, with Janice the experimenter systematically rearranged the sequence of Bliss symbols on her tray (see Appendix A). A new trial commenced when the inter-trial interval timer indicated with a light that the interval has elapsed. In the case of Clayton, Normand, and Sherri, a trial lasted for a maximum of 10 seconds and the inter-trial interval was 5 seconds. In the case of Janice, a trial lasted for a maximum of 15 seconds and the inter-trial interval was 15 seconds.

Procedure. The procedure for training stimuli in this research is a modified version of that described by Kircher, Pear, and Martin (1971) and Stephens, Pear, Wray and Jackson (1975). A session consisted of a series of probe and prompt trials. A probe trial was one in which the experimenter presented a training stimulus to the child and said: "What's this?". A prompt trial was one in which the experimenter presented a training stimulus to the child and said: "What's this? (name of stimulus)". The purpose of this procedure was to transfer the control exerted by the prompt which the child imitated to the training stimulus presented on the probe which the child was to name.

In general, an unknown stimulus was trained with a series of probe and prompt trials which were systematically interspersed with a series of trials in which known stimuli (which were previously trained in that phase) were presented. The purpose of the trials with the known stimuli was to promote stimulus control by ensuring that the child did not

simply repeat a name irrespective of the stimulus presented.

More specifically, an unknown stimulus was trained according to the following steps:

1. The experimenter presented three probe trials to the child with the unknown stimulus. This functioned as a second baseline and ensured that the child did not know the name of the stimulus prior to training. If the child named the stimulus on any of these three initial probe trials, the stimulus was discarded and another was trained. The experimenter proceeded to Step 2 on the next trial.

2. The experimenter presented a prompt trial to the child with the unknown stimulus. If the child correctly imitated the experimenter, the experimenter presented a probe trial to the child with the unknown stimulus. If the child correctly named the stimulus, the experimenter proceeded to Step 3 on the next trial. If the child failed to correctly imitate on the prompt trial or to name on the probe trial, the experimenter repeated the prompt trial, and the sequence continued.

3. The experimenter presented a probe trial to the child with the known stimulus. If the child correctly named the stimulus, the experimenter proceeded to Step 4 on the next trial. If the child failed to correctly name the stimulus, the experimenter presented a prompt on the next trial. A correct imitation resulted in another presentation of the probe trial, while a failure to correctly imitate resulted in another prompt trial, and the sequence continued.

4. During this step the experimenter repeated Step 3 with the unknown stimulus and then proceeded to Step 5.

5. The experimenter presented a series of four probe trials to the child beginning with the known stimulus and alternating thereafter with the unknown stimulus. If the child responded correctly on all four probe trials, the experimenter proceeded to Step 6. If the child did not respond correctly on either of the probe trials with the known stimulus, the experimenter returned to the prompt trial in Step 3. If the child did not respond correctly on either of the probe trials with the unknown stimulus, the experimenter returned to the prompt trial in Step 4.

6. The experimenter repeated Steps 2 to 5 a second time, starting with the probe trial in Step 2, and then proceeded to Step 7.

7. The experimenter repeated Steps 2 to 5 a third time, starting with the probe trial in Step 2. Upon successful completion of Step 7, an unknown stimulus was said to have reached criterion and the experimenter returned to Step 1 and began training another unknown stimulus. The entire training sequence is represented schematically in Figure 2.

When a stimulus reached criterion it was considered to be known and it served as a known stimulus when the next unknown stimulus in that phase was trained. There were five stimuli trained per phase. The first unknown stimulus in a phase was necessarily trained in the absence of a known stimulus. In this special case, the unknown stimulus was presented in place

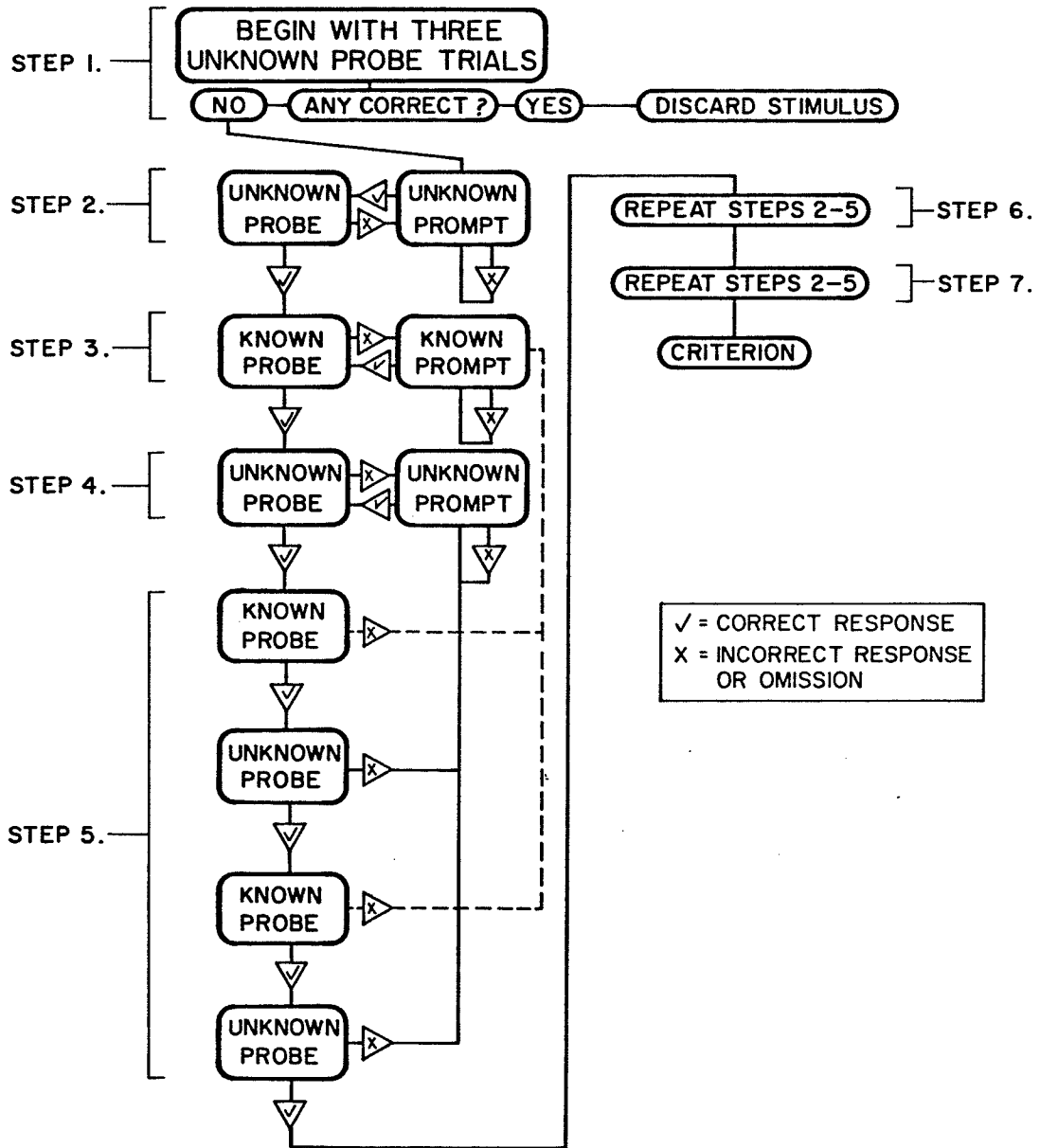


Figure 2. Schematic representation of the training procedure.

of the known stimulus referred to in Steps 3 and 5. Once the first unknown stimulus in a phase reached criterion, it served as a known stimulus while the second unknown stimulus was trained. When the second unknown stimulus reached criterion, it served as a second known stimulus and the two known stimuli alternated over each repetition of Steps 2 through 5 as the third unknown stimulus was trained, and so on. This sequence is summarized in Table 2.

If an unknown stimulus failed to reach criterion within a single session, the experimenter began the next session at that point in the training procedure where the previous session ended. If an unknown stimulus failed to reach criterion within six sessions, it was discarded and one of the two control stimuli was randomly selected and trained in its place.

During training, primary reinforcement for correct responses to probes was delivered on a variable-ratio 5 (range: 1 to 9) schedule, while correct responses to prompts did not receive primary reinforcement. However, social reinforcement (e.g., Good!) was provided for every correct response on both probe and prompt trials.

Post-Training Test

In the preceding section, training stimuli which reached criterion were termed "known" stimuli. It is important to recognize the arbitrary nature of the term "known" in this research. It may be that a naming response becomes highly probable in the presence of a particular training stimulus.

TABLE 2

A Summary of the Procedure for Interspersing Known Stimuli Within
a Phase

Unknown stimulus currently being trained	Known Stimulus for steps 2-5	Known stimulus for step 6	Known stimulus for step 7
first unknown	---	---	---
second unknown	first known	first known	first known
third unknown	second known	first known	second known
fourth unknown	third known	second known	first known
fifth unknown	fourth known	third known	second known

before that stimulus reaches the criterion referred to above. Conversely, a training stimulus may reach criterion but not be emitted with a high probability in a situation differing in some way from the training procedure. Therefore, following training, a test was conducted in the classroom in order to estimate the strength of each of the trained responses. The test consisted of a series of probe trials during which each of the trained stimuli was presented to the child in a semi-random order ten times each. If a child failed to correctly name a stimulus on a particular probe trial, he or she received one prompt trial before proceeding to the next probe trial in the series. The trial time, inter-trial time, and reinforcement schedule remained the same as during training.

The estimate of response strength for an individual training stimulus was the percent of probe trials scored as correct. Thus, if a particular stimulus was named correctly on nine out of ten probe trials (and consequently prompted only once), that training stimulus is referred to as "90% known". The extent to which a naming response was known is important in interpreting the generalization data. For example, if no correct responses occurred during the probe for generalization (discussed in the following section), it would be an error to conclude that no generalization had occurred if the training stimuli themselves were only "20% known". Lack of responding on a probe for generalization would not necessarily reflect a lack of generalization

if the response had not been well learned during training.

Tests for Generalization

Tests for generalization were conducted by repeating the instruction-following baseline procedure described under the heading Baselines, except that the order of the probe and non-probe instructions within the general format were varied from the baseline to the test for generalization.

During these tests, the primary interest was in comparing the degree of generalization to the real object in the natural environment which resulted from training with each of the three stimulus modes. As may be apparent, when the training mode was the real object, generalization need only occur from the classroom to the natural environment. This has often been referred to as "setting generalization". However, when the training mode was either picture-cards or photographs, generalization must occur both across modes and across settings. The test for generalization in the classroom served to assess the degree of inter-modal transfer and thereby avoided confounding inter-modal transfer with setting generality.

The rationale for the paradigm employed for baselines and generalization tests stems from research which has found that children will continue to emit instruction-following responses which are never reinforced as long as those instructions are interspersed among other instructions to which responses are reinforced (Bucher, 1973; Martin, 1971; Whitman, Zakaras, & Chardos, 1971 - refer to the section on generalized imitation in Appendix D). Presumably such a

paradigm allows generalization to be assessed without the confounding influences of reinforcement or extinction.

Dependent Variables

Two types of data were examined in this research: (1) acquisition data and (2) generalization data. Four dependent variables were defined:

(1) The average number of minutes required for a stimulus to reach criterion during training in each phase.

(2) The percentage of correct responses on probe trials during the post-training test.

(3) The percentage of correct responses to probe instructions during the test for generalization (i.e., inter-modal transfer) in the classroom.

(4) The percentage of correct responses to probe instruction during the test for generalization in the natural environment.

With Normand, variables (3) and (4) above were subdivided into: (1) the percentage of correct responses which were pronounced perfectly, and (2) the percentage of "correct" responses which were pronounced imperfectly. A pronunciation was considered to be imperfect if one syllable was dropped or if an extra syllable was added. Examples will be provided later.

Interobserver Reliability

This research required the experimenter to make judgements as to the correctness of the children's naming responses. In order to ensure objectivity, the following

interobserver reliability checks were made:

With Normand and Clayton, all training sessions, post-training tests, generalization tests in the classroom, and generalization tests in the natural environment were recorded on audio-tape. Approximately one-tenth of the training session tapes and one-third of the tapes from each of the other three types of sessions were randomly selected for scoring by an independent listener. Sessions from supplementary phases (which will be described later) were included in the random selection of tapes.

With Janice and Sherri, one training session per phase and most post-training tests and tests for generalization in the classroom were independently scored by a second observer through a one-way window. During most tests for generalization in the natural environment, a second observer was present in the testing area but tried to remain as unobtrusive as possible. Reliability checks were conducted in a similar manner during several supplementary phases with Janice (which will be described later).

Reliability coefficients were obtained by calculating the ratio of agreements to agreements plus disagreements on responses that the experimenter scored as correct and the ratio of agreements to agreements plus disagreements on the responses that the experimenter scored as errors (i.e., incorrect responses and response omissions).

The reliability coefficients are shown in Table 3. As may be seen, the coefficients range between .80 and 1.00,

TABLE 3
Interobserver Reliability Coefficients

Child	Procedure *											
	1		2		3			4				
	C	E **	C	E	C	I	E	C	I	E		
Normand	1.00	.96	1.00	.80	1.00	.90	---	.95	1.00	1.00		
Clayton	.99	.89	1.00	.83	.99		.89	1.00		1.00		
Sherri	.98	1.00	.99	1.00	.99		1.00	1.00		1.00		
Janice	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00		

* Procedure 1 = Training

Procedure 2 = Post-training test

Procedure 3 = Generalization test in the classroom

Procedure 4 = Generalization test in the natural environment

** C = Coefficient for those responses the experimenter scored as correct

I = Coefficient for those responses the experimenter scored as correct - imperfect pronunciation

E = Coefficient for those responses the experimenter scored as errors

with the majority being above .90.

The number of correct responses emitted in the presence of the control stimuli (see Overview of General Procedures) did not increase from baselines to tests for generalization, indicating that training from uncontrolled sources such as home or school probably was not a confounding factor in this experiment.

CHAPTER III

Results

Figure 4 shows the average number of minutes required to reach criterion with each of the stimulus modes during training. There appear to be no differences which are both large and reliable between the stimulus modes. An order effect may be apparent with Janice, but this may be at least partially a function of retraining which occurred after Phase III. This will be explained later.

In Figure 5, Phases I through VI show the extent to which Normand generalized both from the training stimulus mode to the remaining two modes, and from the classroom to the real objects in the natural environment. Two forms of generalization are shown on the graph. Generalized responses identical to those which were accepted as correct during training are represented by the lined areas labelled "perfect pronunciation", while responses which were not quite identical but which nevertheless clearly reflected generalization are represented in the white areas labelled "imperfect pronunciation". Examples of the latter would be when Normand said "brush" instead of "toothbrush" and "oap" instead of "soap". The data reveal a high degree of generalization with no systematic differences between any of the three stimulus modes. Note also that the black dots in the figure indicate that the naming responses were all well known on the post-training test.

A question which arises from the data from Phase I to

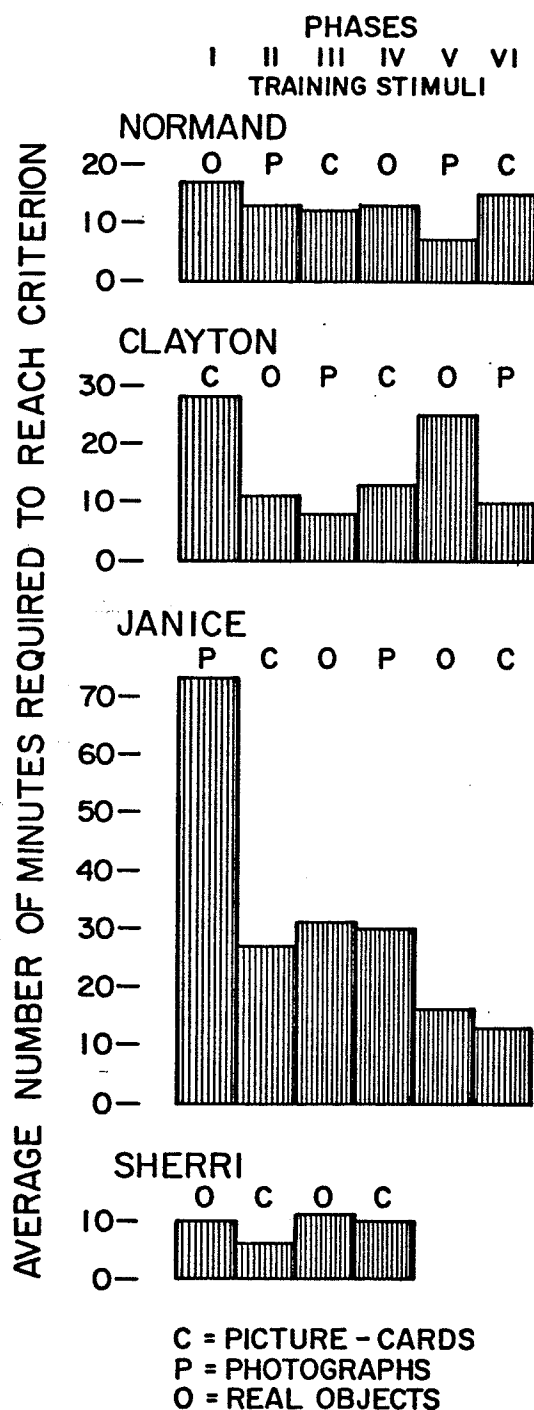


Figure 4. The average number of minutes required for each stimulus mode to reach criterion during training.

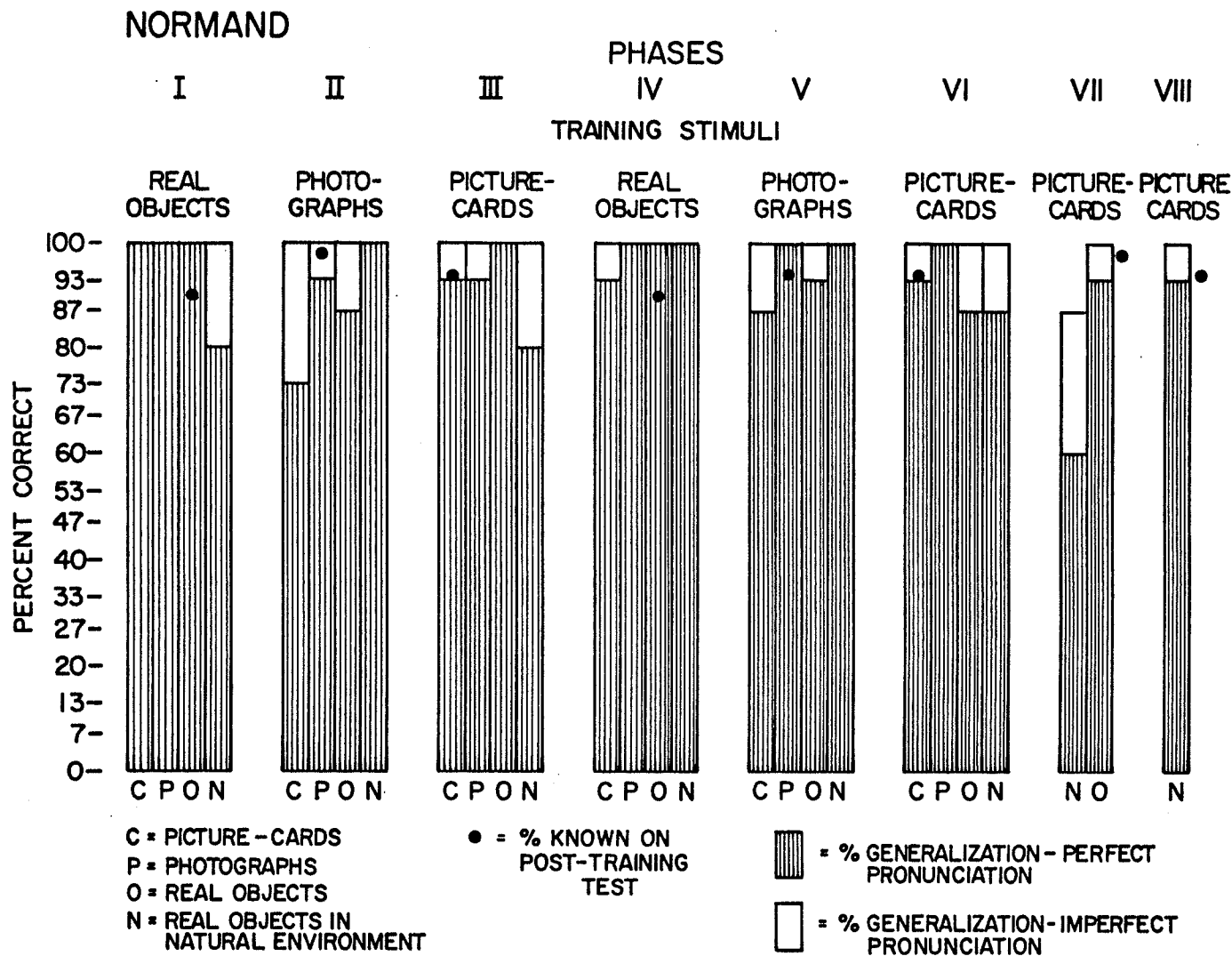


Figure 5. The percentage of correct responses emitted by Normand during tests for generalization in the classroom and natural environment.

VI is whether Normand would have evidenced as much generalization from picture-cards (or photographs) to the real objects in the natural environment if he had not first received experience with the real objects during the classroom test for intermodal transfer. Phases VII and VIII assessed this possibility. In Phase VII Normand was trained with picture-cards and was then tested in the natural environment with the real objects without an intervening classroom test. As can be seen in the figure, the amount of generalization displayed in the natural environment was somewhat less than in previous phases in which picture-cards had been the training mode (i.e., Phases III and VI). A subsequent test with the real objects in the classroom revealed a degree of generalization comparable to that shown in Phases III and VI, suggesting that tests in the classroom for intermodal transfer may in fact facilitate generalization across settings. To determine if this effect was reliable, in Phase VIII Normand was again trained with picture-cards and then tested for generalization to the real objects in the natural environment. This time, however, he displayed an amount of generalization comparable to that shown in Phases III and VI.

In Figure 6, Phases I through VI show the extent to which Clayton generalized both from the training stimulus mode to the other two modes, and from the classroom to real objects in the natural environment. A considerable amount of intermodal transfer occurred from all three stimulus

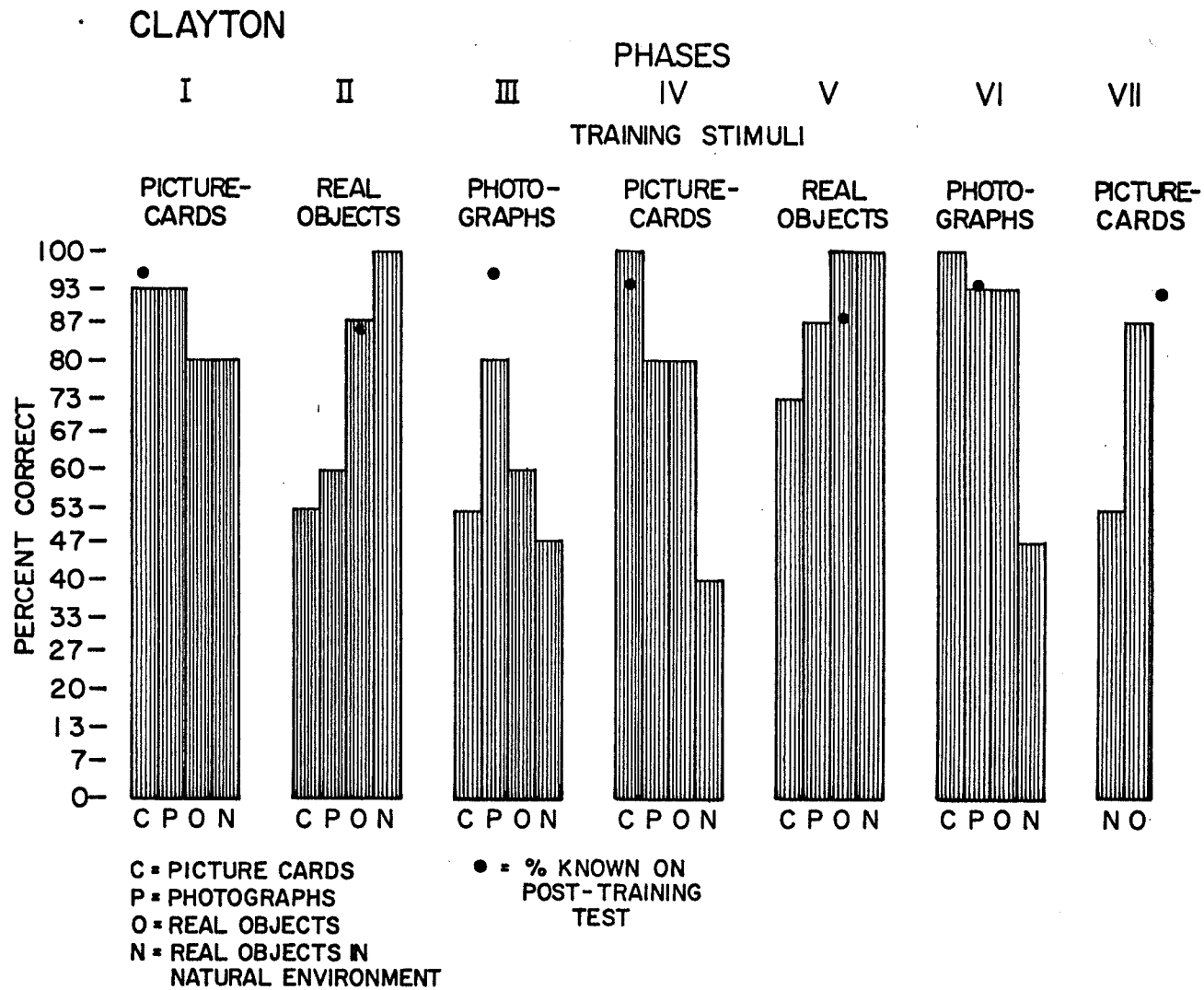


Figure 6. The percentage of correct responses emitted by Clayton during tests for generalization in the classroom and natural environment.

modes, but the effect was most reliable when picture-cards were used in training. However, generalization to real objects in the natural environment was consistently best when real objects were used as the training stimuli. The black dots in the figure reveal that the naming responses were well known on the post-training test. Phase VII assessed the extent to which experience with the real objects during the classroom test for intermodal transfer affected the outcome of the test for generalization to real objects in the natural environment. Clayton was trained with picture-cards, tested with the real objects in the natural environment, and then tested with the real objects in the classroom. The amount of generalization displayed was comparable to the average performance of previous phases in which picture-cards had been the training mode (i.e., Phases I and IV), suggesting that the tests in the natural environment had not been contaminated by the test in the classroom.

In Figure 7, Phases I through IV show the extent to which Sherri, who was trained only with picture-cards and real objects, generalized from both the training stimulus mode to the other two modes and from the classroom to the real objects in the natural environment. The amount of intermodal transfer displayed by Sherri was variable and unsystematic, regardless of which stimulus mode was used in training. As was the case with Clayton, generalization to real objects in the natural environment was clearly and consistently

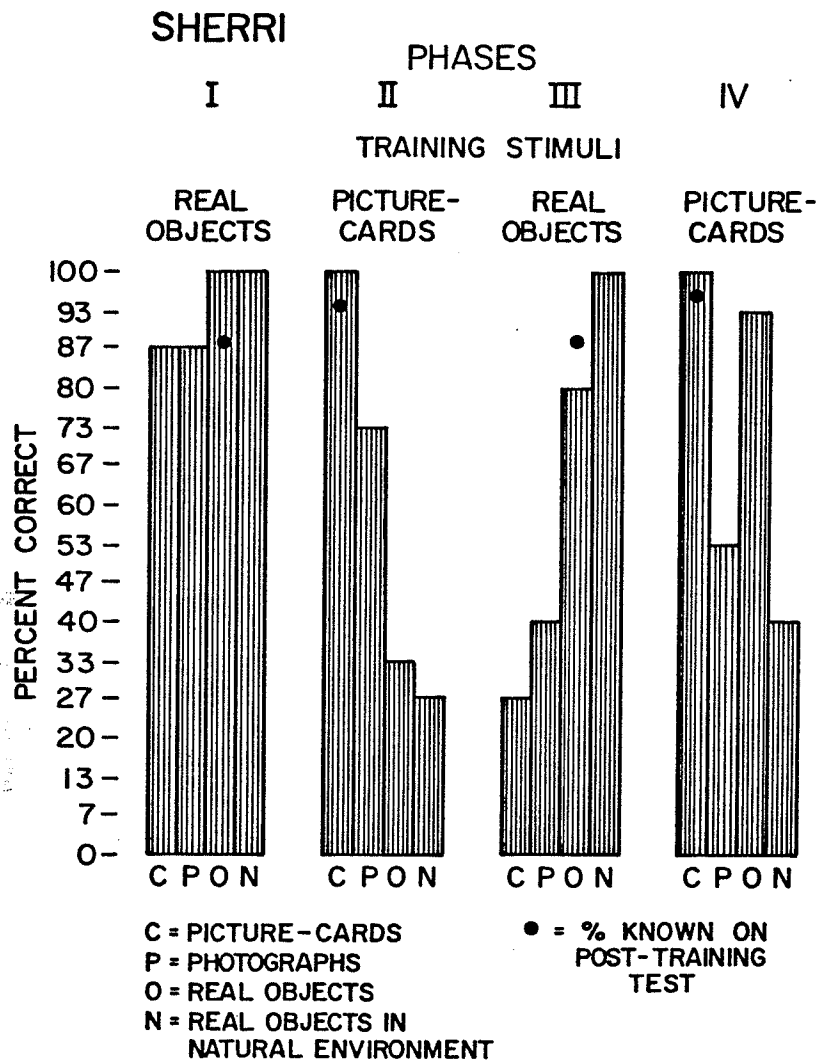


Figure 7. The percentage of correct responses emitted by Sherrri during tests for generalization in the classroom and natural environment.

better when real objects were used during training. The black dots in the figure reveal that the naming responses were well known on the post-training test. This indicates that the small amounts of generalization to the real objects in the natural environment which resulted from training with picture-cards was not a function of ineffective training but rather was a true reflection of poor generalization.

The generalization data for Janice are presented in Figure 8. With reference to Phases I through III, it is likely that the small number of correct responses which occurred during baselines were the result of chance only (since pointing to Bliss symbols was the verbal response modality used with her). The data for Phases I, II, and III indicate that no significant amount of intermodal transfer occurred regardless of which mode was used as the training stimulus. In addition, the data show that when photographs or picture-cards were used in training, no generalization to the real objects in the natural environment occurred. When real objects were used as the training mode, a small amount of generalization to the natural environment took place. Although no greater than the levels which occurred by chance in the classroom baselines, this generalization is probably significant because it represents the only time Janice actually emitted a pointing response during the tests in the natural environment in the first three phases. Because of the large number of omissions

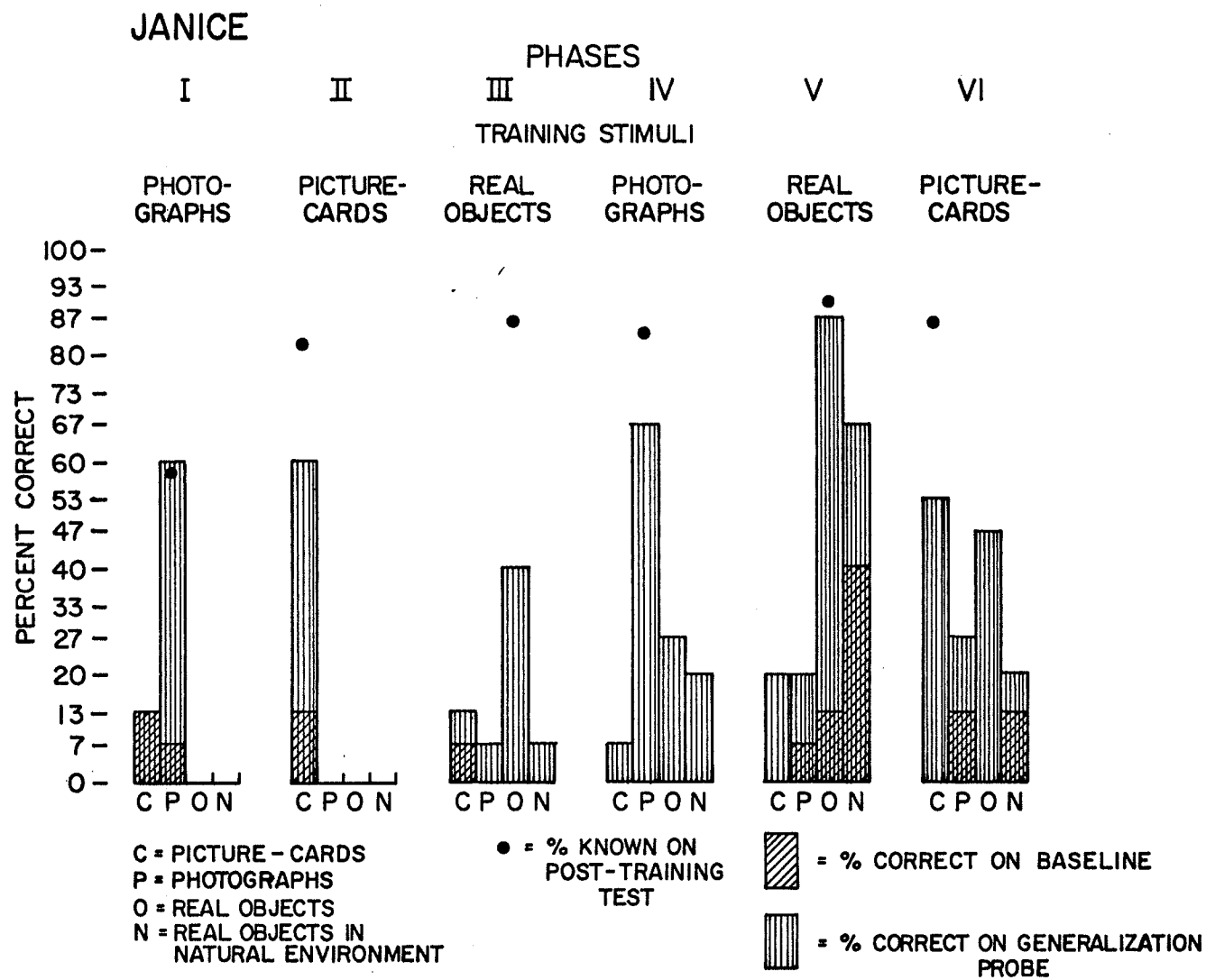


Figure 8. The percentage of correct responses emitted by Janice during baselines and tests for generalization in the classroom and natural environment.

which occurred in Phases I to III, the same stimuli were retrained during Phases IV to VI. However, during these phases if Janice did not respond within 15 seconds, the experimenter said "Hurry up Janice!". This always resulted in the emission of a pointing response. Phases IV through VI of Figure 8 show that under conditions where Janice was prompted to respond, she emitted more correct responses to the real objects in the natural environment when real objects were used as the training mode than when either pictures or photographs were used. The amount of intermodal transfer which occurred was greater relative to the first three phases, but in an absolute sense was quite small.

A question which arises from Janice's data is: what accounts for the relatively large amount of correct responding which occurred during the baseline in the natural environment in Phase V?. The most plausible answer would be that the responses in question reflect generalization from training which took place during Phase III but was not revealed until Janice was prompted to respond in Phase V. The fact that this occurred only during the baseline of Phase V, where the training stimuli were real objects, may simply reflect the fact that generalization appears to be more probable when real objects are used as the training stimuli. The black dots in the figure show that the naming responses were all well known on the post-training tests, with the exception of Phase I.

Results of Some Supplementary Procedures with Janice

Three additional phases were conducted with Janice. Phases VII and VIII had two functions. First, these phases were designed to replicate and confirm the superiority of real objects in promoting generalization to the natural environment. Second, since even the real object training stimuli did not produce large amounts of generalization with Janice, Phases VII and VIII also assessed the value of training in more than one environment as a technique for facilitating setting generalization (see Stokes & Baer, 1977). In Phase VII Janice was trained with a new set of real objects. Following the test for generalization in the natural environment, Janice was administered the post-training test procedure described previously, in another room in the psychology department. This was followed by another test for generalization in the natural environment. This in turn was followed by a post-training test in a third room in the psychology department and another test for generalization in the natural environment. Phase VIII was identical to Phase VII except that picture-cards were used as the training stimuli. The results are shown in Figure 9. The figure shows that, as before, little intermodal transfer occurred in the classroom regardless of the training stimulus mode used. The level of the bars at 1, 2, and 3 reflect the amount of generalization to the real objects in the natural environment after training in the classroom, testing in the second environment and testing in the third environment

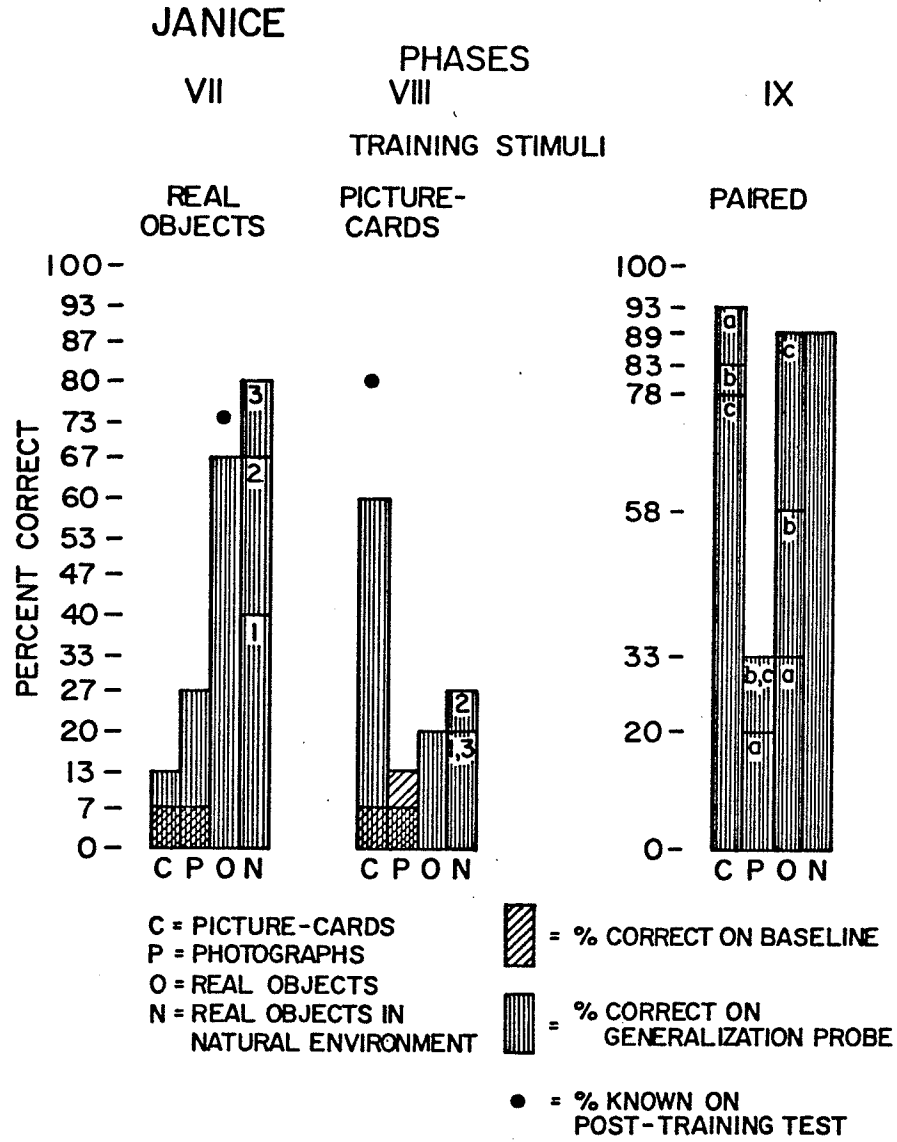
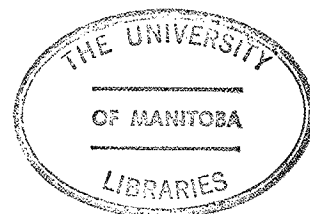


Figure 9. The percentage of correct responses emitted by Janice following testing in a second and third environment and following the concurrent training of picture-cards and objects.



respectively. It may be seen that , as before, more generalization occurred when real objects were used as the training stimuli. In addition, testing in a second and third environment resulted in marked increments in the amount of generalization to the natural environment when real objects were used as the training stimuli but not when picture-cards were used.

In Phase IX a procedure was implemented to facilitate intermodal transfer. The picture-cards which had been used as training stimuli in Phase VIII were baselined again in the classroom. The amount of correct responding on the baseline is represented by the level of the bars at a in Figure 9. As before, little intermodal transfer is demonstrated. Next, one of the five picture-cards was "paired" with the corresponding real object. The picture-card and real object were trained concurrently within the standardized training procedure described previously. The real object served as the "unknown" stimulus and the corresponding picture-card served as the "known" stimulus. Next, a test in the classroom was conducted to again assess intermodal transfer. This is represented by the level of the bars at b in Figure 9 (the paired stimulus was not included in the percentages calculated). As is apparent from the graph, the pairing procedure facilitated intermodal transfer to the remaining four real objects and perhaps to the photographs, although to a lesser degree. Following this, a second pairing of a picture-card and a

real object was conducted, and was followed by a classroom test for generalization. The resulting intermodal transfer is represented by the level of the bars at c in Figure 9, (the two paired stimuli were not included in the percentages calculated). Again the pairing resulted in more intermodal transfer to the remaining three real objects, but not to the photographs. Finally, a test was conducted in the natural environment. As may be seen in the figure, the amount of generalization to the remaining three real objects in the natural environment is considerable.

CHAPTER IV

Discussion

The results of this study support Guess, Sailor, and Baer (1974) when they recommend that parents and teachers use real objects, as opposed to pictures, when conducting language training programs with handicapped children.

Three of the four children who participated in the study displayed considerably more generalization to the real objects in the natural environment when they were trained with real objects than when they were trained with either picture-cards or photographs. The other child, Normand, displayed a considerable degree of generalization to the real objects in the natural environment regardless of the mode of the training stimuli. The amount of intermodal transfer which occurred in the classroom varied within and across children.

Clayton generalized completely to the real objects in the natural environment when trained with the real objects in the classroom. Thus, when this child was not required to generalize across modes, generalization across settings was complete. When picture-cards or photographs were used as training stimuli in the classroom, he showed only moderate amounts of generalization (i.e., about 50 percent) to the real objects in the natural environment. However, this effect cannot be attributed solely to a decrement in intermodal transfer because it occurred in phases where intermodal transfer was quite high (e.g., Phases IV and VI).

Thus in these cases, it would appear that Clayton failed to generalize only to a situation involving both a different stimulus mode and a different physical setting.

Sherri generalized completely to the real objects in the natural environment when trained with the real objects in the classroom. As with Clayton, when Sherri was not required to generalize across modes, generalization across settings was complete. When picture-cards were used as training stimuli, only small amounts of generalization (i.e., 27 to 40 percent) to the real objects in the natural environment occurred. This may not be entirely attributable to a simple failure to generalize across stimulus modes because it occurred even when intermodal transfer was quite high (e.g., Phase IV). In this case, the situation to which generalization failed to occur was one which involved both a different stimulus mode and a different physical setting, as was the case with Clayton. Thus, an interaction between intermodal transfer and setting generalization may occur.

With Janice, decrements in both intermodal transfer and setting generalization occurred, as indicated by the results of Phases VII, VIII, and IX.

The control procedures which were used in this study allow a considerable degree of confidence to be placed in the results. The main effect was replicated both within and between subjects. The two control stimuli used in each phase of the study were never learned, suggesting that influences from external uncontrolled sources were minimal.

The results of the post-training test indicate that the naming responses which were trained were all at a high strength before the tests for generalization were conducted. This means that a low proportion of correct responses on generalization tests truly reflected a lack of generalization rather than a poor training procedure. Finally, the results from Phases VII and VIII with Normand and Phase VII with Clayton suggest that the classroom tests did not influence performance on the tests in the natural environment to any substantial degree.

With Normand, two forms of generalized responses were shown. Responses which were identical to those which were accepted as correct during training were labelled "perfect pronunciation" while responses which were not quite identical were labelled "imperfect pronunciation". When evaluating these data, attention should probably be focussed upon the proportion of generalized responses which were pronounced perfectly since imperfect responses probably reflect a decrement in stimulus control. It is possible, however, that some imperfect pronunciations were simply the result of transient voice irregularities, and it is for this reason that they were included in the graphs.

The results of the supplementary procedures conducted with Janice suggest that teachers may further increase the probability of generalization from the training situation to the natural environment by varying the location of training sessions. This relatively simple procedure

produced substantial increases in generalization in Phases VII. The results of Phases XI must be interpreted with a degree of caution since they have not yet been replicated. Nevertheless, they are potentially important because they suggest that children who have received extensive training with pictures but who have failed to generalize to real objects may be trained to do so by pairing (i.e., concurrently training) several pictures with the corresponding objects. This may prove to be more convenient than retraining with objects.

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Appendix A

Details About Bliss-Symbols

Bliss-symbols are the components of a logical, symbolic language which was developed by Charles K. Bliss (1965). Bliss was concerned with certain practical and philosophical problems he believed to be inherent in current methods of communication and he developed his symbols in an attempt to overcome these problems. According to Archer (1977), "Bliss was particularly inspired by Chinese pictographic writing and also by the philosopher Leibnitz, who speculated about a universal symbolism comparable to the Chinese pictographs that would be more pictorial and would incorporate simple mathematical logic." Although the symbols were not initially developed for use by handicapped individuals, it has been estimated that there are over 3000 such users in North America and Europe (Archer, 1977).

Four types of symbols are used in the vocabularies of the Blissymbolics Communication Foundation (1976):

- (1) simple pictographs which represent concrete terms such as glass or book,
- (2) arbitrary symbols such as / (the), and + (and),
- (3) abstract representational symbols which indicate relational concepts such as .| (before) and V (on), and
- (4) compound ideograms which consist of several symbols in a sequence and which represent objects or concepts. For example, the symbol for "towel" is a compound of three simple symbols: "cloth" followed by "opposite", followed by "water".

Description of Bliss-Symbols Used by Janice

The symbols which were used with Janice were each drawn in black ink upon a thin white cardboard square, and each square was encased in transparent plastic. Symbols were approximately 2.5 x 2.5 cm, and were situated in the center of the card squares, which were approximately 5 x 5 cm. The word corresponding to the symbol was written below the symbol. Several sample symbols are depicted in Figure 10.

During the various procedures involved in this research, the symbols were placed in a row on the top left hand portion of a tray affixed to Janice's wheelchair. Each symbol was separated from adjacent symbols by approximately 2 cm. The symbols lay on a yellow background. All symbols used in this research were obtained from the Provisional Dictionary of the Blissymbolics Communication Foundation (1976). Occasionally, when no symbol existed for a certain object, a suitable symbol was substituted. For example, since there was no symbol for "soap", the symbol for "wash" was substituted.

Procedural Details

This section provides additional information about the training procedure which is relevant only to Janice.

During training, five symbols were located on the tray in front of Janice. The order of these symbols was changed: (1) after every correct response on a probe trial with a known stimulus, and (2) before the first trial of steps 6

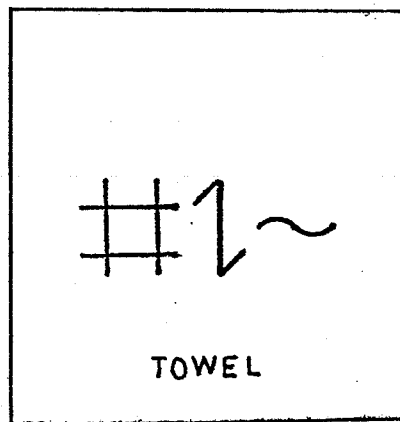
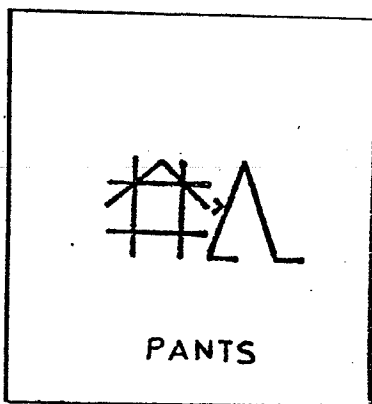
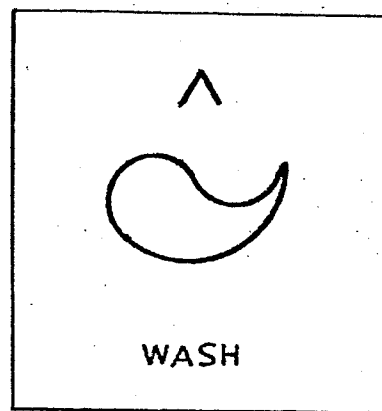
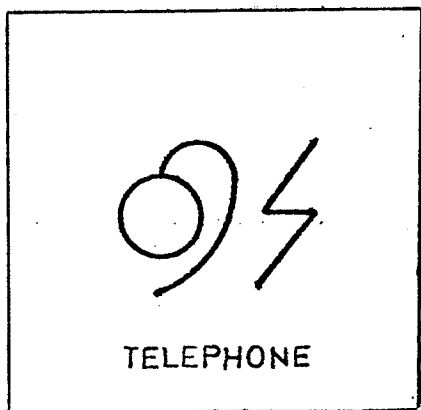
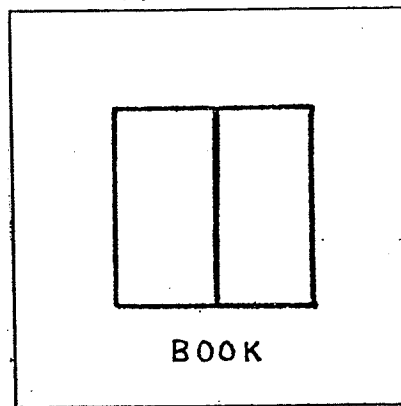
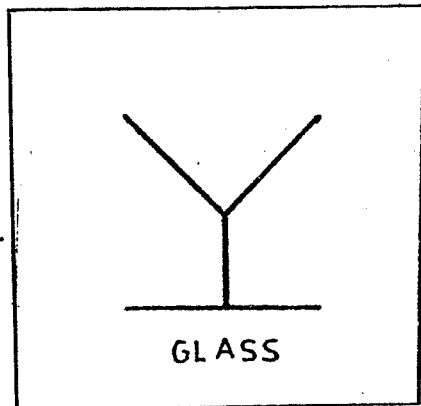


Figure 10. Six sample Bliss symbols..

and 7. This was done so that pointing responses would come under the control of the symbols per se rather than their position on the tray. Letting the letters A through E represent the five symbols, the procedure for systematic rearrangement is as follows:

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
begin with	A	B	C	D	E
first rearrangement	B	D	A	E	C
second rearrangement	D	E	B	C	A
third rearrangement	E	C	D	A	B
fourth rearrangement	C	A	E	B	D
fifth rearrangement	A	B	C	D	E

The third symbol goes to the fifth position and the second and fourth symbols go to the first and second positions respectively. This leaves the first symbol in the third position and the fifth symbol in the fourth position. The sequence repeats itself on the fifth rearrangement.

During baselines and tests for generalization the symbols were left in a fixed sequence. Letting the letters A through E represent the experimental stimuli, and F and G represent the control stimuli, the sequence was as follows:

A B C D E
F G

During the post-training tests the symbols were left in the same fixed position, but only the experimental stimuli were on the tray.

Appendix B

A Description of Cottage and Ward Settings

During the first three phases of the experiment with Normand and Clayton, the tests for generalization took place in three areas of the cottage in which they lived: (1) the bedroom (which they share), (2) the kitchen, and (3) the bathroom. The main features of the bedroom were two closets, two beds, two night-tables, and a single small table with two small chairs. During the tests in the bedroom the child sat at the table opposite the experimenter and objects to be named were placed on the table in front of him. The kitchen contained several large tables with four chairs each. The child sat at one of the tables and objects were placed in front of him. The experimenter stood beside the table. The bathroom contained two sinks side-by-side, a large mirror, and some towel racks. The child and experimenter stood in front of the sinks and objects were placed in the space between the sinks. In each of the first three phases, there were always two kitchen objects and one bathroom object. The remaining objects were tested in the bedroom. A diagram depicting the relative locations of the three cottage areas, including the precise location of objects to be named, is presented in Figure 11. In all three areas, only one object at a time was placed in front of a child. Tests always began in the bedroom area. Tests with Clayton were conducted at a time when both cottage staff and other children were sometimes present in the kitchen and bathroom areas. For this reason, an assistant to the experimenter attempted to keep other children some distance

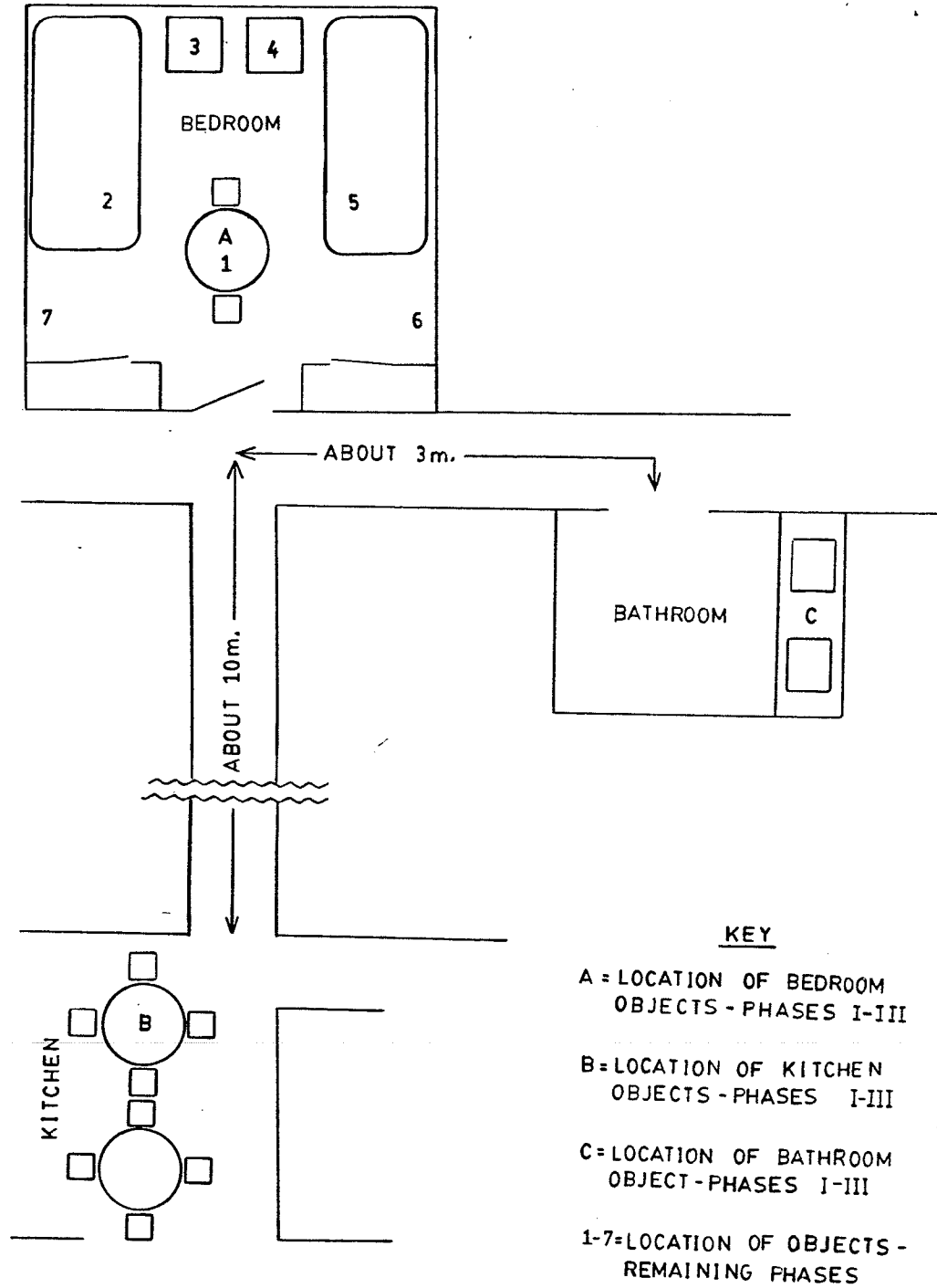


Figure 11. A diagram depicting Normand's and Clayton's natural environment.

away while tests were being conducted in those areas. In general however, the regular routine of cottage staff and children was not impinged upon. No special arrangements were made to have test areas vacated or general noise level reduced. Tests with Normand took place during school hours, thus the cottage was generally empty except for one or two staff.

During the remaining phases of the experiment with Normand and Clayton, tests for generalization took place only in the bedroom area. This was partly because objects which would normally be found in the bathroom and kitchen had been exhausted in the first three phases, and partly because school had ended for the summer and the subsequent increase in activity in the cottage would have made testing in the bathroom and kitchen difficult. In these phases, the objects were placed in the locations shown in Figure 11 before a test for generalization was conducted. The child was led from one location to the next by the experimenter.

With Janice, the tests for generalization in the natural environment took place in her bedroom on her ward. No other ward areas were used with Janice because of the difficulties inherent in maneuvering her wheelchair about the ward. The main features of her bedroom (which she shared with another resident) include two beds, a night-table, a large chair, and a long counter which contained a sink and supported a television set. A diagram depicting the room, the locations of the objects and the location of a second observer (for interobserver reliability purposes) are presented in Figure 12.

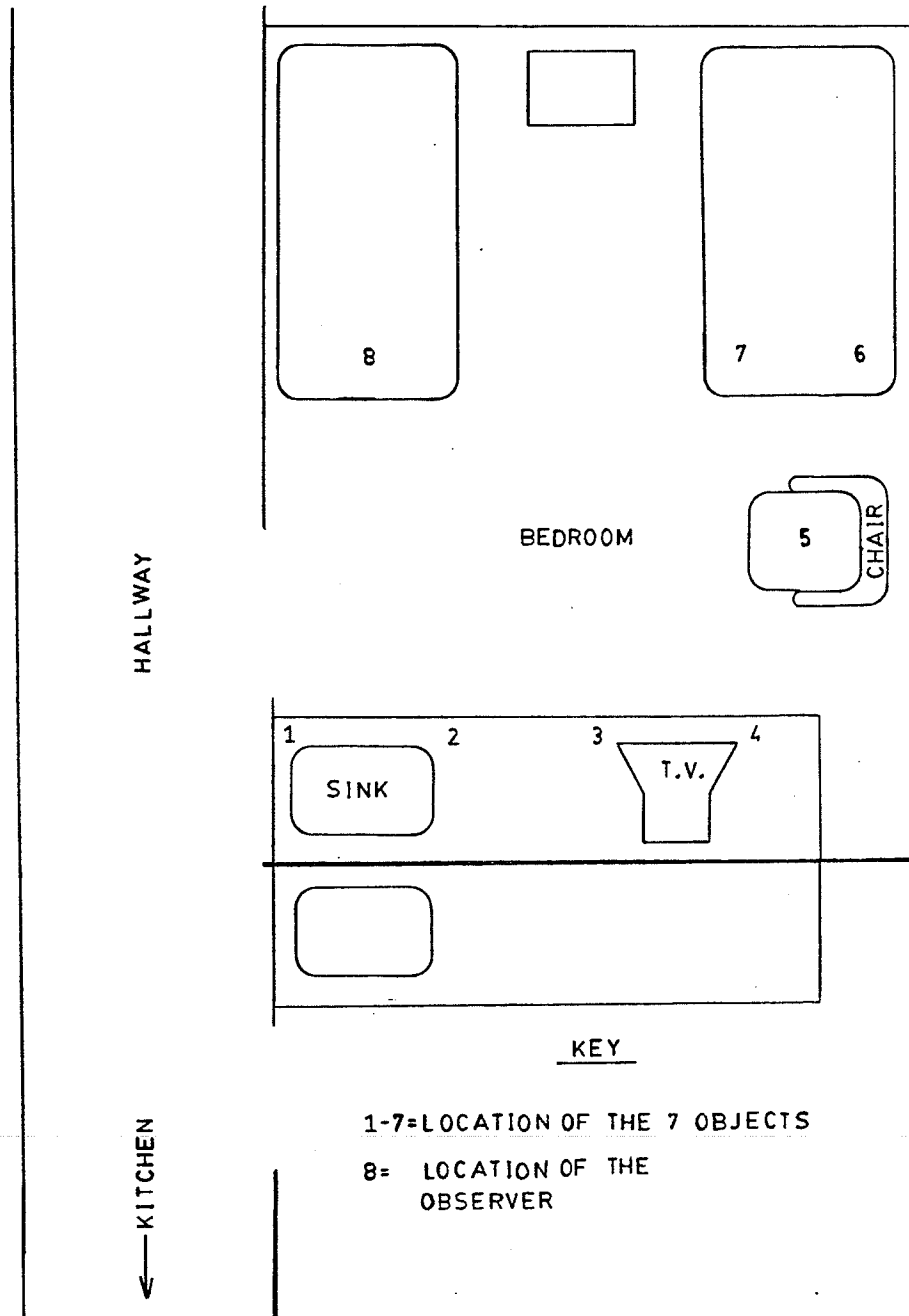
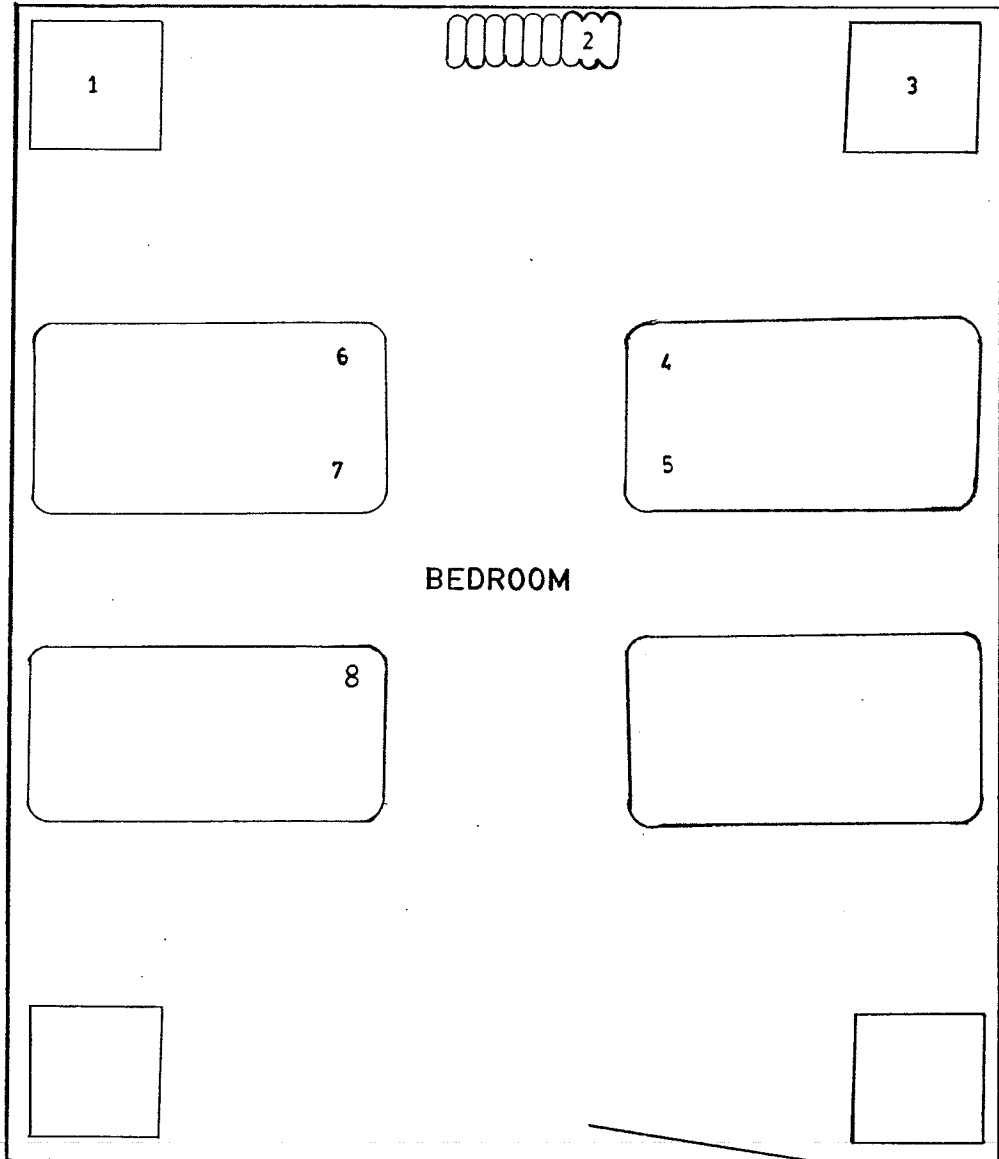


Figure 12. A diagram depicting Janice's natural environment.

Objects were placed in the locations shown in the figure before a test for generalization was conducted. Objects which might normally be found in the kitchen or bathroom were located near the sink. During the tests, Janice was moved from one location to the next by the experimenter. The tests were conducted during the supper hour and other residents and staff were generally visible and audible since the bedroom contained no door.

With Sherri, the tests for generalization in the natural environment also took place in her bedroom on her ward. No other areas were available. The main features of her bedroom (which she shared with four other children) include four beds, four night-tables, a radiator, and several chairs. A diagram depicting the room, the locations of the objects, and the location of a second observer (for interobserver reliability purposes) are shown in Figure 13. Objects were placed in the locations shown before the test for generalization was conducted. During the test, the child was led from one location to the next by the experimenter.

As is apparent in the procedure section, all that has been stated above as pertaining to the tests for generalization in the natural environment also apply to the baselines as well.



KEY

1-7=LOCATION OF THE 7 OBJECTS

8= LOCATION OF THE
OBSERVER

Figure 13. A diagram depicting Sherri's natural environment.

Appendix C

Criteria for the Selection of Training Stimuli

Most of the stimuli selected to function as training stimuli in this experiment were judged as being of some applied value to the child, although no reliability check was attempted. The majority of stimuli represented objects which might really be found in the child's cottage or ward. For example, many of the stimuli would fall into one of the following categories: (1) kitchen utensils, (2) toiletry supplies, (3) clothing, and (4) toys. In the case of Janice, the stimuli selected to be trained were also dependent upon the existence of an appropriate Bliss symbol.

The Written Criteria for the Selection of Picture-Cards.

The experimenter and the two observers selected picture-cards according to the following written criteria:

I. The following cards are to be excluded:

A. Any card which contains:

1. foods or drinks
2. animals
3. people (including "stick" people) or body parts

B. Cards consisting entirely of:

1. numerals or symbols such as cent signs etc.
2. a "color" card
3. a "geometric form" card

C. Any card which portrays an object or objects or scene which physically could not be brought into the training room. Examples would be cards portraying most vehicles

(cars, boats, trains, but not bicycles or wagons), cards depicting or containing outdoor scenes, cards depicting indoor scenes of rooms or other large or complex stimuli such as bathtubs, dishwashers, etc.

II. Any card not excluded under I is acceptable.

The Written Criteria for Determining the Representativeness of the Objects

The experimenter and the two observers judged whether certain acquired objects were representative of the objects portrayed by the picture-cards according to the following written criteria:

Rate the following objects as being either (1) representative or (2) not representative of the object portrayed by the picture-card. Use the following criteria:

- A. The object should be approximately the same basic color as that depicted by the picture-card (but not necessarily the same shade). Differences in detail may be ignored.
- B. The object should be approximately the same figure and shape as that depicted by the picture-card. Differences in detail may be ignored.
- C. An object should be rated as not representative only if it is, in your opinion, very different in general color or shape from that depicted by the picture-card. Exact matches are not required.

Appendix D

Review of the Literature

The early development of a behavioral technology for the production of verbal behavior in nonverbal populations focused primarily upon training techniques while relatively little emphasis was placed upon the problem of extending trained verbal responses beyond the therapeutic situation (for a review of training procedures see Harris, 1975). More recently however, researchers have begun to act upon the fact that generalization is not an automatic outcome of verbal training. This fact, coupled with the recognition that the effectiveness of verbal training procedures depends ultimately on their ability to promote generalization (e.g., Barton, 1970; Garcia & Delahen, 1974; Sailor, Guess, & Baer, 1973; Snyder, Lovitt & Smith, 1975), has resulted in an incipient technology of generalization (see Stokes & Baer, 1977).

Systematic research pertaining to generalization of the verbal behavior of retarded individuals can be divided into several areas: (1) generalized imitation, (2) generalization of articulation, (3) generalization of autoclitics, (4) generalization of phrases and sentences across settings and individuals, and (5) generative phrase and sentence construction. A review of the research conducted in these five areas is presented below.

Generalized Imitation

The maintenance of non-reinforced imitation is a critical issue in the generalization of appropriate

verbal behavior. The goal of language training is verbal behavior that is maintained on the intermittent basis that characterizes reinforcement in the natural environment. The normal child must emit familiar responses again and again with minimal reinforcement and must generate novel responses that may or may not be reinforced. These requirements make language training difficult and enhance the importance of that literature which has dealt with the question of generalized imitation, both verbal and non-verbal. The identification of variables central to this process would certainly aid in the programmed development of generalized verbal imitation. (Harris, 1975, p.567)

The term "imitation" refers to operant behavior which is similar in topography to behavior emitted by a model (Epstein, Peterson, Webster, Guanieri, & Libby, 1973; Skinner, 1953, p. 119-122). Generalized imitation refers to the continued performance of non-reinforced imitative responses. This phenomenon is obtained in a paradigm wherein trials in which specific imitative responses are never reinforced (termed S^{Δ} trials) are interspersed with trials in which different imitative responses are reinforced (termed S^D trials) (e.g., Bucher & Bowman, 1974; Steinman, 1970). It has also been used to refer to the initial performance of a new, untrained imitative response within the same basic paradigm (e.g., Metz, 1965; Peterson, Merwin, & Moyer, 1971).

To avoid confusion, it is important to distinguish between generalized imitation and stimulus generalization.

The latter refers to an increase in the probability of a particular response in the presence of certain stimuli after the response had been reinforced in the presence of a different stimulus (Reynolds, 1968, p.37; Gewirtz, 1971). For example, a young child who has been reinforced for saying "Daddy" in the presence of his/her father will likely refer to other adult males as "Daddy" as well, until a discrimination is formed. It is also important to distinguish between generalized imitation and response generalization. The latter refers to an increase in the probability of responses similar to the response being reinforced, (Reynolds, 1968, p.39). For example, a young child who is reinforced for imitating the phoneme /b/ will likely also begin to emit the phonemes /d/, /g/, and /k/ when asked to say /b/, until a discrimination is formed.

Most research on the phenomenon of generalized imitation has addressed itself to discovering why children continue to respond on S^{Δ} trials. Successive discrimination experiments with animals closely resemble the generalized imitation paradigm (Bucher & Bowman, 1974), and these experiments typically result in discriminative responding under both free-operant and discrete trial conditions (Mackintosh, 1974, ch. 10). Why then, do children fail to develop discriminative responding under the generalized imitation paradigm: Three theories have been proposed: (1) the similarity theory, (2) the discrimination theory, and (3) the social control theory.

The similarity theory. Several investigators (Baer, Peterson, & Sherman, 1967; Baer & Sherman, 1964; Lovaas, Berberich, Perloff, & Schaeffer, 1965) have noted that "similarity" between the modeled response and the child's imitative response reliably precedes reinforcement and they have proposed that similarity becomes a conditioned reinforcing stimulus which maintains responding on S^{Δ} trials. There appears to be no direct empirical support for this hypothesis, but indirect support has been offered by a study which employed a modified matching-to-sample procedure. In this study, children who could either match or mismatch the standard maximized the occurrence of the former. The authors concluded that within this paradigm similarity per se was reinforcing (Parton & Foutes, 1969). The similarity theory has been criticized on conceptual grounds by several researchers (Bandura, 1969; Bandura & Barab, 1971; Gewirtz & Stingle, 1968; Parton, 1970; Steinman, 1970). These criticisms mainly reflect questions as to the plausibility of "similarity" being a stimulus capable of becoming a conditioned reinforcer. More damaging evidence has come from empirical studies which have demonstrated that generalized imitation is most probably a subset of a broader classification which may be termed "generalized responding". It has been shown that within the same basic paradigm a variety of non-imitative behaviors may be maintained without reinforcement and in the absence of any apparent "similarity" between the experimenter's behavior and the child's response.

More specifically, the following examples of generalized responding have been demonstrated: (1) generalized "non-imitative" behaviors (Peterson, 1968; Wilcox, Meddock & Steinman, 1973), (2) generalized oddity and nonoddity performance (Bucher, 1973), (3) generalized matching and mismatching (Sherman, Saunders, & Brigham, 1970), (4) generalized labeling (Whitehurst, 1971), and (5) generalized instruction-following (Bucher, 1973; Martin, 1971; Whitman, Zakaras, & Chardos, 1971). It is not possible for a theory of generalized imitation based on the concept of similarity to account for these examples of generalized responding which do not involve any form of similarity between the modeled stimulus and the child's response.

The discrimination theory. A second theory which has been developed to account for generalized imitation contends that the nature of the generalized imitation paradigm precludes the formation of a discrimination between S^D and S^A trials. Hence, the children respond on all trials (Bandura, 1969; Bandura & Barab, 1971; Gewirtz, 1969; Gewirtz & Stingle, 1968). This theory, unlike the similarity theory, can potentially account for all subsets of generalized responding. While there is little empirical evidence to unequivocally support the discrimination hypothesis, a number of studies yielding partial support exist. They are based on the proposition that if the discrimination hypothesis is correct, then making S^D and S^A trials more dissimilar should result in discriminative responding.

Manipulations which have been made in an attempt to enhance the formation of a discrimination include: (1) associating different physical cues with S^D and S^Δ trials (Bucher & Bowman, 1974; Sherman, 1970; Wilcox, Meddock, & Steinman, 1973), (2) using imitative vs non-imitative tasks on S^D and S^Δ trials (Martin, 1971; Peterson, 1968; Steinman & Boyce, 1971), (3) using english vs non english words on S^D and S^Δ trials (Brigham & Sherman 1968; Burgess, 1970; Lovaas, Berberich, Perloff, & Schaeffer, 1966), (4) systematically reducing the proportion of S^D trials relative to S^Δ trials (Bufford, 1971), (5) manipulating the relative difficulties of the S^D and S^Δ tasks (Bucher & Okovita, 1977), and (6) using topographically distinct S^D and S^Δ responses (Acker & Acker, 1974; Bandura & Barab, 1971; Bucher, 1973; Garcia, Baer & Firestone, 1971; Schumaker & Sherman, 1970; Steinman, 1970). The results of these studies have yielded varying amounts of discriminative responding, both within and across studies. For the most part, children have continued to respond on a large proportion of S^Δ trials. Hence, the results suggest that failure to discriminate may be a factor with some children, but they do not confirm the theory. Moreover, failure to produce discriminative responding does not unequivocally refute the theory since it may always be argued that the S^D and S^Δ responses were still not made dissimilar enough.

Some investigators have obtained discriminative responding by grossly modifying the generalized imitation

paradigm (Bucher, 1973, Bucher & Bowman, 1974; Epstein, Peterson, Webster, Guanieri & Libby, 1973; Furnell & Thomas, 1976; Steinman, 1970; Steinman & Boyce, 1971). However, these data do not prove that generalized responding in original paradigm is the result of a failure to discriminate, and therefore these studies will not be discussed further. In addition, some investigators have produced discriminative responding by giving their subjects specific instructions not to respond on S^{Δ} trials (Bufford, 1971; Steinman, 1970; Waxler & Yarrow, 1970). However, such instructions may produce the discrimination rather than merely reveal it's presence. In summary, there is no unequivocal empirical evidence for the discrimination theory.

The social control theory. A third theory which has been developed to account for generalized imitation states that the child's responses are under the control of social variables (arising from the child's pre-experimental reinforcement history) which are present on both S^D and S^{Δ} trials. This theory, like the discrimination theory, can potentially account for all subsets of generalized responding. The studies mentioned above which demonstrated instructional control over discriminative responding suggest that social variables are capable of influencing children's imitative responses although they do not prove that social variables are responsible for generalized imitation. More direct evidence for the social control theory stems from experiments which have manipulated social variables

(Oliver & Hoppe, 1974; Peterson, Merwin & Moyer, 1971; Peterson & Whitehurst, 1971; Wilcox, Meddock, & Steinman, 1973). Such manipulations have included: (1) experimenter or model presence vs absence on S^D and S^Δ trials, and (2) the generalized vs discriminative responding of models the children were required to watch. These studies have found that these social variables controlled the children's responses on S^Δ trials to a considerable extent. Another study has strongly supported the social control theory by demonstrating that generalized imitation is a function of children's reinforcement history for compliance with instructions (Oliver, Acker, & Oliver, 1977). Children who were first reinforced for compliance with instructions later displayed more generalized imitation relative to a control group while children who were first reinforced for non-compliance with instructions displayed less generalized imitation (i.e., more discriminative responding) relative to a control group. Finally, a number of studies which have demonstrated the unimportance of immediate consequent events in maintaining generalized responding (by extinction and differential reinforcement of other behavior) support the social control theory since they imply by deduction that if consequences are not important, antecedent events (i.e. social variables) must be (Brigham & Sherman, 1968; Bucher, 1973; Epstein et al., 1973; Parton, 1970; Peterson & Whitehurst, 1971; Steinman, 1970; Steinman & Boyce, 1971; Wilcox et al., 1973).

Unfortunately, a second group of studies exist which

force the opposite conclusion. These studies have found (with the same procedures mentioned above) that consequent events are responsible for maintaining generalized responding. This implies an absence of social control (Acker, Acker, & Pearson, 1973; Baer & Sherman, 1964; Martin, 1971; Peterson, 1968; Whitman et al., 1971).

A possible reason for these conflicting results may stem from possible differences in the controlling variables of the behavior of normal children as opposed to retarded children. A casual analysis of the studies investigating generalized responding reveals the following: (1) Most studies which have found evidence of control by immediate consequences have used retarded children as subjects. (2) Virtually all studies which have found evidence of a lack of control by consequences have used normal children as subjects. (3) Virtually all studies which have found evidence of social control have used normal children as subjects. (4) There are very few studies which have found evidence of a lack of social control in normal children. It is reasonable to believe that the behavior of normal children might be more under the control of social variables than the behavior of retarded children, and conversely, that the behavior of retarded children might be more dependent upon immediate consequences than the behavior of normal children. This seems to be what the experiments cited are demonstrating.

In summary, it appears that the generalized responding of normal children is under the control of social variables. It is possible that generalized responding in retarded children can be accounted for by the discrimination theory. If the children do not discriminate reinforced responses from nonreinforced responses, then the generalized imitation paradigm may functionally be operating like a variable ratio reinforcement schedule where nonreinforced trials make up part of the ratio (Gewirtz, 1968; Gewirtz & Stingle, 1968; Steinman & Boyce, 1971).

Generalization of Articulation Training

Articulation errors constitute the greatest proportion of speech defects for all ages. . . . Since only a small percentage of articulation defects have a known organic cause, functional articulation defects constitute a large proportion of the disorders in the field of speech pathology. (Monnin & Huntington, 1974, p. 352)

Traditionally, the objective of articulation therapy has been the carry-over of the corrected target phoneme to spontaneous conversational speech. (Gerber, 1977, p.30)

Mowrer (1971) has identified several areas within the province of articulation therapy where generalization or "transfer of training" has been studied. These areas include: (1) transfer of training and auditory discrimin-

ation; (2) transfer of training across phonemes; and (3) transfer of training across words. Each of these areas will be examined in sequence.

Transfer of training and auditory discrimination.

Traditionally, sound discrimination training has been considered by speech clinicians to be a necessary prerequisite to successful articulation training (e.g., Powers, 1957; Van Riper, 1947). Indeed, correlational studies tend to reveal a strong positive relationship between articulation defects and poor auditory discrimination performance (e.g., Monnin & Huntington, 1974; Stitt & Huntington, 1969), particularly at age level below nine years (Weiner, 1967). However, the exact nature of the relationship between sound discrimination and articulation has not been well determined empirically. Several investigators have reported that the effects of pre-training in sound discrimination generalizes to productive speech. That is, the vocal articulation of the sounds previously employed as discriminative stimuli during discrimination training is improved relative to other sounds and other subjects (Mann & Baer, 1971; Winetz & Preisler, 1965). Conversely, other investigators found that pre-training in sound discrimination had no effect upon production (Williams & McReynolds, 1975). Interestingly, these latter investigators found that the effects of pre-training in sound production did transfer to a sound discrimination task. Thus, it is currently

possible only to conclude that the effects of sound discrimination training may result in positive transfer to sound articulation. No more conclusive a statement may be made until the causes of the discrepancies in the literature have been determined.

Transfer across phonemes. A substantial amount of data indicates that positive transfer occurs to untrained phonemes when articulation training is provided for a target phoneme (Costello & Onstine, 1976; Elbert & McReynolds, 1975; Elbert, Shelton & Arndt, 1967; McReynolds & Bennett, 1972; Mowrer, 1964; Shelton, Elbert & Arndt, 1967). These studies have typically found that when children with multiple articulation defects are trained to correctly articulate a single phoneme, phonemes similar to the target phoneme also increased in articulation accuracy. However, phonemes dissimilar to the target phoneme were not affected. Apparently the occurrence or non-occurrence of positive transfer is dependent upon the degree to which the untrained phonemes are similar to the target phoneme. Saporta (1955) has devised a method of determining degrees of similarity based upon nine distinctive features which phonemes may share (e.g., vocalic/nonvocalic, nasal/oral, interrupted/continuant, etc.). According to Saporta, positive transfer may be expected to occur between /s/ and /z/ since these two phonemes have in common seven of the nine distinctive features. No transfer would be expected to occur between /s/ and /d/ since these phonemes have only two distinctive features in common (examples cited by Mowrer,

1971). While it appears empirically clear that the degree of transfer is dependent upon phoneme similarity, more empirical study of the predictability of Saporta's distinctive feature analysis is required.

Several other studies have been conducted which also pertain to generalization and phoneme articulation training. Each deals with generalization across settings. Costello & Bosler (1976) taught three children to correctly articulate an error phoneme in their homes and then probed for generalization in four other settings. They concluded that corrected articulations generalized to the nontreatment settings to a large degree. Griffiths & Craighead (1972) taught a retarded woman to correctly articulate an error phoneme but found that the corrected phoneme did not generalize to nontreatment settings until it had been reinforced in one of those settings. A similar finding with retarded subjects was obtained by Murdock, Garcia, & Hardman, (1977). Johnson and Johnson (1972) trained young children to emit correct articulations of error phonemes but obtained no generalization to settings outside of the training setting. Setting generalization was obtained when the children were divided into pairs and trained to monitor and reinforce each other's correct articulations. These investigators report that the children maintained these behaviors across settings even though they were not reinforced by the experimenters for doing so. Thus it would appear that setting generality may be expected to occur spontaneously or may be easily

programmed following phoneme articulation training

Transfer of training among words. A substantial number of empirical studies suggest that children who are taught to correctly articulate a target phoneme within a word will generalize the correctly articulated phoneme to other untrained words, usually on a large percentage of probe trials (Bailey, 1974; Costello & Bosler, 1976; Elbert & McReynolds, 1978; Leonard, 1933; McLean, 1970; Mowrer, 1964; Powell & McReynolds, 1969). In addition, several studies have demonstrated the generalized usage of phonemes trained in one position within a word (i.e., initial, medial, or final position) to other untrained positions within untrained words (Bennett, 1974; Powell & McReynolds, 1969). However, one investigator (McLean, 1970) found that his retarded subjects failed to generalize to untrained words which contained the target phoneme in positions different from those used in training, although they did generalize to untrained words which contained the target phoneme in the same position as employed during training. In general however, it would appear that the correct usage of trained phonemes may be expected to generalize to both untrained words and positions.

A number of articles exist which pertain to transfer of articulation training in phrases, sentences, and spontaneous speech. However, the majority of these articles simply describe procedures for attaining transfer of training. They have not been empirically tested, and therefore will

not be presented here. For a review, see Mowrer, (1971).

Generalization of Autoclitic Training

Functional behaviorists are content to devise "strict training procedures" that succeed in producing generative syntactic behavior in experimental subjects. In the course of devising effective procedures, such research unavoidably identifies critical functional variables controlling syntactic behavior, insofar as these reside in environmental contingencies among the antecedent variables, the behavior, and the reinforcing consequences. (Segal, 1977, p. 640)

A substantial literature has arisen over the past decade which pertains to the training and generalization of autoclitic processes in retarded children. This research may be ordered most simply according to the forms of speech trained.

Noun suffixes. Severely retarded children have been successfully taught to label pictures correctly by converting the verb form of the action depicted in a picture into a noun suffix (Baer & Guess, 1973). For example, upon being presented with a picture of a boy swimming and the vocal stimulus "This boy swims. He is a ____?", children were reinforced for producing the appropriate noun suffix, "swimmer". The investigators found that over time the number of trials to criterion decreased. They also found

that the probability of a correct production of a noun suffix on the first trial increased with training. These data were interpreted as evidence of the establishment of a generative noun suffix usage.

Noun pluralization. A number of studies have been conducted wherein retarded children were taught to identify and/or produce plural nouns appropriately. In an initial investigation a retarded child was taught to name objects and pairs of objects with singular or plural vocalizations. (Guess, Sailor, Rutherford, & Baer, 1968). Plural vocalizations consisted of adding either the /s/ or /z/ morpheme to the singular form. The child generalized correctly to untrained objects and object pairs. However, she also used the /s/ or /z/ morpheme when pluralizing untrained nouns which normally require irregular endings (e.g., "mans" was produced instead of "men", and "leafs" instead of "leaves"). A study which followed examined the effects of training plural forms requiring the /s/ morpheme and plural forms requiring the /z/ morpheme as separate response classes (Sailor, 1971). When trained to produce words requiring the /s/ morpheme, both subjects generalized that plural form to untrained words requiring the /z/ morpheme for correct production. Similarly, when trained to produce words requiring the /z/ morpheme, both subjects generalized that plural form to untrained words requiring the /s/ morpheme for correct production. Research in pluralization was extended in a third study in which a retarded child was