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 protrayed 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 $2\frac{1}{2}$ 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 $3\frac{1}{2}$ 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 $2\frac{1}{2}$ 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 $2\frac{1}{2}$ 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 12½ 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 pro-
nounciation (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 base-
line, imitative response were reinforced with primary rein-
forcement 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 exper-
imental 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 exper-
imenter 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
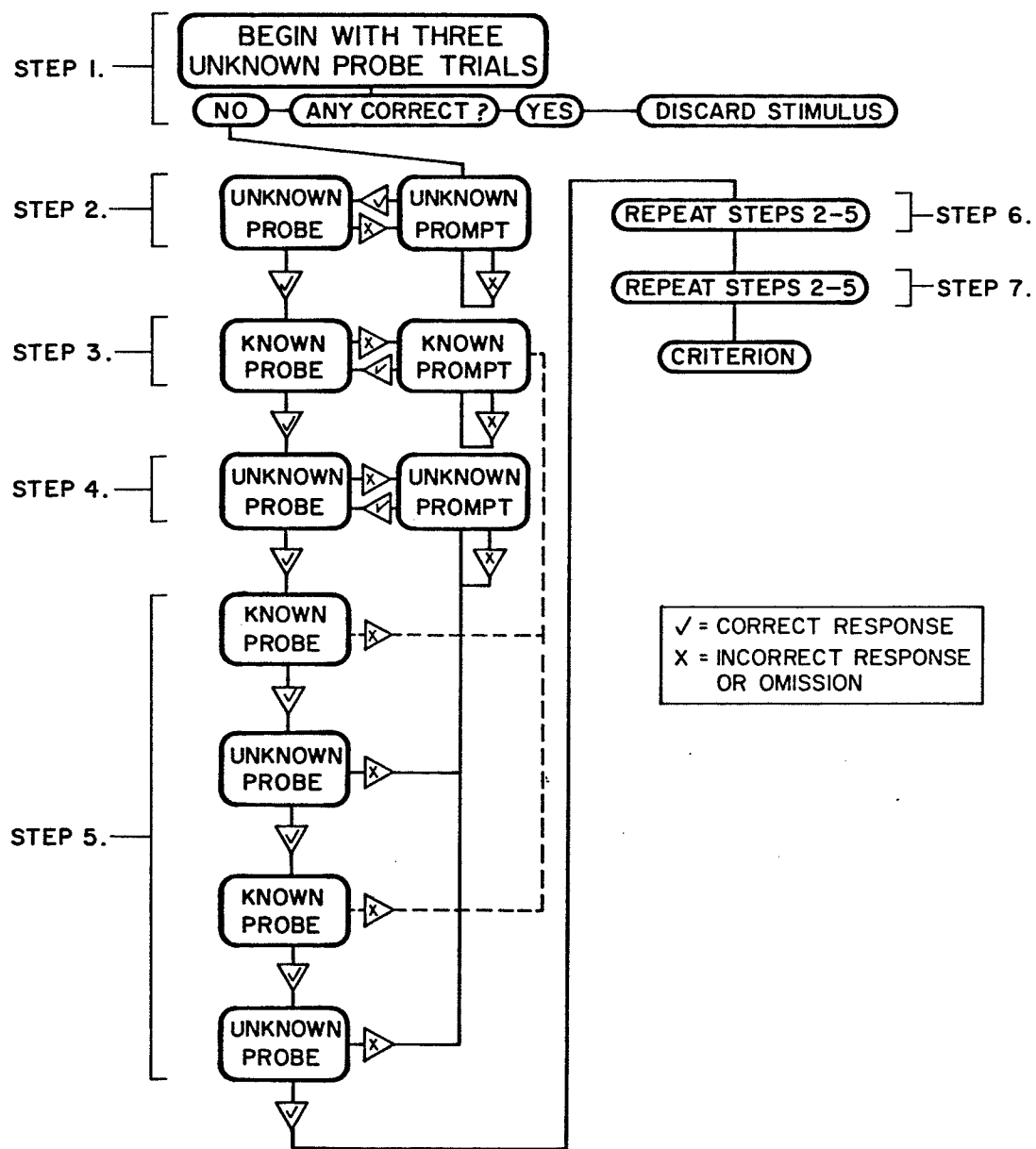
Figure 2. Schematic representation of the training procedure.

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 it's 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 rein-
forcement (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) acquistion 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 sub-divided 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 coefficents 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 cources 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
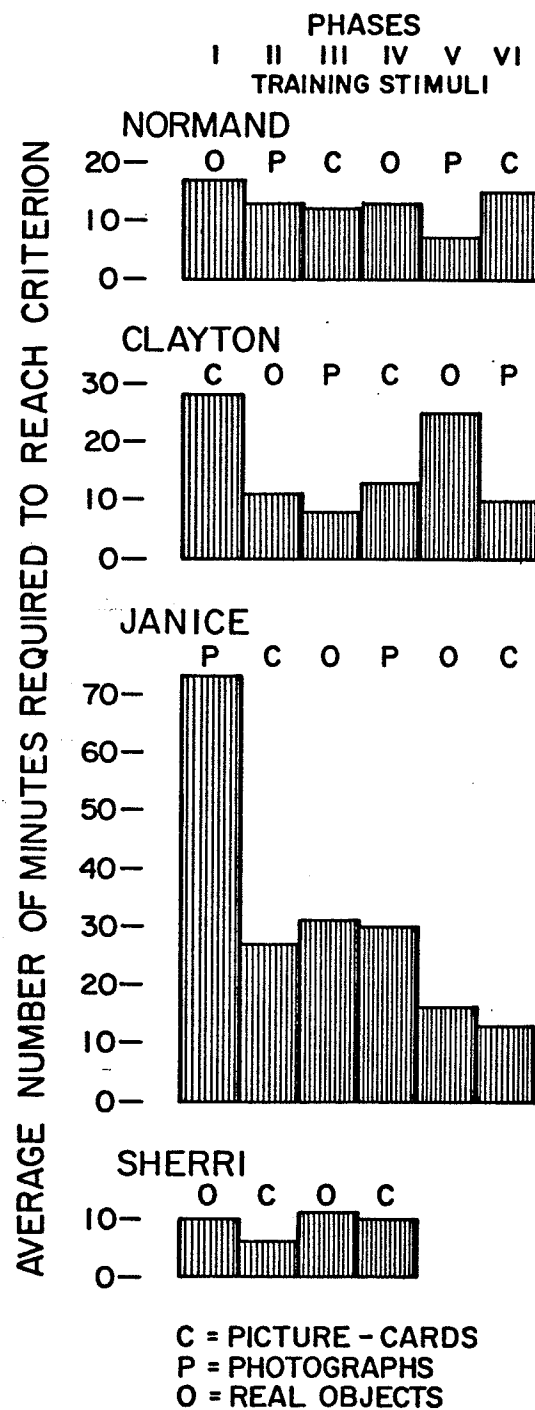
Figure 4. The average number of minutes required for each stimulus mode to reach criterion during training.

NORMAND

PHASES

I	II	III	IV	V	VI	VII	VIII

TRAINING STIMULI

| REAL OBJECTS | PHOTO-GRAPHS | PICTURE-CARDS | REAL OBJECTS | PHOTO-GRAPHS | PICTURE-CARDS | PICTURE-CARDS | PICTURE CARDS |

C = PICTURE - CARDS
P = PHOTOGRAPHS
O = REAL OBJECTS
N = REAL OBJECTS IN
    NATURAL ENVIRONMENT

● = % KNOWN ON
    POST-TRAINING
    TEST

▦ = % GENERALIZATION - PERFECT
    PRONUNCIATION

☐ = % GENERALIZATION - IMPERFECT
    PRONUNCIATION

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
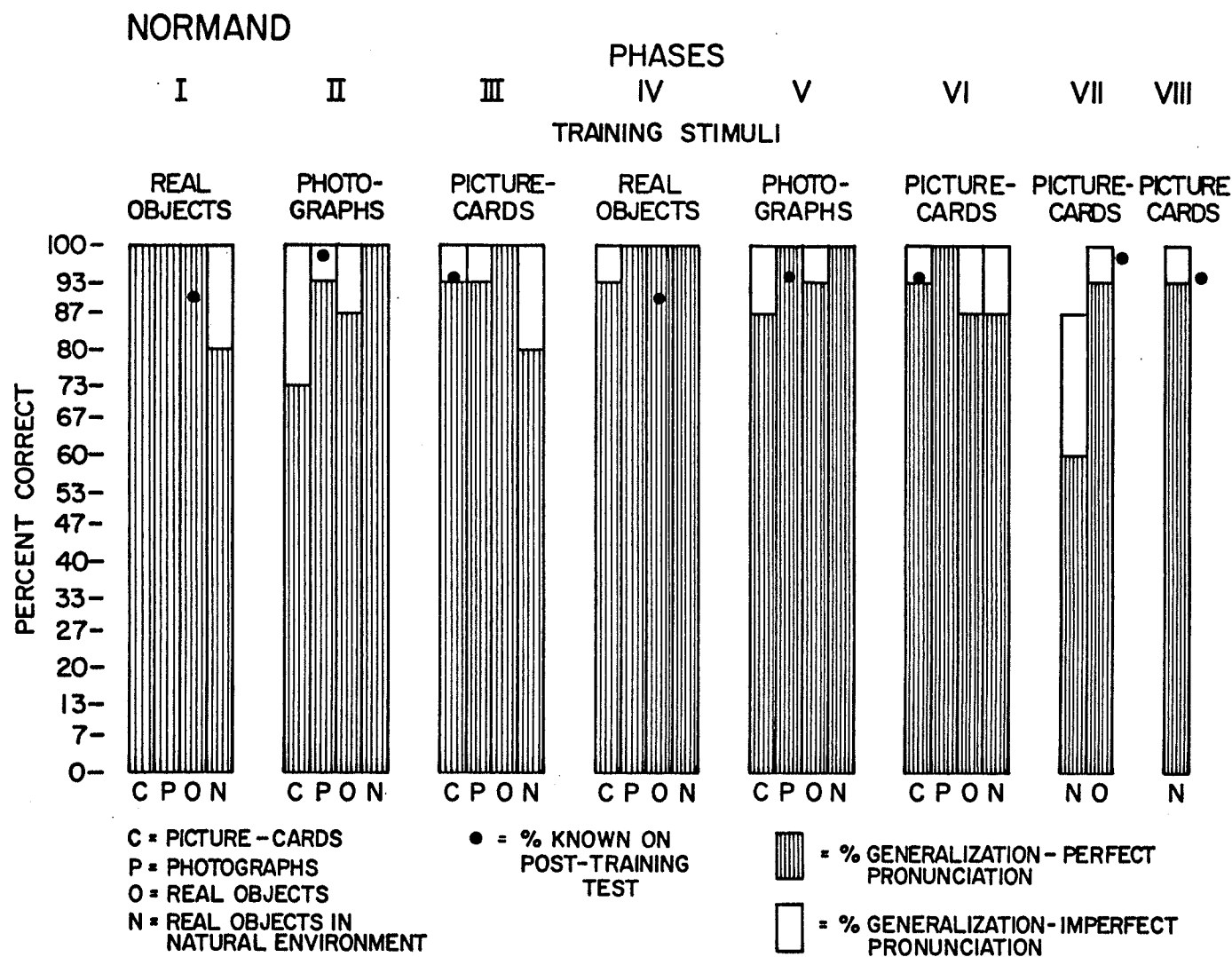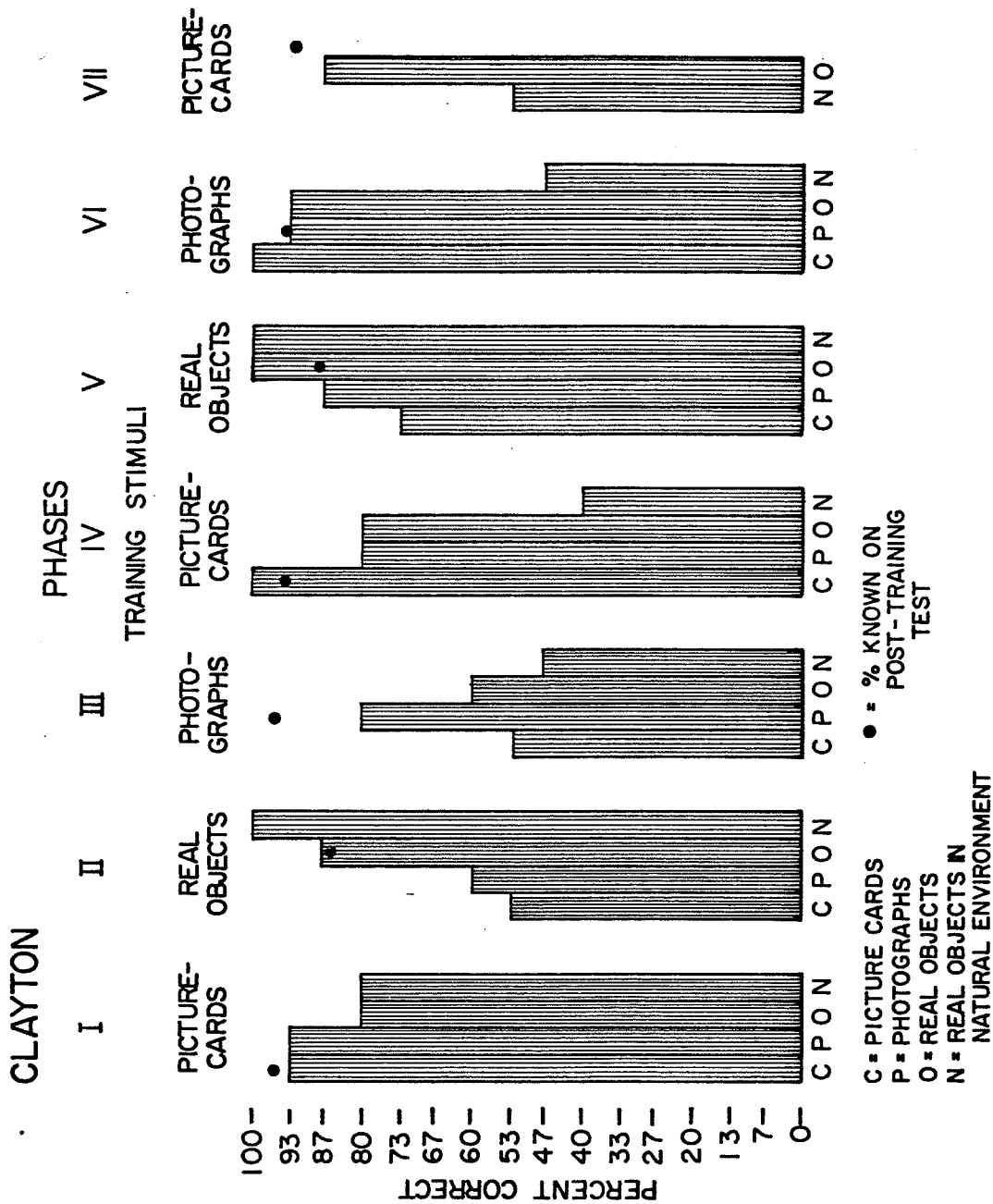responses were well known on the post-training test. Phase
VII assessed the extent to which experience with the real
objects during the classroom test for intermodal transfer
affected the outcome of the test for generalization to real
objects in the natural environment. Clayton was trained
with picture-cards, 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 inter-
modal transfer displayed by Sherri was variable and unsystem-
atic, 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

SHERRI

PHASES

I   II   III   IV

TRAINING STIMULI

REAL   PICTURE-   REAL   PICTURE-
OBJECTS   CARDS   OBJECTS   CARDS

PERCENT CORRECT

100 –
93 –
87 –
80 –
73 –
67 –
60 –
53 –
47 –
40 –
33 –
27 –
20 –
13 –
7 –
0 –

C P O N   C P O N   C P O N   C P O N

C = PICTURE-CARDS   ● = % KNOWN ON
P = PHOTOGRAPHS   POST-TRAINING
O = REAL OBJECTS   TEST
N = REAL OBJECTS IN
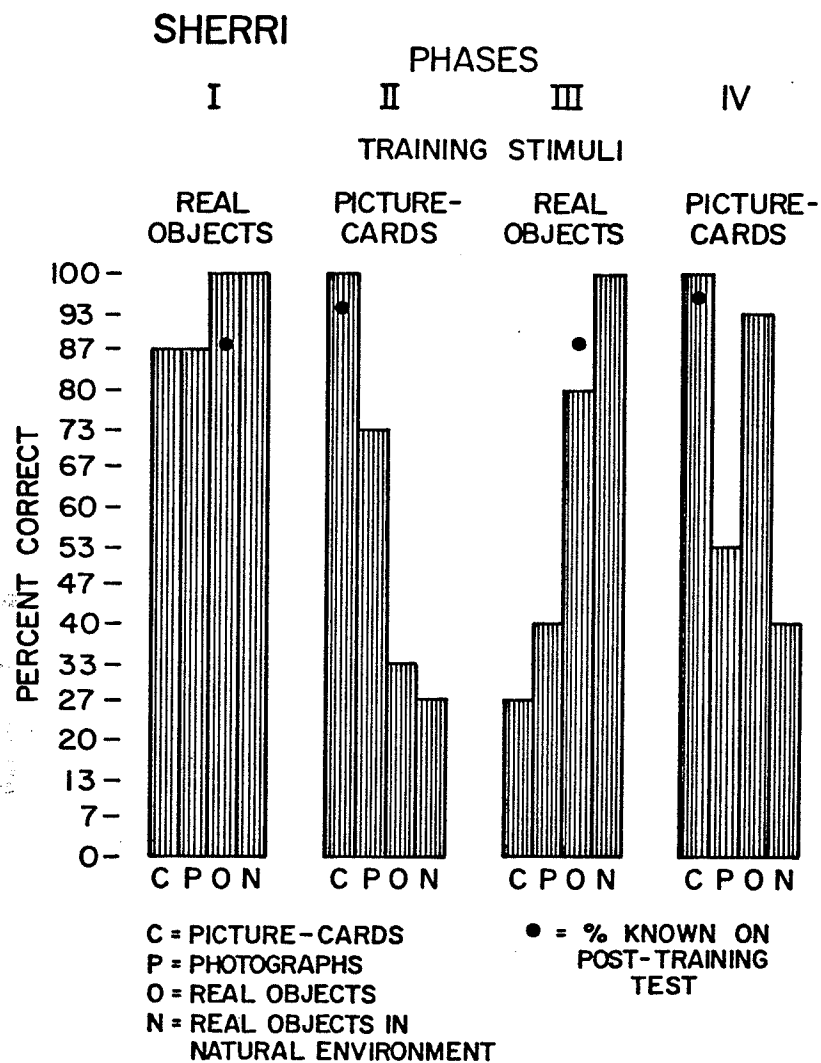   NATURAL ENVIRONMENT

Figure 7.   The percentage of correct responses emitted by Sherri
            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 ineffec-
tive 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 environ-
ment 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
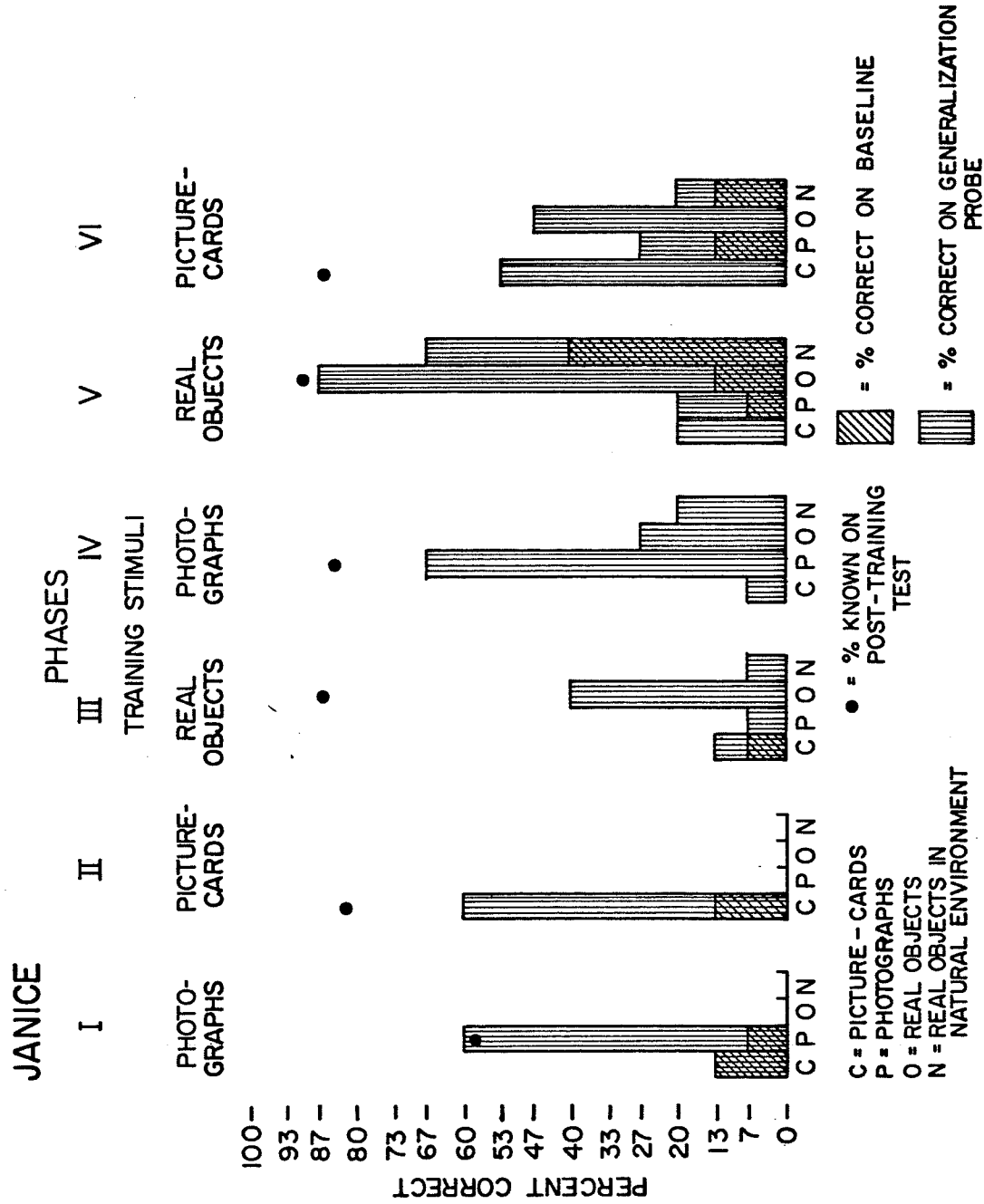first three phases. Because of the large number of omissions

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 $\underline{1}$, $\underline{2}$, and $\underline{3}$ 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

JANICE

PHASES

VII	VIII	IX

TRAINING STIMULI

REAL OBJECTS	PICTURE- CARDS	PAIRED

C = PICTURE-CARDS
P = PHOTOGRAPHS
O = REAL OBJECTS
N = REAL OBJECTS IN
    NATURAL ENVIRONMENT

= % CORRECT ON BASELINE

= % CORRECT ON
   GENERALIZATION PROBE

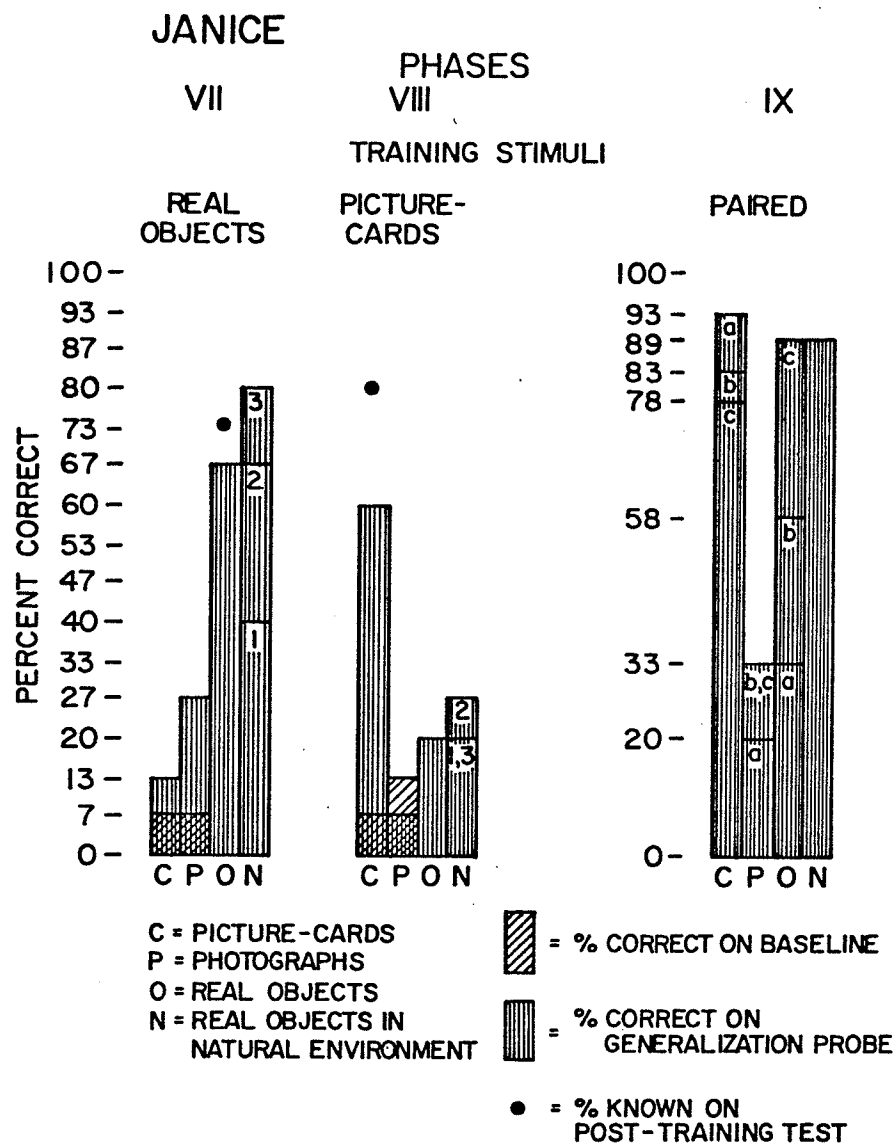● = % KNOWN ON
     POST-TRAINING TEST

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 inter-
modal 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 $\underline{c}$ 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 controll 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
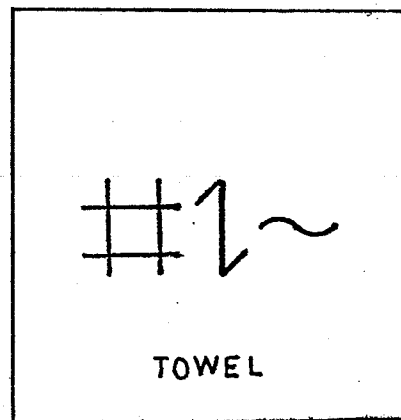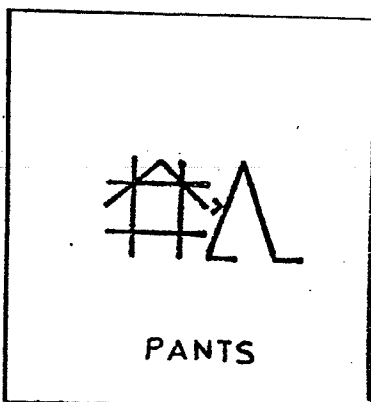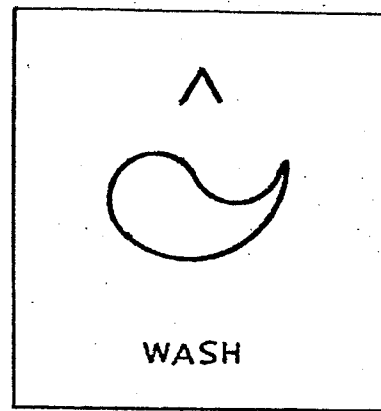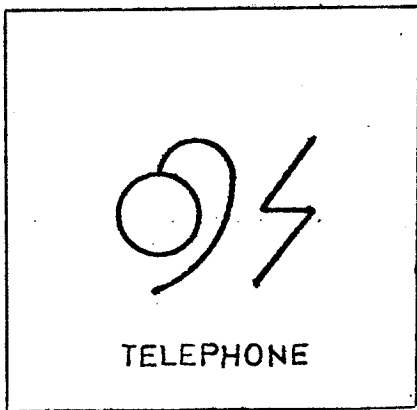
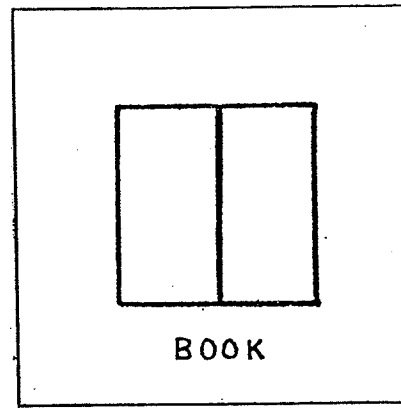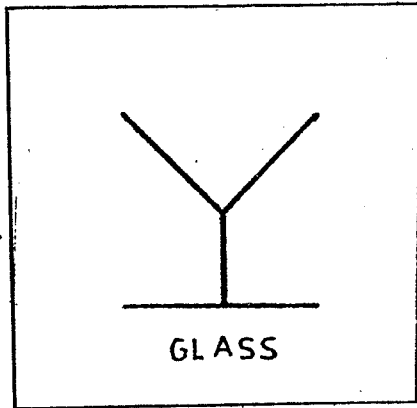Figure 10.   Six sample Bliss symbols.

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:

	1	2	3	4	5
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
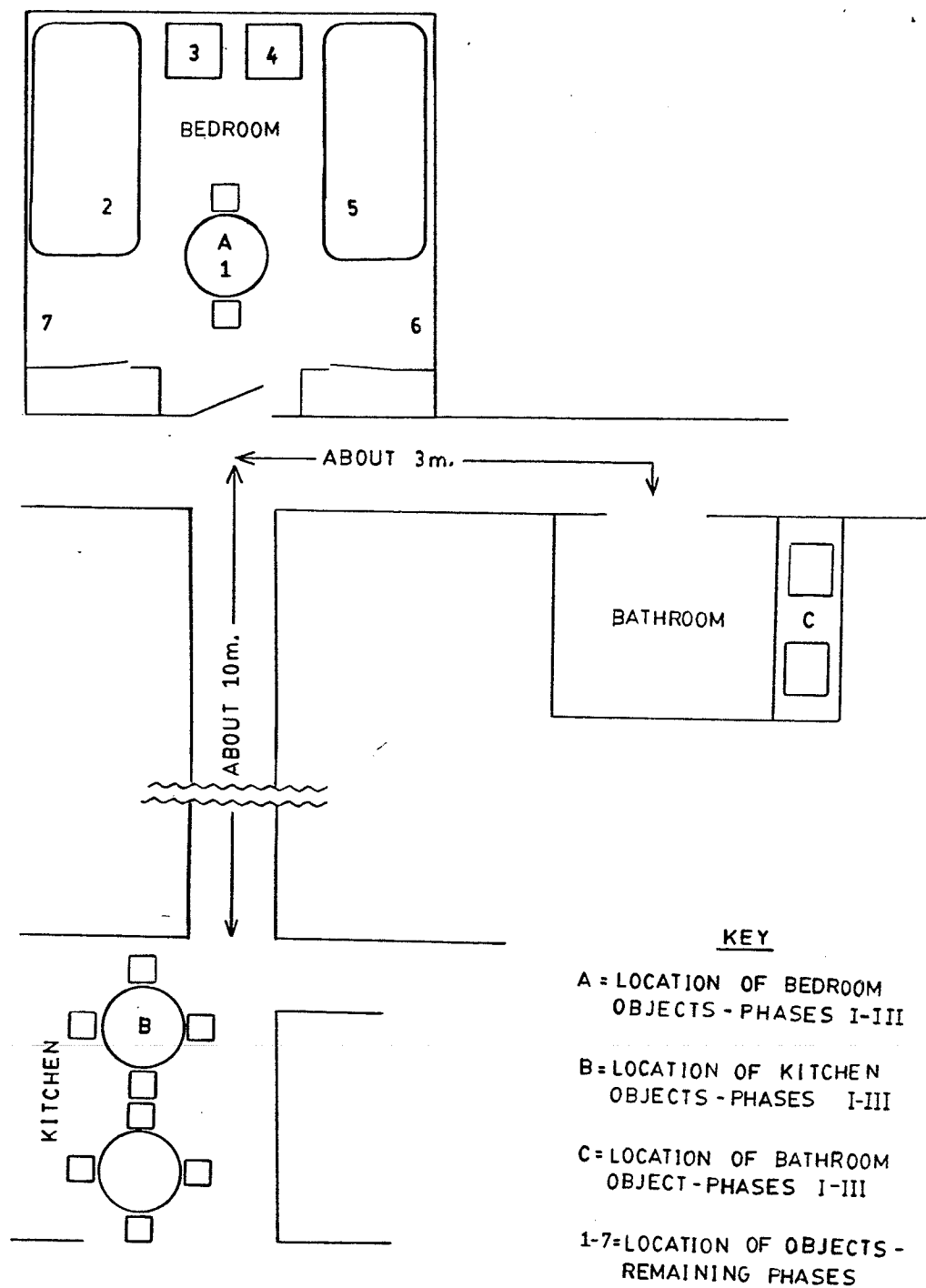
Figure 11. A diagram depicting Normand's and Clayton's natural environment.

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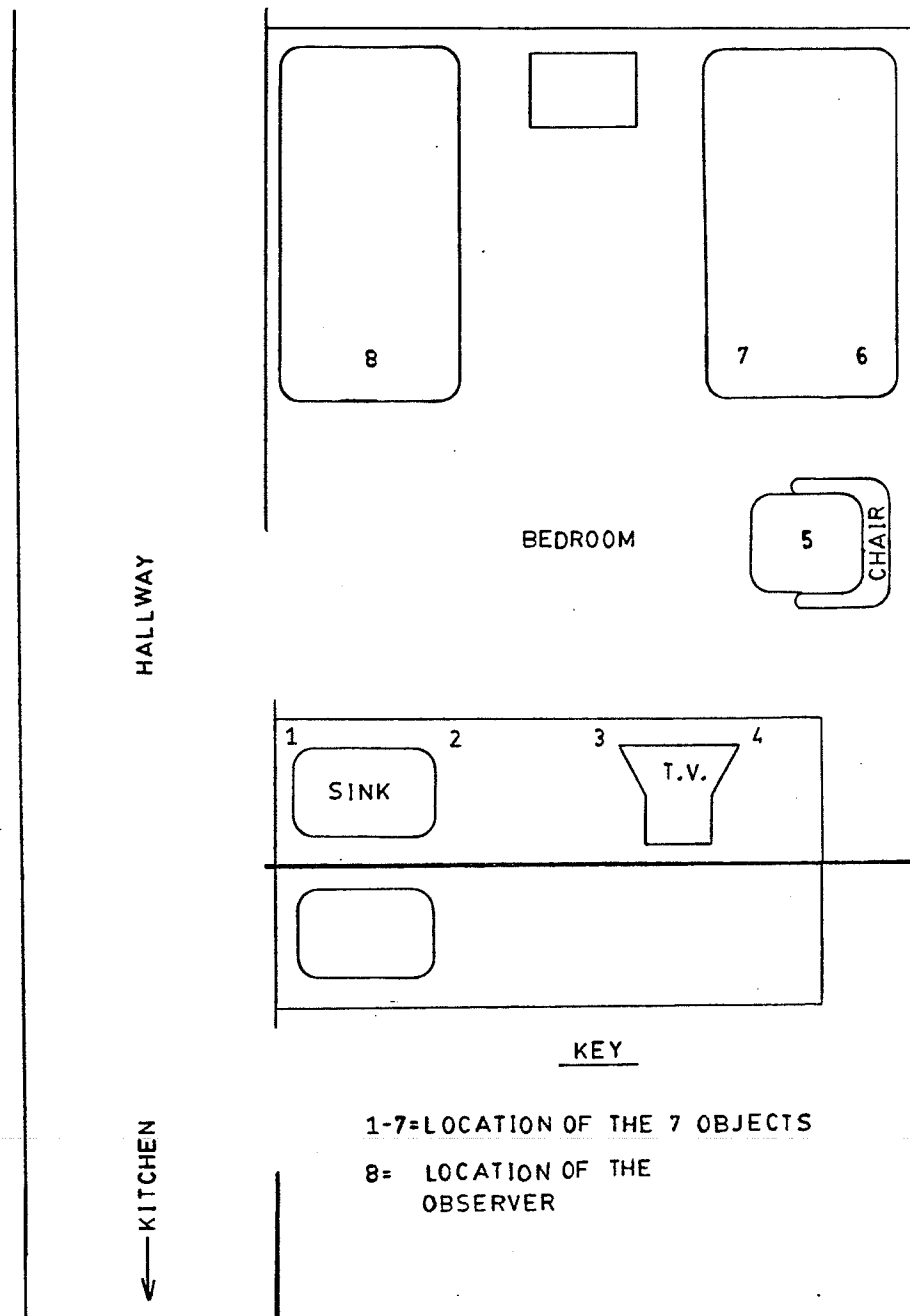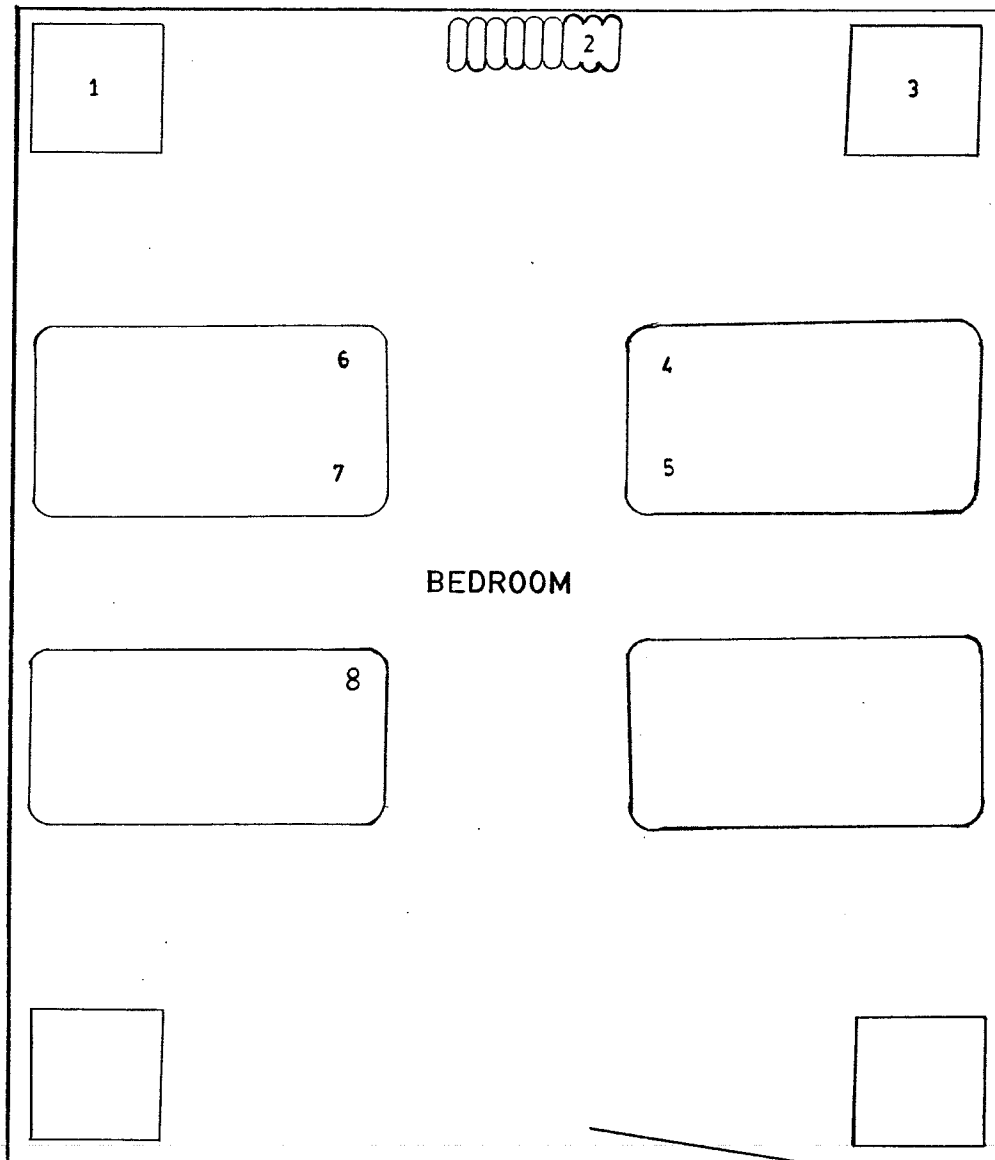
Figure 12. A diagram depicting Janice's natural environment.

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 visable 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.

BEDROOM

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 catagories: (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) represen-
tative 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 para-
digm (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 phenominon 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 on 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^Δ 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^Δ 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 rein-
forcement 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 dis-
> orders 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 pre-
requisite 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 discrimin-
ation 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 discrim-
ination 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 usuage 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 environ-
> mental 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 con- verting 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 usuage.

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 vocal-
izations 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

taught to use singular or plural sentence forms. (Garcia, Guess, & Byrnes, 1969). The singular sentence form trained was, "That is one_____", while the plural sentence form trained was, "These are two_____.". The subject generalized the correct sentence forms when asked to identify untrained items. Finally, several studies have found that training to discriminate plurals from singulars at the receptive level does not generalize to the productive level (Guess, 1969; Guess & Baer, 1973). Most children who could point to single objects or pairs of objects upon request were not able to accurately produce singular or plural labels for single objects or pairs of objects, although when both receptive and productive training was given, generative responding occurred within each level.

Adjectives. Severely retarded children have been taught to discriminate /er/ and /est/ suffixes at the receptive level (Baer & Guess, 1971). The children were first taught to point correctly to stimuli represented on picture-cards in response to a label presented by the experimenter (e.g. "big - small"). Then they were taught the comparatives or superlatives for those opposites (e.g."small-smaller" or "small-smallest"). In the comparative training phase the children generalized to stimulus combinations which had not been directly trained, but correct superlative discriminations remained low. When trained to identify superlatives, the children again generalized to novel stimulus combinations.

Investigators have also taught retarded and disadvantaged children to use color, number, and size adjectives using a variety of techniques. Increased usuage of color and size adjectives have been achieved by labeling picture-cards and consequating the children's imitative responses with praise (Martin, 1975). These responses were found to generalize to untrained picture-cards. Increased rates of color-noun usuage have also been achieved in a free-play situation by making play materials contingent upon their production (Hart & Risley, 1968). The investigators found that the rate of color-noun usuage remained above baseline levels even after the formal contingency was discontinued. Size and number adjectives were also monitored but the effects of the color contingency did not appear to generalize to these two types. Finally, modeling without explicit reinforcement has been successfully used to increase the usuage of color and size adjectives. Children who observed a model who used color and number adjectives while labeling the contents of several boxes increased their own usuage of these adjectives relative to baseline levels when asked to label objects. Generalization was demonstrated in that the objects the children identified were different from those identified by the model.

Articles. Several investigators have taught speech-deficient children to include the article "the" when describing pictures (Bennett & Ling, 1972; Wheeler & Sulzer, 1970). In one study the sentence form trained was "The (noun) is

(verb) + ing", and in the other study the sentence form trained was "The (noun) is (present participle) the (object)". Prior to training, the children in both studies spoke only "telegraphic" english and used no articles (or auxiliary verbs). Following training the children generalized the use of the article (and the auxiliary verb) when describing untrained pictures. However, with one child a number of exemplars had to be trained before generalization was achieved.

Verbs. As indicated above, the children trained by Bennett and Ling (1972) and Wheeler and Sulzer (1970) were also deficient in their use of auxiliary verbs. Consequently, these investigators also trained the children to use the auxiliary verb "is" in the same sentence formats described previously. As was the case with the article, following training the children generalized the use of the auxiliary verb when they were required to describe untrained pictures. In another study, retarded and normal children were taught to describe pictures using correct subject-verb agreement. (Lutzker & Sherman, 1974). When a picture depicted a singular subject, the children were taught to use "is" and when the subject was plural, the children were taught to use "are" (e.g., "Boat(s) is (are) sailing."). After training, four of the five subjects generalized the appropriate form of the response to untrained pictures depicting singular or plural subjects. The fifth child (a retarded child) began to use "are" correctly after

having received training on only "is" sentences. In a
fourth study (Leonard, 1974), eight language-handicapped
children were trained to use the auxiliary verb "is"
(e.g., "The boy is sleeping.") and the negative modal
"don't" (e.g., "Tables don't fly.") when describing
pictures. Training was preceded and followed by a test,
wherein the children's correct uses of the following
grammatical structures were assessed: (1) the auxiliary
"is" question inversion (e.g., "Is the girl smiling?"),
(2) the copula "is" (e.g., "The cat is white."), (3) the
copula "is" question inversion (e.g., "Is Daddy old?"),
(4) the auxiliary verb "are" (e.g., "The kids are
running."), and (5) the negative modal "can't" (e.g., "They
can't see."). The authors found that training with the
auxiliary verb "is" increased the frequency of the
auxiliary "is" question inversions, the copula "is", and the
copula "is" question inversions, but not the auxiliary verb
"are". Training with the negative modal "Don't" did not
appear to increase the correct use of the negative modal
"can't". The authors concluded that training in one syntatic
structure facilitated the proper use of different syntactic
structures containing the same morpheme, but not identical
syntactic structures containing dissimilar morphemes. Other
investigators have trained retarded children to correctly
produce the present and past tense forms of verbs (Schumaker
& Sherman, 1970). The children were taught to produce a
verb in both the present and past tense, and then were probed
with untrained verbs to test for generalization. Since three

types of inflections can be added to verb stems to produce
the past tense (e.g., /t/ as in "stopped", /d/ as in "smiled",
or /ǝd/ as in "painted"), these inflectional classes were
trained separately. When one class was trained the
children correctly produced the present and past tense forms
of untrained verbs within that class. When the children
were trained to discriminate between two or more classes,
they generalized this discriminative response to other un-
trained verbs. Finally, three retarded children and four
disadvantaged children were taught to produce sentences in
response to questions such that the child used a verbal
inflection appropriate to the tense of the question (Clark
& Sherman, 1975). Three forms of questions were trained:
(1) a past tense question (e.g., "What did he do yesterday?")
which required a /t/ inflection (e.g., "Yesterday he baked."),
(2) a future tense question (e.g., "What will he do
tomorrow?") which required no specific inflection (e.g.,
"Tomorrow he will bake."), and (3) a present tense question
(e.g., "What is his job?") which required an /ing/ inflection
(e.g., "His job is baking."). Each child was taught to
respond to all three forms of questions and to discriminate
between question forms. Modelling and reinforcement were
used. Following training, the children generated correct
answers to new (but similar) questions which had not been
previously trained.

Prepositions. Several studies have been conducted
wherein retarded and autistic children were taught to

correctly use prepositions. In one study retarded children
were taught to respond correctly at the receptive level to
three types of requests: (1) "Put the ___ next to the
___.", (2) "Put the ___ under the ___.", and (3) "Put the
___ on top of the ___." (Frisch & Schumaker, 1974). These
investigators found that as responses trained to one type of
request became increasingly correct, responses to untrained
requests of the same type also became increasingly correct.
Also, when discriminations between the three types of
requests were trained, the children's responses to untrained
requests of all three types became increasingly correct. In
a second study, autistic children were trained to produce
the preposition "in" and "on" under conditions which were
called "ambiguous" or "non-ambiguous" (Sailor & Taman,1970).
In the ambiguous condition the stimulus objects used in
training the preposition "in" were the same as those used
in training the preposition "on" (e.g., "Where is the circle?
In the hat" versus "On the hat."). In the non-ambiguous
condition the stimulus objects used in training the prep-
osition "in" were different from those used in training the
preposition "on" (e.g., "Where is the circle? In the box"
versus "On the chair."). In both conditions the two prep-
ositions were trained concurrently. The investigators found
that two of three subjects failed to discriminate between
stimulus situations requiring the "in" preposition from
those requiring the "on" preposition under the ambiguous
condition. In the non-ambiguous condition however, correct

usuage of the two prepositions was high.

Generalization of Prases and Sentences to New

Settings and Individuals

> The occurrence of behavior in settings and with
> individuals not directly involved in training
> has been a growing issue of interest within
> various therapeutic programs. Theoretically,
> these phenomena have been identified as
> generalization.... In the area of language,
> the occurrence of trained behavior outside the
> formal therapeutic settings is of extreme
> interest (Garcia, Bullet, & Rust, 1977).

Most often it has been found that retarded and autistic

children do not automatically generalize newly learned

phrases and sentences to environments and individuals not

originally involved in training. However, a number of

investigators have discovered a relatively simple technique

for programming generalization across both settings and

individuals. Simply stated, the child is trained by one

experimenter in several different environments, or by several

experimenters in one environment, or by some combination of

both tactics, until generalization over settings, individ-

uals, or both is achieved (Hamilton & Stephens, 1967; Hewett,

1965; Garcia, 1974; Garcia, Bullet & Rust, 1977; Risley &

Wolf, 1967). Typically, the following format has been

involved in such research. First, a target environment or

individual is specified. Following training by an initial

experimenter in an initial environment, the child is probed

for generalization in the target environment or by the
target individual. Most often no generalization occurs.
Following this, the child is trained in a second environment
or by a second individual. Generalization probes in the
target environment or by the target individual are then
conducted. This time, generalization may be found to occur.
If not, the sequence is repeated in a third environment or
with a third individual, and so on. This procedure appears
to always result in generalization. A variation on this
basic procedure has also been successfully employed (Koegel
& Rincover, 1974). When autistic children were trained in
a one-to-one situation (i.e., one child and one experimenter),
it was found that their performance decreased considerably
when the situation was changed to one consisting of two
children and one experimenter or eight children and one
experimenter. However, generalization was achieved by
beginning with a one-to-one situation and then fading in
more children until a classroom sized group was achieved.
In this example the setting was systematically changed
until the children were responding in what was essentially
the target setting.

Generative Phrase and Sentence Construction

> One area of agreement ... is the prevalence
> and importance of the development of generative
> language. Generative language simply means the
> appearance of novel language responses within
> the language repertoire of the child that have

not been modelled or directly trained, but
that may be related to other language
responses (Lutzker & Sherman, 1974).

A number of investigators have discovered that when
retarded children are taught to appropriately emit phrases
or sentences, novel sentences are sometimes produced
"spontaneously". That is, the children sometimes substitute
one word for another word which is appropriate for the
current stimulus setting, and they sometimes combine com-
ponents of trained sentences into a single new sentence.
However, some of the reports in the literature are anec-
dotal in nature.) In an early investigation (Hewett, 1965),
an autistic child was first taught to imitate single words
and to name pictures. He was then taught to respond to
simple questions with single word answers (e.g., "What is
your name?" - "Peter"). Next, he was trained to ask for
items he wanted using the sentence format "I want ___".
After some initial training, the child began to request
items which had not been trained and he began to acquire
new words and phrases. Similar results have been reported
by other investigators using the same basic procedure
(Hamilton & Stephens, 1967; Risley & Wolf, 1967). The
retarded subjects of these experiments were first taught to
imitate and picture-name. Next they were taught to imitate
sentences and then to answer questions and/or make requests.
Typically, the children generalized the grammatical sentence
forms (e.g., "I want ___ please".) and made word substitu-

tions appropriate to the situation. In addition, some children created new sentences by combining components of trained sentences. In another study, an autistic child was trained to describe pictures using simple and compound sentences. During generalization tests, the child combined trained sentences in order to describe novel pictures (Stevens-Long & Rasmussen, 1974). Another investigator (Barton, 1970) trained a retarded child to answer a series of questions with sentences. Prior to training, the child had possessed a large vocabulary which was not under appropriate stimulus control. Following training, the child increased appropriate answers to untrained questions relative to baseline levels. Finally, a group of investigators trained 20 autistic children to imitate, name, and use appropriate syntax, with varying degrees of success. These investigators report that " ... spontaneous social inter-actions and the spontaneous use of language occurred about eight months into treatment for some of the children ..." Lovaas, Koegel, Simmons, & Long, 1973, p.156).

As is apparent from this review of the literature, a considerable amount of time and interest has been devoted to research pertaining to the generalization of verbal behavior in retarded children. One problem in this area of investigation which has not yet been dealt with is described in Chapter I.