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GENERALIZATION OF NAMING RESPONSES TO OBJECTS IN THE NATURAL ENVIRONMENT AS A FUNCTION OF TRAINING STIMULUS MODALITY WITH RETARDED CHILDREN

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Picture-cards, photographs, and real objects were compared as training stimuli in order to determine which best facilitated the generalization of naming responses learned in a special training room to real objects in the natural environments of four retarded children. The amount of transfer of naming behavior between the three stimulus modes and the average amount of training time required per stimulus mode were 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 substantial generalization regardless of the training stimulus mode. No particular training stimulus mode clearly facilitated the transfer of naming responses to other modes or greatly reduced training time. The results of two supplementary procedures conducted with one child showed that: (1) training in several environments facilitated generalization to real objects in the natural environment when real objects were used as training stimuli but not when picture-cards were used, and (2) transfer from picture-cards to real objects was facilitated by training other picture-cards and the real objects portrayed by them at the same time.

DESCRIPTORS: generalization, verbal training, names, training stimulus modality, retarded children

The early development of a behavioral technology for the production of language in nonverbal children focused primarily upon training techniques whereas relatively little emphasis was placed upon the problem of extending trained verbal responses beyond the therapeutic situation (for a review, see Harris, 1975). More recently, however, the recognition that generalization is not necessarily an outcome of language training has become an issue of considerable concern. Undoubtedly, the effectiveness of language training procedures will ultimately be assessed according to their ability to promote generalization (e.g., Garcia & DeHaven, 1974; Sailor, Guess, & Baer, 1973; Snyder, Lovitt, & Smith, 1975).

One procedure which warrants an immediate assessment because of its prevalence in language training programs for the retarded is a procedure wherein children are taught to identify stimuli portrayed on colorful picture-cards (e.g., Biberdorf & Pear, 1977; Martin, England, Kaprowy, Kilgour, & Pilek, 1968; Olenick & Pear, 1980; Risley & Wolf, 1967; Stephens, Pear, Wray, &

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Jackson, 1975; Wolf, Risley, & Mees, 1964). A question that arises with this procedure is whether learning to name picture-cards in the classroom is the best strategy for enabling children to name the objects represented by those picture-cards when they encounter them in their natural environment. Because the objects portrayed by picture-cards necessarily differ from actual objects in a number of stimulus characteristics, they may not facilitate the generalization of responses learned in the classroom to naturally occurring stimuli. Thus, in a handbook on language training for the severely handicapped, several well-known investigators advise "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, it appears that no empirical studies to confirm this suspicion have thus far been reported. Since picture-cards are much more convenient to use as training stimuli than are real objects, it is unlikely that teachers in applied settings will want to discontinue their use in the absence of evidence that using real objects is more effective in facilitating generalization to the natural environment.

Consequently, the purpose of the present study was to compare several training stimulus modalities to determine which best facilitates the generalization of naming responses trained in the classroom to the real objects found in the natural environment. Photographs were included in the comparison because like picture-cards they would be convenient to use, but they would presumably retain more of the stimulus characteristics of the real objects. With reference to the strategies put forth by Stokes and Baer (1977) for obtaining generalization, this research may be conceptualized as a comparison of the effects of *programming common stimuli* (in this case, real objects) with the effect of using stimuli (in this case, photographs and picture-cards) which differ systematically from the stimuli (i.e., real objects) in the generalization setting.

It should be noted that the general issue of concern here extends beyond the teaching of object names, as it is also important for a variety of other procedures in which picture-cards and photographs have been used; for example, procedures designed to train articulation (e.g., Griffiths & Craighead, 1972; Murdock, Garcia, & Hardman, 1977) grammar (e.g., Baer & Guess, 1973; Martin, 1975), and complex sentences (e.g., Garcia, 1974; Garcia, Bullet, & Rust, 1977). The applied value of training procedures such as these will be lessened if the behaviors they produce fail to generalize to corresponding real stimuli in the natural setting.

METHOD

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 were trained with each of the three modes in a sequential fashion. The order was partially counterbalanced across the three children to control for possible effects of order. After each child had received training 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 format. Later, a fourth child 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 that 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 phase, randomly selected stimuli were trained to a prespecified criterion with one of the three stimulus modes. Tests for generalization took place at the end of each phase.[1]

[1]A more detailed text of the procedures described below may be obtained from the authors.

Table 1
Summary of Experimental Design

	Phases					
	I	II	III	IV	V	VI
Subjects	*Training Stimuli*					
Andy	O	P	C	O	P	C
Bobby	C	O	P	C	O	P
Cathy	P	C	O	P	O*	C*
Debby	O	C	O	C	—	—

O = real objects, P = photographs, C = picture-cards.
*With Cathy, the sequence of 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.

Participants[2]

Andy was a 9-year-old boy with a diagnosis of Down's syndrome. He was first admitted to the St. Amant Centre in Winnipeg 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 2.5 year level. Andy's vocal behavior consisted primarily of single syllable imitations, a number of picture-card names, and several short phases (e.g., "No," "Go away," "Bye-bye, see you").

Bobby 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 Andy, lived in a cottage-style residence. A recent developmental assessment had found him to be functioning at the 3 to 3.5 year level. Bobby's vocal behavior consisted of a few single syllable imitations, a few picture-card names, and a few single word utterances (e.g., "Hi," "No," "Yeah").

Cathy was a 14-year-old girl with a diagnosis of cerebral palsy and spastic quadriplegia, and hence was confined to a wheelchair. She was first admitted to the Centre at 1 year of age and lived on a special ward for nonambulatory children. A recent developmental assessment found her to be functioning at the 2.5 to 3 year level. Cathy had no vocal behavior, but she could reliably imitate a pointing response with her right arm and was therefore trained to name by pointing to Bliss symbols (see Archer, 1977). She could not reliably name any stimuli in this manner at the beginning of the experiment.

Debby 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 young children. A recent developmental assessment had found her to be functioning at the 2.5 to 3 year level. Debby's vocal behavior consisted of several single syllable imitations. However, because her voice was raspy and often inaudible, she was taught to make sign language words rather than vocal words. Debby could not name any stimuli at the beginning of the experiment.

Training and Testing Situations

Training sessions and some testing sessions were conducted in a small room in the psychology department at the St. Amant Centre. The room contained a single child-sized table and two chairs, and audio-recorder, and a one-way window. Each child was worked with individually while seated across from the experimenter at the table.

Testing sessions were also conducted in the children's "natural" environment, i.e., in their living areas. During the first three phases of the experiment with Andy and Bobby, these tests took place in three areas of the cottage in which they lived: (1) the kitchen, (2) the bathroom, and (3) a bedroom (which they shared). Two objects which would normally be found in a kitchen (e.g., a pot and a plate) and one object which would normally be found in a bathroom (e.g., a towel) were tested in those respective areas. The remaining objects, which would normally be found in a bedroom or some other area (e.g., a hanger, a watch, a ball), were tested in the bedroom. To avoid inconveniencing other

[2]Due to the fact that a detailed description of the participants is provided and that reference is made to the Centre in which they live, their names have been changed in order to protect their rights to privacy.

children, tests took place only in the bedroom area during the remaining phases of the experiment. With Cathy and Debby, the tests in the natural environment took place in their bedrooms on their respective wards. No other areas were available because of ongoing ward routines. With all four children, the objects used during the tests in the natural environment were placed in standardized locations throughout the areas described above. Staff or other children were occasionally visible or audible.

Training Stimuli

Picture-cards (17 × 22 cm) 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. Picture-cards depicting people, animals, food items, or symbols were excluded, as were objects that could not be easily transported into the training room by the experimenter. Based on the written criterion, 58 picture-cards were selected by the experimenter as eligible to serve as stimuli. The ratios of agreements to agreements plus disagreements for those picture-cards the experimenter selected, and for those the experimenter rejected, as representing objects ranged from .98 to 1.0.

The experimenter acquired 58 objects which he judged to be representative of the objects portrayed by the 58 picture-cards according to a written criterion. Differences in fine detail were not considered. Those objects then became eligible to serve as training stimuli. Objects that the experimenter judged to be nonrepresentative were also acquired for 18 of the picture-cards. Two observers then independently judged the 76 objects according to the written criterion. The ratios of agreements to agreements plus disagreements for those objects judged as representative, and those judged as nonrepresentative, by the experimenter ranged from .89 to 1.0. The objects that were eligible for use as stimuli ranged in size from a ring to a broom.

Standard 9 × 12 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 expense involved would lessen their applied value as training stimuli.

The majority of the 58 stimuli used in this research represented common household items. For example, there were kitchen utensils (e.g., fork, glass), bathroom items (e.g., comb, brush), clothing and accessories (e.g., dress, purse), toys (e.g., basketball, sled), tools, (e.g., scissors, hammer), and miscellaneous items (e.g., magazine, umbrella).

Bliss Symbols

The Bliss symbols that were used with Cathy were each drawn in black ink on a thin white cardboard square and each square was encased in transparent plastic. Symbols were approximately 2.5 × 2.5 cm and were situated in the center of the cardboard squares which were approximately 5 × 5 cm. A tray for displaying the symbols was affixed to Cathy's wheelchair. All symbols were obtained from the *Provisional Dictionary* of the Blissymbolics Communication Foundation (1976).

Reinforcers

The edible reinforcers for Andy, Bobby, and Debby were chosen on the basis of: (1) the rate at which the child would press a lever in order to receive a particular reinforcer, and (2) nutritional considerations. The reinforcers chosen were pureed peaches (one teaspoon), applesauce (one teaspoon), and ice-cream (one-half teaspoon) for Andy, Bobby, and Debby, respectively.

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

Preliminary Procedures

Following the selection of the 58 training stimuli described previously, an imitation assessment was conducted with Andy, Bobby, and Debby. The function of this assessment was to determine which stimulus names the children could reliably imitate (either vocally, or in the case of Debby, in sign language). This was important because the training procedure was designed to develop stimulus control over naming responses, not to shape imitation. No imitation assessment was conducted with Cathy because her naming response only involved pointing to the correct Bliss symbol.

Preliminary testing with Cathy 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. This impaired the establishment of stimulus control by the training stimuli. Therefore, Cathy was taught to emit an observing response (cf. Eckerman, Lanson, & Cumming, 1968) by pointing to a picture-card for 5 sec before pointing to a Bliss symbol. During the experiment, Cathy was allowed this interval of time to point to the training stimulus, but no specific contingency was implemented to ensure that she did. Nevertheless, Cathy did maintain this observing response.

Finally, during this preliminary phase, all four 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 elbow.")

Overview of General Procedures

At the beginning of each phase in the study, seven stimuli of the appropriate stimulus mode were randomly selected from the pool of 58 described earlier. (With Andy and Bobby, the pool was divided into several categories that were sampled in a manner designed to obtain two kitchen objects and one bathroom object during each of the first three phases.) Five of the seven stimuli were randomly selected to serve as training stimuli and the remaining two served to control for learning that might occur outside of the experimental setting.

In each phase of the study four types of procedures were used. First a *pretraining test* was conducted to ensure that none of the stimuli to be used in that phase was known prior to training. Trials in which the child was presented with stimuli to name were interspersed among trials in which the child was presented with simple instructions he or she was known to follow reliably. Responses to instructions to name stimuli were never reinforced whereas responses to the simple instructions were continuously reinforced with praise and intermittently reinforced with edibles. In the training room, the child was tested with all three stimulus modes while sitting at a table and facing the experimenter. In the natural environment, the child was tested only with the real objects which were situated in standardized locations. The child was led from one location to the next by the experimenter. Second, *training* took place in the training room with one of the three stimulus modes. The procedure for name training was a modified version of a standardized procedure which has been described elsewhere (see Kircher, Pear, & Martin, 1971; Olenick & Pear, 1980; Stephens et al., 1975). Third, a *posttraining test for learning* was conducted in the training room. The newly trained stimuli were presented to the child ten times each in an unsystematic order. The percentage of correct naming responses was used to estimate the extent to which the names were known. Fourth, a *posttraining test for generalization* was conducted which was essentially identical to the pretraining test. The primary interest was in comparing the degree of generalization to the real objects in the natural environment which resulted from training with each of the three stimulus modes. When the training stimulus mode was the real object, generalization only had to occur from the training room to the natural environment. This has often been referred to as "setting generalization." However, when the training stimulus mode was either

picture-card or photographs, generalization had to occur across both modes and settings. The test for generalization in the training room served to assess the degree of intermodal transfer and thereby avoided confounding intermodal transfer with setting generalization.

For each phase, the pretraining test in the training room and the pretraining test in the natural environment were conducted on two successive weekdays. Training was carried out on successive weekdays until each stimulus reached a preset criterion. The posttraining test for learning, the posttraining test for intermodal transfer in the training room, and the posttraining test for generalization in the natural environment followed training on the next three successive weekdays.

Interobserver Reliability

This study required the experimenter to make judgments as to the correctness of the children's naming responses. In order to ensure objectivity, the following reliability checks were made:

With Andy and Bobby, all training sessions, posttraining tests for learning, and posttraining tests for generalization in the training room and in the natural environment were recorded on audiotape. Approximately one-tenth of the training session tapes and one-third of the tapes from each of the three types of posttraining tests were randomly selected for scoring by an independent listener. Sessions from some supplementary phases were included in the random selection of tapes.

With Cathy and Debby, one training session per phase and most posttraining tests for learning, and posttraining tests for intermodal transfer in the training room were independently scored by a second observer through a one-way window. During most posttraining tests for generalization in the natural environment, a second observer was present but remained as unobtrusive as possible. Reliability checks were conducted in a similar manner during several supplementary phases with Cathy.

The interobserver reliability measures used were the ratio of agreements to agreements plus disagreements (cf. Martin & Pear, 1978, pp. 296-297) for responses the experimenter called correct, for responses the experimenter called correct-imperfect pronunciation (in the case of Andy only), and for responses the experimenter called incorrect. The average ratios across children were .99, .95, and .96, respectively. Omissions were excluded from the calculations so as not to inflate the ratios.

RESULTS

Andy

In Figure 1, the bars to the left of the heavy vertical line show the extent to which Andy generalized both from the training stimulus mode to the remaining two modes, and from the training room to the real objects in the natural environment in Phase I through VI. (The bars to the right of the heavy vertical line show the results of two supplementary phases.) The data reveal a high degree of generalization with no systematic differences among 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 posttraining test for learning.

A question that arises from the data from Phase I to VI for Andy is whether he 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 test for intermodal transfer in the training room. Phases VII and VIII assessed this possibility. In Phase VII Andy was trained with picture-cards and was then tested for generalization to the real objects in the natural environment without an intervening test for intermodal transfer in the training room. 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 (e.g., Phases III and VI). A subsequent test with the

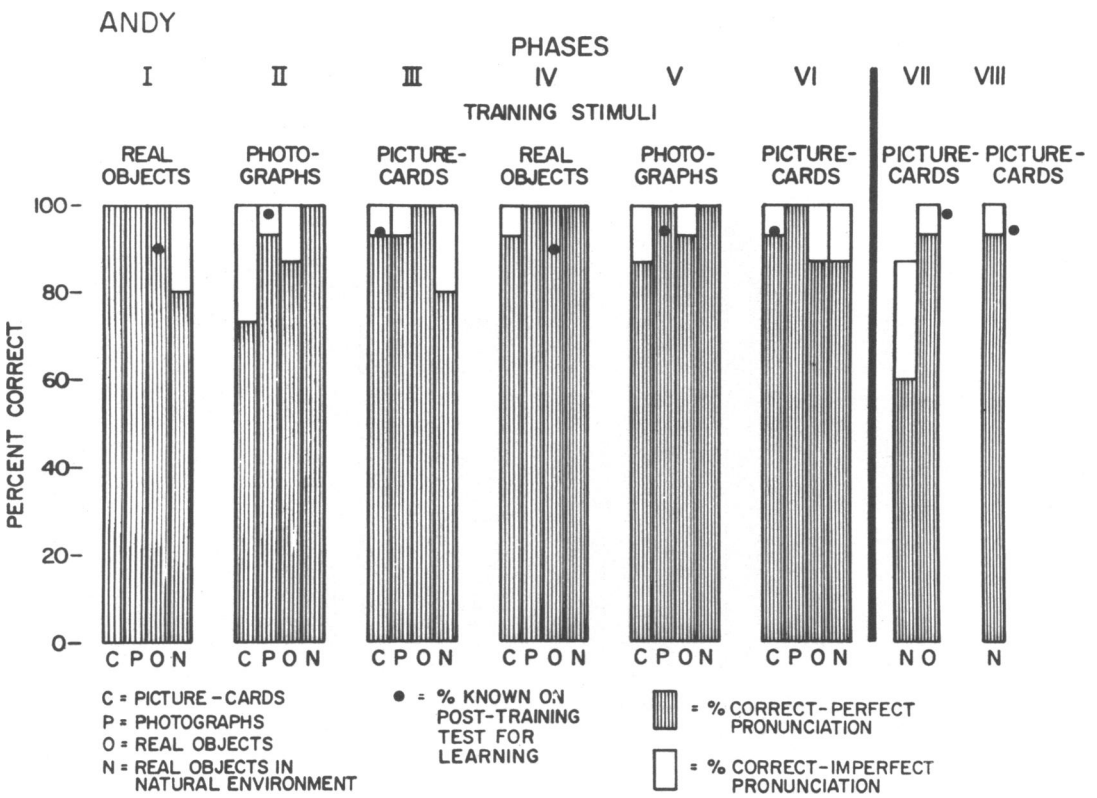

Fig. 1. The percentage of correct responses emitted by Andy to the three stimulus modes during the post-training tests for generalization in the training room (C, P, & O) in the natural environment (N) for all phases. Responses identical to those accepted as correct during training are represented by the lined areas labeled "perfect pronunciation" whereas responses which were not quite identical but which clearly reflected generalization (e.g., "brush" instead of "toothbrush" and "oap" instead of "soap") are represented by the white areas labeled "imperfect pronunciation."

real objects in the training room revealed a degree of generalization comparable to that shown in Phases III and VI, suggesting that tests for intermodal transfer in the training room may in fact facilitate generalization across settings. To determine if this effect was reliable, in Phase VIII Andy 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.

Bobby

In Figure 2, the bars to the left of the heavy vertical line show the extent to which Bobby generalized both from the training stimulus mode to the other two modes, and from the training room to real objects in the natural environment, during Phases I through VI. A considerable amount of intermodal transfer occurred from all three stimulus modes, but the effect was not very reliable. 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 posttraining tests for learning. As with Andy, Phase VII assessed the extent to which experience with the real objects during the test for intermodal transfer affected the outcome of the test for generalization to real objects in the natural environment. Bobby was trained with picture-cards, tested with the real objects in the natural environment, and then

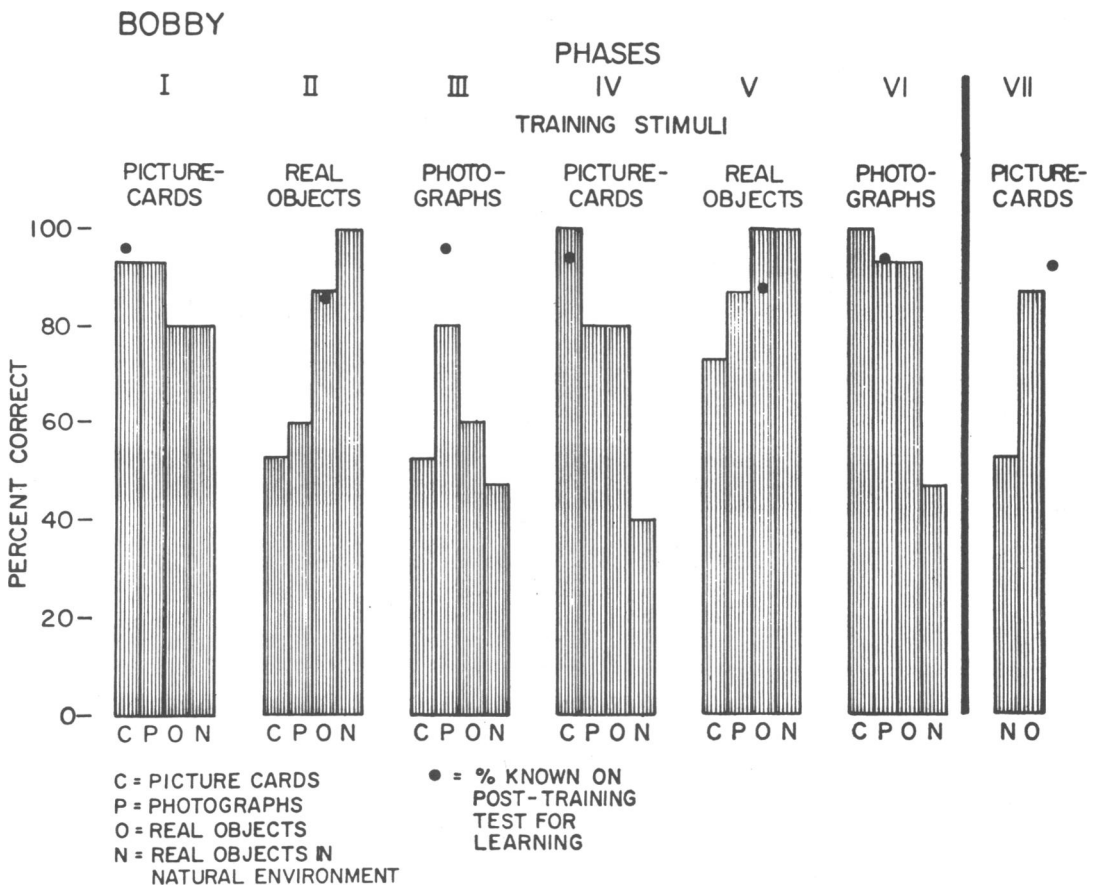

Fig. 2. The percentage of correct responses emitted by Bobby to the three stimulus modes during the post-training tests for generalization in the training room (C, P, & O) and in the natural environment (N) for all phases.

tested with the real objects in the training room. The amount of generalization he displayed was comparable to the average performance of previous phases in which picture-cards had been the training stimulus mode (i.e., Phases I and IV), suggesting that the tests for generalization in the natural environment had not been contaminated by the tests for intermodal transfer in the training room.

Debby

Figure 3 shows the extent to which Debby, 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 training room to the real objects in the natural environment. The amount of intermodal transfer displayed by Debby was variable regardless of which stimulus mode was used in training. As was the case with Bobby, generalization to real objects in the natural environment was clearly and consistently better when real objects were used during training. The black dots in the figure reveal that the naming responses were well known on the posttraining tests for learning. This indicates that the small amount of generalization to the real objects in the natural environment that resulted from training with picture-cards was not a function of ineffective training but rather was a true reflection of poor generalization.

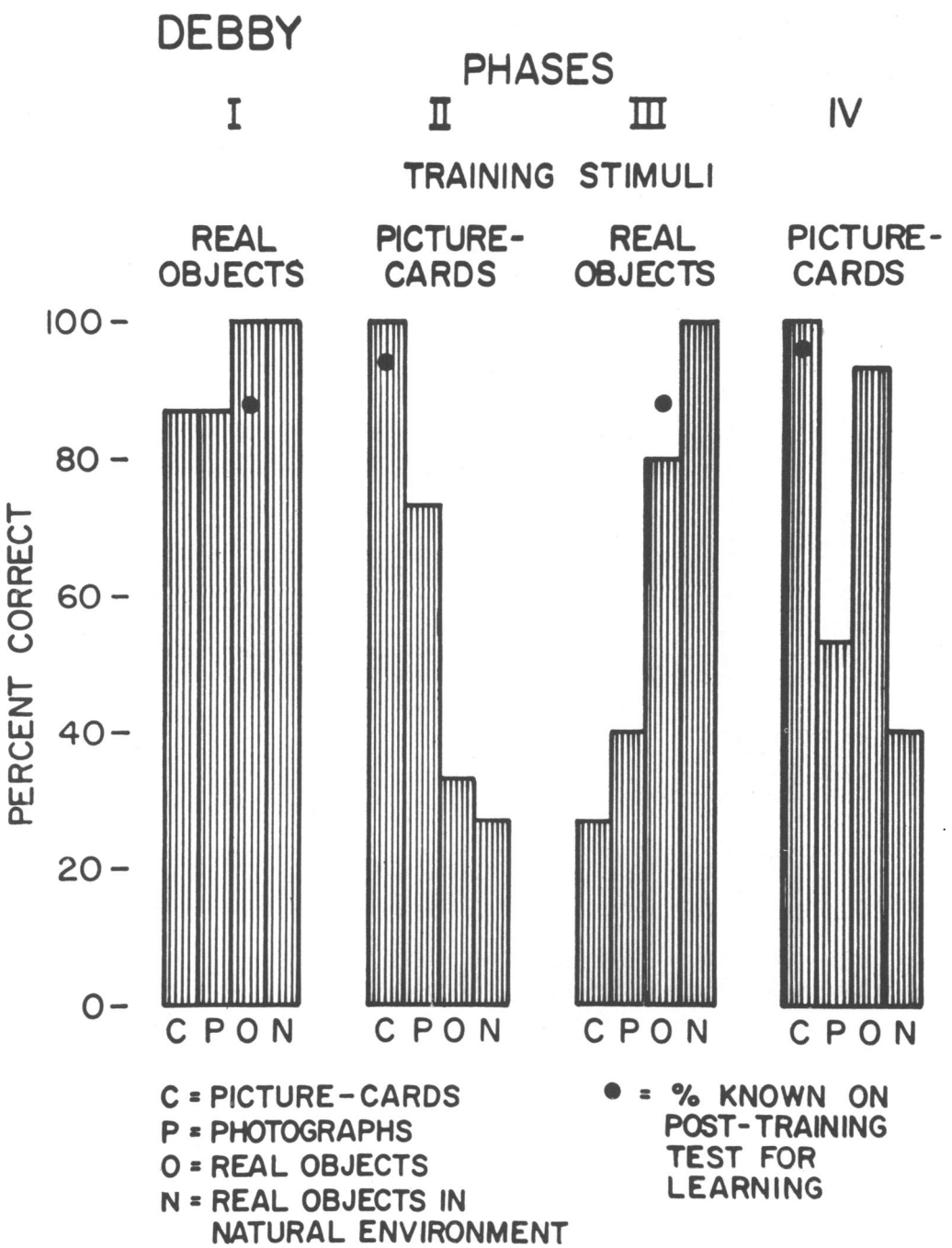

Fig. 3. The percentage of correct responses emitted by Debby to the three stimulus modes during the post-training tests for generalization in the training room (C, P, & O) and in the natural environment (N) for all phases.

Cathy

Figure 4 shows the generalization data for Cathy. Unlike the other children, Cathy occasionally made correct responses during the pre-training tests. In Phases I to III, these were likely the result of pointing to the correct Bliss symbol by chance only. The generalization data for

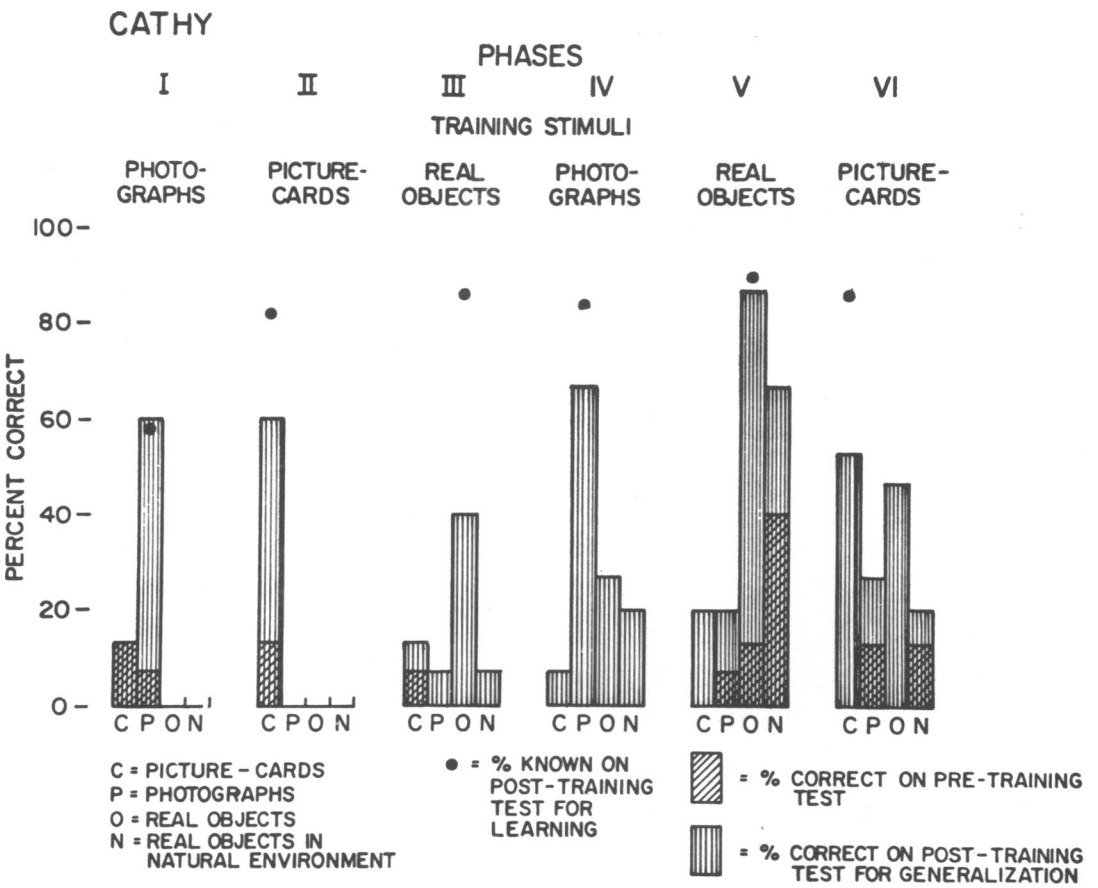

Fig. 4. The percentage of correct responses emitted by Cathy to the three stimulus modes during both the pretraining tests and the posttraining tests for generalization in the training room (C, P, & O) and in the natural environment (N) in Phases I to VI.

Phases I, II, and III indicate that no significant amount of intermodal transfer occurred regardless of which mode was used as the training stimulus. In addition, the data show that when photographs or picture-cards were used in training, no generalization to the real objects in the natural environment occurred. When real objects were used as the training mode, a small amount of generalization to the natural environment took place. Although no greater than the levels that occurred by chance in the pretraining tests, this generalization is probably significant because it represents the first time Cathy actually pointed to a Bliss symbol during the posttraining tests for generalization in the natural environment. In the first two phases, she had always failed to respond in the natural environment.

Because of the large number of omissions that occurred in Phases I to III, the *same* stimuli were retrained during Phases IV to VI. However, during these phases if Cathy did not respond within 15 sec, the experimenter said "Hurry up, Cathy!". This always resulted in a pointing response. Phases IV through VI of Figure 4 show that under conditions in which Cathy 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 that occurred was greater relative to the first three phases, but in an absolute sense was quite small. The black dots in the figure show that during all phases the

naming responses were all well known on the posttraining tests for learning, with the exception of Phase I.

A question that arises from Cathy's data is: what accounts for the relatively large amount of correct responding that occurred during the pretraining test in the natural environment in Phase V? The most plausible answer would be that the responses in question reflect generalization from training that took place during Phase III but was not revealed until Cathy was prompted to respond in Phase V. The fact that most of these correct responses occurred when 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.

Results of Some Supplementary Procedures with Cathy

Three additional phases were conducted with Cathy. The first two of these, 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, because even the real object training stimuli did not produce large amounts of setting generalization with Cathy, 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, Cathy was trained with a new set of real objects. Following the posttraining test for generalization in the natural environment, the procedure used for conducting posttraining tests for learning (described previously) was administered in another room in the psychology department. This was followed by another posttraining test for generalization in the natural environment. This in turn was followed by a posttraining test for learning in a third room in the psychology department and another posttraining 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 5.

Note that, as before, little intermodal transfer occurred in the training room regardless of the training stimulus mode used. The level of the bars at *1*, *2*, and *3* indicates the amount of generalization to the real objects in the natural environment after training in the training room, testing in the second room, and testing in the third room, respectively. It can 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 room 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. Naming responses to picture-cards which had been used as training stimuli in Phases VIII were assessed again in the training room. The amount of correct responding on this assessment is represented by the level of the bars at *a* in Figure 5. As before, little intermodal transfer occurred. Next, one of the five picture-cards was "paired" with the corresponding real object. That is, the picture-card and the real object were trained together according to the training procedure referred to previously. Next, a posttraining test for intermodal transfer in the training room was again conducted. The resulting intermodal transfer is represented by the level of the bars at *b* in Figure 5 (the paired stimulus was not included in the percentages calculated). As is apparent from the graph, the pairing procedure facilitated intermodal transfer to the remaining four real objects and perhaps to the photographs, although to a lesser degree. Following this, a second "pairing" with another picture-card and real object was conducted in the manner just described, and this was followed by another posttraining test for intermodal transfer in the training room. The resulting intermodal transfer is represented by the level of the bars at *c* in Figure 5 (the two paired stimuli were not

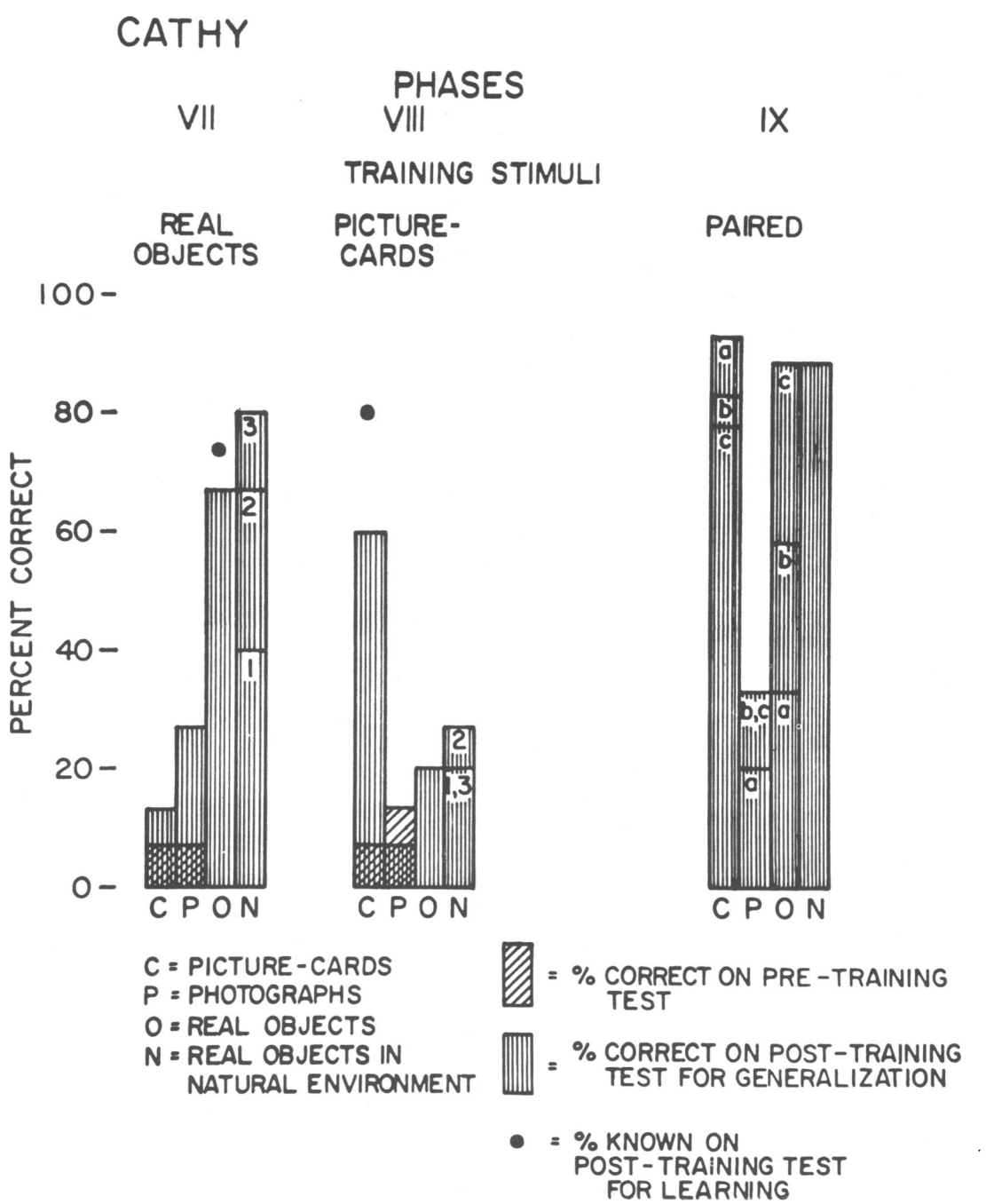

Fig. 5. The percentage of correct responses emitted by Cathy to the three stimulus modes during both the pretraining tests and the posttraining tests for generalization in the training room (C, P, & O) and in the natural environment (N) in Phases VII and VIII and following the pairing procedure (Phase IX). The bars at *1*, *2*, and *3* indicate the amount of generalization to the real objects in the natural environment after training in the training room, testing in the second room, and testing in the third room, respectively. The small letter designations on the Phase IX bars indicate correct responding before training with a picture-card paired with a real object (*a*), after the initial "paired" training (*b*), and following the second "paired" training (*c*).

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 posttraining test for generalization in the natural environment was conducted. As may be seen in the figure, the amount of generalization that occurred to the remaining three real objects in the natural environment was considerable.

Control Stimuli and Acquisition Data

The number of correct responses emitted in the presence of the control stimuli did not increase from pretraining tests to posttraining tests for generalization, indicating that learning outside of the training situation was not a confounding factor in this experiment. There were no substantial differences between stimulus modes in the average number of minutes required to reach criterion during training.

DISCUSSION

Three of the four children who participated in this 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 displayed a considerable amount of generalization to the real objects in the natural environment regardless of the mode of the training stimuli. These results support Guess et al. (1976) when they recommend that parents and teachers use real objects rather than pictures to conduct language training programs with severely handicapped children.

The control procedures that were used in this study allow a considerable degree of confidence to be placed in these results. The main effect was replicated both within and between subjects. The control stimuli used in each phase of the study were never learned, suggesting that influences from external uncontrolled sources were minimal. The results of the posttraining tests for learning indicated that the naming responses that were trained were all well known 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 Andy and Phase VII with Bobby suggest that the tests for intermodal transfer in the training room did not influence performance on the tests for generalization in the natural environment to any substantial degree.

The outcome of this study has serious implications for language training programs for the retarded that use picture-cards or photographs as training stimuli. It now seems that the various forms of verbal behavior trained in this manner often may not come under the control of naturally occurring stimuli, and that these training programs are therefore unnecessarily limited in their applied value. It therefore seems advisable for parents, teachers, and researchers to use real objects as training stimuli as much as possible whenever generalization to these stimuli is the desired objective. If picture-cards or photographs must be used, then assessments of generalization to naturally occurring stimuli should be routinely undertaken because, given the current research findings, their continued use could only be justified by a demonstration that generalization was not being impeded.

There are two findings in the present study that may suggest qualification of this recommendation. First, the results of the supplementary procedures conducted with Cathy suggest that training in more than one setting may facilitate setting generalization and that the "pairings" procedure may facilitate intermodal transfer. Both of these techniques would be classified as *training sufficient exemplars* by Stokes and Baer (1977), and the effectiveness of the former technique has been previously documented (e.g., Garcia, 1974). If the latter ("pairing") technique is found to be replicable in future research, then language trainers may be able to justify using picture-cards or photographs for convenience

on the grounds that they can readily obtain generalization to naturally occurring stimuli by implementing these techniques. It must be realized though, that to date the efficacy of these techniques has yet to be clearly established. Second, one of the four children who participated in this research, Andy, displayed a large amount of intermodal transfer and setting generalization from all three stimulus modes. It may be possible to identify a priori those children who are likely to display large amounts of generalization from picture-cards or photographs by their pretraining linguistic proficiency. Of the four children, Andy was the most linguistically proficient. He was able to imitate most phonemes and he used several short phrases (e.g., "Bye-bye, see you") appropriately. In addition, he knew the names of a number of picture-cards. Conversely, Cathy, who at first displayed almost no intermodal transfer or setting generalization, was the least linguistically proficient. Prior to this study she had essentially no expressive verbal behavior. If future research identifies a reliable predictor, language trainers will have justification for using the more convenient stimulus modes with certain children. In fact, it may be argued that children who generalize very well from pictures should be provided with the opportunity to emit this behavior because of the broad range of learning experiences that are commonly depicted in picture books but that are not readily available in the classroom.

There were no substantial differences between stimulus modes with respect to the average number of minutes required to reach criterion during training. Cutting (1973) obtained similar results when comparing real objects to photographs on a trials-to-criterion measure with retarded children (see his figure 4, p. 48). This finding is somewhat surprising because normal children are thought to attend more readily to three-dimensional objects than to two-dimensional objects (Ault, Cromer, & Mitchell, 1977). It is possible that retarded children may differ from normal children in this respect.

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