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TRAINING GENERALIZED RECEPTIVE PREPOSITIONS IN RETARDED CHILDREN[1]

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Three retarded children were trained, using prompting and reinforcement procedures, to respond correctly to three categories of prepositional requests: "put the ——— next to the ———", "put the ——— under the———", and "put the ——— on top of the ———". Training sessions were alternated with probe sessions throughout the study. During training, a child was trained to respond to one request (*e.g.*, "put the doll next to the cup"); during probing, the child was tested for generalization of this training to untrained requests. Responses to untrained requests were never prompted nor reinforced. The results showed that, as requests from one category were trained, the children's responses to the untrained requests of that category became increasingly correct. As discriminations among two or more categories were trained, the children's responses to the untrained requests of those categories also became increasingly correct. Thus, the methods employed appear to be successful in training generalized receptive discrimination among prepositional categories and possibly can be utilized in training other generalized receptive language skills.

As the volume of experimental research in language development has grown, a large proportion of it has concentrated on productive or spoken language (*e.g.*, Brigham and Sherman, 1968; Guess, Sailor, Rutherford, and Baer, 1968; Hursh and Sherman, 1973; Lovaas, Berberich, Perloff, and Schaeffer, 1966; Sailor, 1971; Schumaker and Sherman, 1970; Wheeler and Sulzer, 1970). In contrast, little research has dealt with the acquisition of receptive language or the skill of responding appropriately to productive speech.

Zimmerman, Zimmerman, and Russell (1969) demonstrated that rates of responding to verbal instructions could be increased in children who responded inconsistently in baseline conditions. Whitman, Zakaras, and Chardos (1971) replicated these findings and also increased two children's rates of instruction-following in response to untrained instructions. Others have been successful in training generalized receptive responding to specific language classes: plurals (Guess, 1969); and adjectival inflections (Baer and Guess, 1971). These investigators found that as children learned to respond correctly to specific examples within a response class, they generalized their training by correctly responding to untrained examples within the same response class. Baer and Guess argued that these patterns of generalization could be termed "generative".

Thus, research in receptive language has shown that children can be trained to comply with simple instructions and to respond in accordance with morphological rules governing two receptive language classes. Since receptive language skills are important for any child to acquire, in terms of their usefulness in daily living, the present study sought to extend this

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research by developing and analyzing a method for teaching generalized instruction-following to prepositional requests.

EXPERIMENT I

METHOD

Experimental Design

A multiple baseline design (Baer, Wolf, and Risley, 1968) was employed across three categories of prepositional requests: "put the ——— next to the ———", "put the ——— under the ———", and "put the ——— on top of the ———". Two types of experimental sessions were conducted: training sessions and probe sessions. In training sessions, a child was trained on one request of one category (*e.g.,* "put the flower next to the cup") until a criterion performance was attained. Then, in a probe session the child was presented with untrained requests of all three categories to determine whether he generalized the trained response. If generalization to untrained requests of the same category was incomplete, the child was trained on another request from the same category (*e.g.,* "put the thimble next to the hat") and again tested for generalization. This alternation between training and probing on the first category of requests ("next to" requests) continued until the child responded correctly to 100% of the untrained "next to" requests in two consecutive probe sessions.

Next, a discrimination between the "next to" request category and the "under" request category was taught by concurrently training one request from each category. Once the child reached an appropriate criterion on this training, he was probed to test whether he could make the discrimination on untrained requests. If generalization was incomplete, he was trained on a new request from each category and probed again for generalization.

Since the children seemed unable to discriminate between untrained "next to" and "under" requests, "under" requests were trained separately (as the "next to" requests had been trained). Probing continued in alternation with training until the child correctly responded to all of the untrained "under" requests in two consecutive probe sessions. Then, discrimination training on "next to" and "under" requests was re-instituted, probing all the while for generalization. When the child responded correctly to 100% of the untrained "next to" and "under" requests in two consecutive probe sessions, training of "on top of" requests was initiated. Again, probing alternated with training until the child correctly responded to all untrained "on top of" requests in two consecutive probe sessions. Finally, a discrimination among all three request categories was trained by concurrently training one request from each category to a specified criterion. Probing continued in alternation with training until the child correctly responded to 100% of the untrained requests in the probe list in two consecutive probe sessions.

Subject

Johnny was a 3.5-yr-old boy residing at the Central Wisconsin Colony and Training School, Madison, Wisconsin. His diagnosis was "psychogenic retardation associated with emotional disturbance". Johnny had developed no communicable speech, did not respond to verbal requests, did not establish eye contact or initiate social interaction with others, and used toys and other objects inappropriately. Many of his behaviors were considered autistic.

Procedure

The study was conducted in a small room containing a table and two chairs. Johnny came to the experimental room daily for a 30-min session and sat opposite the experimenter at the table. Next to the experimenter's chair was a box containing stimulus items used in the requests. Data were recorded by the experimenter on recording sheets.

Pretest sessions. Five requests were devised for each category in order to compile a probe list of 15 request items (See Table I). Five objects were used for the direct object; five different objects were used for the object of the

Table 1

Probe Requests

"Next to" probe requests
Put the crayon next to the cup
Put the pompom next to the basket
Put the ball next to the hat
Put the mouse next to the dish
Put the flower next to the bucket
"Under" probe requests
Put the crayon under the hat
Put the ball under the bucket
Put the mouse under the basket
Put the flower under the cup
Put the pompom under the dish
"On top of" probe requests
Put the mouse on top of the bucket
Put the pompom on top of the cup
Put the crayon on top of the dish
Put the ball on top of the basket
Put the flower on top of the hat

Table 2

A Sample of Training Requests

"Next to" training requests
Put the dog next to the boat
Put the block next to the chair
Put the cow next to the truck
Put the horn next to the bottle
Put the chicken next to the wheelbarrow
"Under" training requests
Put the cow under the glass
Put the lady under the wagon
Put the lion under the hat
Put the beanbag under the saucer
Put the cube under the eggshell
"On top of" training requests
Put the bus on top of the boxtop
Put the hedgehog on top of the drum
Put the whistle on top of the jar
Put the tiger on top of the tower
Put the bug on top of the suitcase

preposition. Since each object was used for each category of request, this ensured that the child had to attend to the prepositional cues to respond correctly to the probe requests. The 15 probe requests were randomly presented to Johnny for several sessions until a stable performance across sessions was obtained. To make a request (*e.g.*, "put the shovel next to the bucket"), the experimenter first placed the object of the preposition (in this case, the bucket) on the table in front of the child. The object of the preposition, a hollow container, was placed on its side so that its position could not cue the correct response. Then, the experimenter waited until the child was quiet and looking at her before verbally making the request. As the experimenter spoke the request, the direct object (in this case, the shovel) was placed in the child's hand. No consequences were provided for correct or incorrect responses during these pretest sessions. Each response to a request was simply recorded, and the next request was made after a 10-sec interval.

Training sessions. For training sessions, the request to be trained was presented to the child as in pretest sessions (See Table II for a sample of training requests). If Johnny responded correctly, he was praised and given a small amount of ice cream. If he made no response to the request within 10 sec of its presentation, the experimenter prompted him by physically guiding him through the response (See Baer, Peterson, and Sherman, 1967) and immediately delivered praise and ice cream. An incorrect response produced "No" from the experimenter, followed by a 10-sec period when the experimenter fell silent with head bowed. Then, the request was presented again, and the subject prompted for the correct response, which was followed by praise and ice cream. Physical prompts were faded out over several trials by gradually reducing the physical dimensions of the prompts until the subject was responding correctly to the verbal request without assistance. The training procedure continued until the subject reached a criterion of five successive correct trials without prompting. The session was then terminated. If criterion was not reached in a session, training on the same item was continued in the next session.

During discrimination training, sessions consisted of concurrent training on one request from each request category involved in the discrimination. Different pairs of objects were used for each request trained. The requests were presented in a random order, and criterion perform-

ance was reached when the subject responded correctly to each request in a randomly presented sequence containing at least five trials of each request. When criterion was reached, the training session was terminated. If the subject did not reach criterion in a session, training was continued in the next session.

Probe sessions. A probe session followed each training session in which Johnny had reached the training criterion. In probe sessions, trained requests were randomly interspersed with the 15 untrained probe requests used in the pretest (in an average ratio of one trained request for every untrained request). As new requests were trained within a condition, they, along with previously trained requests, were interspersed with the probe requests. The order of requests was varied each time the probe list was presented and its length remained stable at 31 requests. When the number of trained requests within a given condition became greater than 16, the trained requests to be interspersed with untrained requests were randomly selected from the requests that had been trained up to that point.

The requests were presented in probe sessions as in pretest and training sessions. Consequences for correct responses, nonresponding, and incorrect responses to the trained requests were identical to those in training sessions. Responses to probe requests were never prompted or followed by praise and ice cream; they were merely recorded by the experimenter. Every effort was made by the experimenter to remain expressionless during and after a probe trial.

Scoring of Responses and Reliability

A correct response to a "next to" request was recorded when the subject placed the direct object (the item handed him by the experimenter) on the table within 1 in. (2.5 cm) of the object of the preposition (the item on the table). The subject was required to remove his hands from both objects, and the direct object could not be in, under, or on top of the object of the preposition. A correct response to an "under" request was recorded if the subject lifted the object of the preposition and placed the direct object under it (such that the direct object was completely covered by the object of the preposition) and removed his hands from both objects. A correct response to an "on top of" request was recorded if the subject balanced the direct object on top of the object of the preposition and removed his hands from both objects.

Reliability was evaluated by an additional observer in the experimental room during at least one training and one probe session in each condition. The observer's and experimenter's recording sheets were compared on a trial-by-trial basis. In the training sessions, there were 84 agreements on responses to 84 requests. In the probe sessions, there were 72 agreements on responses to 75 probe requests (96% agreement), and 80 agreements on responses to 80 trained requests.

RESULTS

The graphs of Figure 1 show Johnny's performance on the untrained requests in probe sessions. During three pretest sessions, Johnny did not respond appropriately to any of the probe requests. In the training sessions of Condition I, he made no errors on new "next to" requests after the eighth request. His number of correct responses to untrained "next to" requests in the probe sessions rose gradually until he met the criterion of 100% correct in two consecutive sessions by probe session 15.

In Condition II, a discrimination training condition in which one "next to" and one "under" request were concurrently trained before each probe session, Johnny's performance on "next to" training requests remained nearly errorless, but his performance on "under" training requests fluctuated. Johnny correctly responded to most of the untrained "next to" requests. However, when he failed to evidence any trend toward criterion on the untrained "under" requests after 12 pairs of requests had been trained, Condition III was instituted where Johnny was

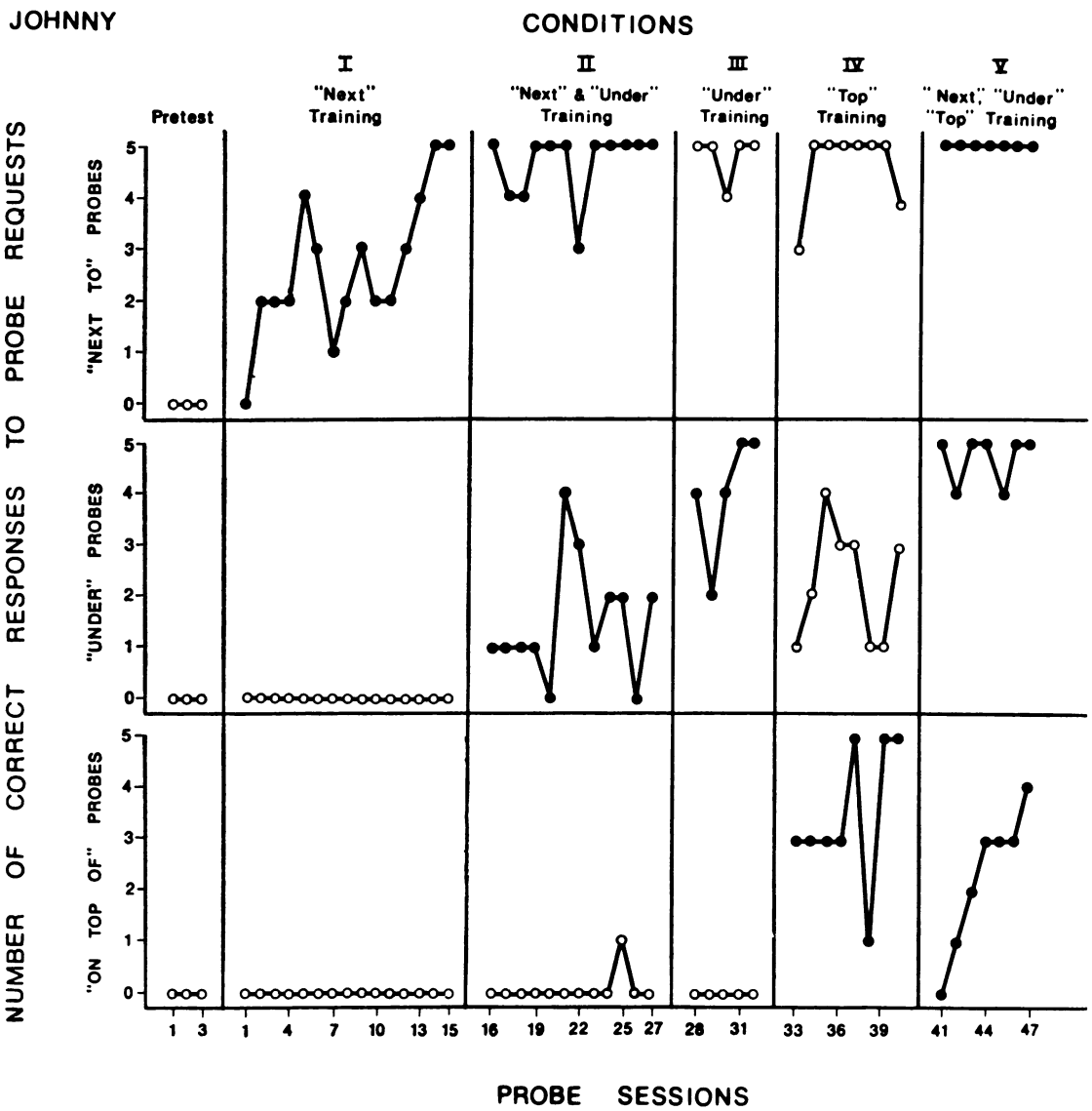

Fig. 1. The number of correct responses Johnny made to untrained requests in probe sessions. Dots indicate the categories trained within a given condition and open circles indicate the categories that were not trained in each condition.

trained on only "under" requests. Johnny performed errorlessly on three of four "under" training requests and reached criterion performance on untrained "under" requests in probe sessions 31 and 32. Since he also responded correctly to all of the untrained "next to" requests in probe sessions 31 and 32, it was not necessary to re-institute discrimination training between "next to" and "under" requests.

Johnny was trained on "on top of" requests during Condition IV. In training sessions, he responded errorlessly on the fifth and sixth trained requests. During probe sessions, Johnny reached criterion in probe sessions 39 and 40 on untrained "on top of" requests.

Condition V was designed to teach a discrimination among all three requests. Since Johnny was placed in a foster home before he

reached criterion in the probe segment of the experiment, this condition was never completed. However, after Johnny had been trained on seven trios of requests, he was responding correctly to all of the untrained "next to" and "under" requests, and was displaying increasingly correct responding to untrained "on top of" requests.

Johnny's responses to the trained requests interspersed in the probe lists were generally correct throughout the study, ranging from 75% to 100% correct, with an average of 97% correct across all probe sessions.

EXPERIMENT II

In Experiment I, Johnny was handed the direct object for each trial and the object of the preposition was the only item on the table. Thus, he need not have attended to the differences among the items. This possibility is important for two reasons. First, it is necessary to show that the child's object-placing behavior was under control not only of the preposition presented to him, but also of the names of the objects available, if a fair approximation to normal receptive language is to be claimed. Second, it is important that the child attend to the differences in the objects in order to call correct responding to untrained requests "generalized" behavior. To ensure that future subjects would attend to the stimulus objects in addition to the prepositions, the procedure was altered slightly for Experiment II.

By changing the procedure for Experiment II it also became possible to examine the findings of Sailor and Taman (1972), who reported problems in training the productive use of prepositions in three retarded children. They suggested that the initial use of different objects ("the *pail* is in the *box*" *versus* "the *plate* is on the *chair*") helped children to form a discrimination between prepositions, whereas the initial use of the same objects ("the *circle* is in the *hat*" *versus* "the *circle* is on the *hat*") made it more difficult to train the discrimination. Although the present study involved receptive use of prepositions (Sailor and Taman's concerned productive use), an attempt was made to determine whether the use of different objects facilitated discrimination training and generalization in Experiment II.

METHOD

Subjects

Two children with limited receptive repertoires were chosen. Like Johnny, both were residents of the Central Wisconsin Colony and Training School. Alice, a severely retarded 11-yr-old girl, was diagnosed as retarded due to hydrocephalus. She followed simple instructions such as "come here" and "sit down" but did not respond correctly to requests involving prepositions. Kevin, a moderately retarded 4-yr-old boy, had about the same receptive repertoire as Alice. The cause of his retardation was unknown.

Procedure

The procedures for these children were similar to those used for Johnny, except for the procedure of presenting the objects on each trial. Before Experiment II began, both children were trained to point to objects named by the experimenter within an array of objects on the table. After a few sessions, the children were correctly identifying all the objects to be used in the probe sessions. Before a training session in which a new request (involving new objects) was to be introduced, the children were trained to point to the objects as they were labelled by the experimenter.

During pretest, training, and probe sessions, four objects were placed in front of the child on the table. Two of the objects were hollow containers (*e.g.,* a box and a bucket), which were always placed on their sides, and two were smaller objects (*e.g.,* a car and a button) that would fit under or balance on top of either of the containers. The request (*e.g.,* "put the car next to the bucket") was presented to the child

when he was quiet and looking at the experimenter. During training sessions, the subjects were required to choose the named objects from the array on the table and to place them in the correct position in order to receive praise and ice cream. The extra objects appearing on the table and the positions of all four objects were varied for each trial.

Reliability

Reliability was evaluated as in Experiment I. For training sessions, there were 159 agreements on responses to 159 requests. In the probe sessions, there were 177 agreements on responses to 177 untrained requests and 211 agreements on responses to 213 trained requests (99% agreement).

RESULTS

Figures 2 and 3, respectively, show Alice and Kevin's responses to untrained requests during probe sessions. During the pretest condition, both Alice and Kevin did not respond appropriately to any of the probe requests; although they selected the proper objects for the requests, they did not position them as requested. In Condition

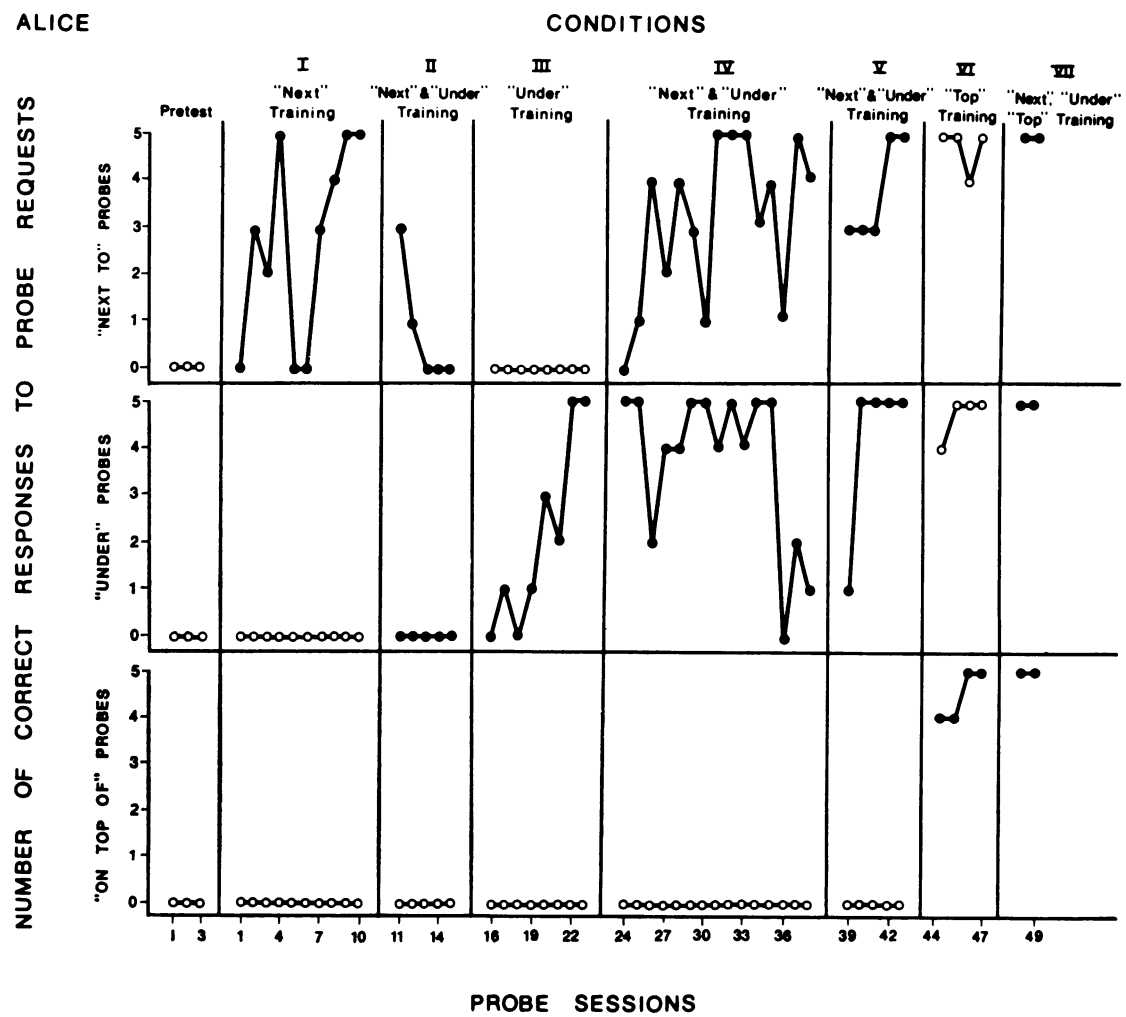

Fig. 2. The number of correct responses Alice made to untrained requests in probe sessions. Dots indicate the categories trained within a given condition and open circles indicate the categories that were not trained in each condition.

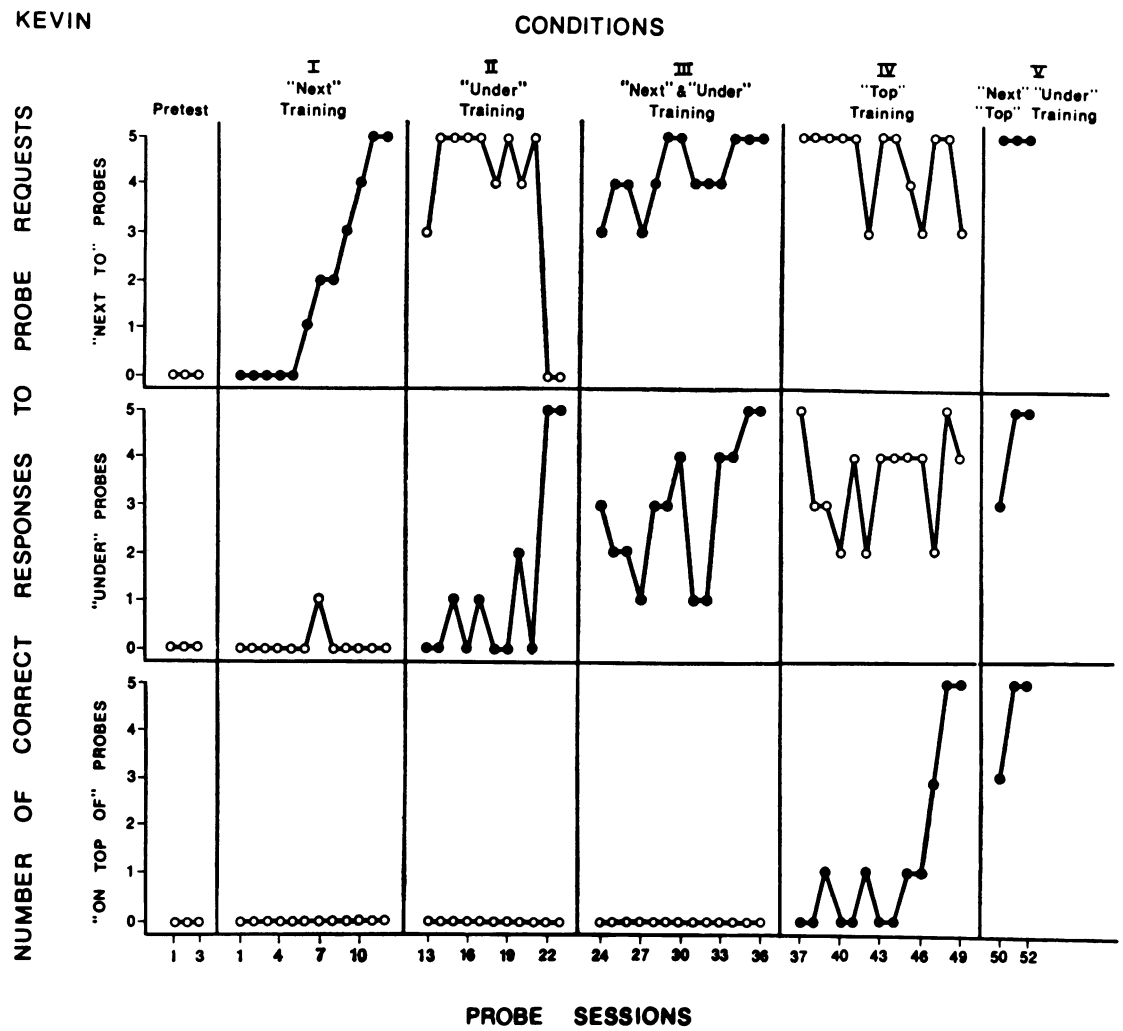

Fig. 3. The number of correct responses Kevin made to untrained requests in probe sessions. Dots indicate the categories trained within a given condition and open circles indicate the categories that were not trained in each condition.

I, Alice and Kevin reached criterion on untrained "next to" requests after training on eight and 10 "next to" requests, respectively. Both children continued to respond incorrectly to untrained "under" and "on top of" requests during Condition I.

In Condition II, Alice received discrimination training on "next to" and "under" requests, with different objects being used for each request. Although she learned the discrimination on requests in training sessions in an average of 19 trials, she did not discriminate when asked to respond to the probe requests. Alice's correct responding to untrained "next to" requests dropped to pretest level, and her responding to untrained "under" and "on top of" requests remained at that level. Condition III was then instituted to train responding to "under" requests. After training on seven "under" requests, Alice correctly responded to all of the untrained "under" requests in probe sessions 22 and 23.

Discrimination training on "next to" and "under" requests was re-instituted in Condition

IV. Alice had not reached criterion performance in probe sessions after 15 pairs of "next to" and "under" requests had been trained. Since different objects were being used in the concurrent training of the two different requests (*e.g.,* "put the *ball* next to the *shoe*" *versus* "put the *cat* under the *cup*") it was hypothesized that Alice was attending to the object cues ("ball-shoe" *versus* "cat-cup") rather than the prepositional cues ("next to" *versus* "under") to make discriminations during this training. Thus, when she was asked to make the discrimination in probe sessions to requests involving previously untrained objects, she had difficulty doing so. Condition V was instituted to continue concurrent training on pairs of "next to" and "under" requests using the same objects in each pair of requests (*e.g.,* "put the *flower* next to the *cup*" *versus* "put the *flower* under the *cup*"). Alice learned the discrimination on the first pair of training requests after 92 trials. However, she only used an average of 10 trials to learn the discrimination on the next three pairs of training requests, and reached criterion on the untrained "next to" and "under" requests in probe sessions 42 and 43.

In Condition VI, where responses to "on top of" requests were trained, Alice was able to generalize this training to all of the untrained "on top of" requests after learning only three training requests. Alice then received discrimination training on a triad of one "next to", one "under", and one "on top of" request in Condition VII (using the same objects in each triad of requests), and immediately met the final criterion performance in probe sessions 48 and 49, thereby terminating training.

Kevin was trained on only "under" requests in Condition II, since neither Johnny nor Alice had made the discrimination between untrained "next to" and "under" requests before "under" requests were trained separately. He reached criterion on untrained "under" requests in probe sessions 22 and 23. Condition III involved discrimination training on "next to" and "under" requests. To avoid the problems Alice encountered in making the discrimination to untrained requests, Kevin was trained in this condition using the same objects in each pair of requests. Kevin learned to discriminate between the first two training requests after 140 trials. However, he reached criterion on the next 11 pairs of training requests in an average of 11 trials. He reached the criterion on both untrained "next to" and untrained "under" requests after having been trained on 12 pairs of requests. "On top of" training was instituted in Condition IV, and Kevin responded correctly to all of the untrained "on top of" requests after he had been trained on 12 "on top of" requests. Condition V involved discrimination training on all three request categories (using the same objects in each triad of requests). Kevin responded correctly to all of the probe requests after training on only two triads of requests.

Alice and Kevin's responses to the trained requests interspersed in the probe lists were consistently correct. Alice correctly selected 98% of the direct objects and 98% of the objects of the preposition and positioned them correctly in 97% of the trials. Kevin correctly selected 99% of the direct objects and 99% of the objects of the preposition and positioned them correctly in 97% of the trials. In the untrained probe requests, Alice correctly selected 99% of the direct objects and 99% of the objects of the preposition, and Kevin correctly selected 97% of the direct objects and 97% of the objects of the preposition.

DISCUSSION

Experiments I and II demonstrated that retarded children can be taught to follow prepositional instructions through the use of reinforcement and prompting procedures. In addition, the results show that as the children learned to respond to prepositional requests of one category, or learned a discrimination between categories, their responses to untrained requests of those categories became increasingly correct.

Thus, these results replicate and further extend the receptive language research of Guess (1969) and Baer and Guess (1971). Furthermore, the similarity between the present results and those of productive language studies (*e.g.,* Schumaker and Sherman, 1970) indicates that acquisition of generalized receptive language skills can be very similar to acquisition of generalized productive language skills. From the present data, it appears that receptive language learning, like productive language learning, involves the gradual formation of rules that can be used in a generative manner. Whether or not these findings reflect the processes involved in the acquisition of language skills in the natural environment remains to be determined.

The results of Experiments I and II also identify some problems to be considered in the training of discriminations. From the results with Johnny and Alice, it seems necessary to train and obtain generalization in each category separately before training a discrimination between categories and obtaining generalization of that discrimination. This sequence of conditions was used in Kevin's case, producing correct discrimination in response to untrained requests. It remains to be determined whether children normally learn to make discriminations in the natural environment in this manner. However, this seems to be a fairly efficient way to teach retarded children to do so.

Further, Alice did not make the discrimination between two categories of untrained requests even after she had learned to generalize to untrained requests of each request category separately. Possibly she was attending to the visual object cues, rather than the auditory prepositional cues in training sessions. Thus, when she was asked to respond to untrained requests and the previously learned object cues were not available, she was not able to make the discrimination. The solution of using the same object cues in training each pair of requests seemed to help Alice; she quickly responded correctly to the untrained requests in both categories. She also quickly discriminated among all three types of untrained requests in the final condition. When this new procedure was used with Kevin, he also learned to generalize the discriminations without much difficulty. These results suggest that in training the generalization of a discrimination, it is important to eliminate any cues that may be used by the child in forming unsound generative rules. This conclusion is directly contrary to the conclusions of Sailor and Taman, who suggested that the use of extraneous cues might help children to learn discriminations. There are two possible explanations for this contradiction. First, Sailor and Taman trained productive use of prepositions, whereas the present study involved receptive use of prepositions. Second, Sailor and Taman used only a few sets of stimulus items in training and did not determine how the use of extraneous cues affected performance on untrained items. For the present study, the disadvantages of the use of extraneous cues became apparent only when children were asked to respond to untrained items.

It is important to note that although the children in the present study learned to respond to three categories of prepositional requests, they did so within a laboratory setting and, since all of the needed objects were on the table within easy reach, their final responses were, at best, approximations to the responses that might be required of them in the natural environment. However, it would not be difficult to extend such training to the natural environment by transferring training and probe sessions to the ward or home and using the common household objects found there as the stimulus items in the requests. The distance between the child and the named objects could be gradually increased until the child could be asked to find the objects and perform the requested task in any part of the ward or home. In addition, different prepositions (*e.g.,* "in", "behind", "in front of", *etc.*) or even different requests (*e.g.,* "bring me the ——", "open the ——", *etc.*) could be inserted within the program in expanding any child's receptive language repertoire.

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