JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1983, 16, 379-394 NUMBER 4 (WINTER 1983)

AN ALTERNATING TREATMENT COMPARISON OF ORAL AND TOTAL COMMUNICATION TRAINING PROGRAMS WITH ECHOLALIC AUTISTIC CHILDREN

RICARDO D. BARRERA AND BETH SULZER-AZAROFF

UNIVERSITY OF VERMONT AND UNIVERSITY OF MASSACHUSETTS-AMHERST

An alternating treatment comparison was conducted of the relative effectiveness of oral and total communication training models for teaching expressive labeling skills to three echolalic autistic children. The results of this comparison demonstrated that total communication proved to be the most successful approach with each of the subjects. In addition, the replication of these findings both within and across subjects suggest that total communication may be, in general, the most effective of these two training models for teaching basic vocal language skills to echolalic children. A number of hypotheses are presented that may provide a basis for the demonstrated effect.

DESCRIPTORS: echolalia, autistic children, language training, alternating treatment

Of all the language disorders associated with autism, echolalia has been described as the most common characteristic of those autistic children who do speak (Hingtgen & Bryson, 1972; Rutter, 1968; Wing & Wing, 1971). Although echolalia represents a serious and frequent language impairment within this population, it has been described by a number of researchers as a phase of normal language development peaking at approximately 30 months of age (Van Riper, 1963; Zipf, 1949). In contrast with this, autistic echolalia is most common at preschool and school ages, and occasionally persists through adolescence (Fay, 1969). Further differentiating between autistic and nonautistic echolalia, Fay (1973) noted that autistic echolalia is characterized by the existence of both immediate and delayed forms of the disorder, and a greater percentage of echolalic utterances.

In contrast with earlier subjective hypotheses regarding the function of autistic echolalia, researchers have recently found evidence to suggest that echolalia in autism may reflect a general strategy for responding to verbal stimuli which are not understood. Thus, once a verbal stimulus takes on meaning, echolalic responding to that stimulus dissipates (Carr, Schreibman, & Lovaas, 1975; Schreibman & Carr, 1978). The issue then becomes one of identifying effective strategies for developing stimulus control with this population; that is teaching the student that specific verbal stimuli have specific meanings and can produce specific behaviors in others.

Historically, operant language training programs for echolalic autistic children have sought to obtain stimulus control over existing echolalic/imitative verbal behavior (Lovaas, Koegel, Simmons, & Long, 1973; Risley & Wolf, 1967). In both of these studies, therapy began with a period of intensive training designed to increase the frequency and reliability of vocal imitative behavior and to establish reliable and precise

This article was based on a dissertation submitted by the first author to the Department of Psychology, University of Massachusetts, in partial fulfillment of the requirement for the Ph.D. This research was supported, in part, by a grant from the Bureau of Education for the Handicapped, No. 451AH60923. The authors acknowledge with gratitude the administration and staff of the May Institute and Drs. Walter P. Christian and Stephen C. Luce for their assistance and support in this research. We also thank Ms. Laura Clark, and Drs. Debra Lobato, Patricia Wisocki, Thomas Zane and Jey Melrose for their critical review and ongoing feedback. Requests for reprints should be sent to Ricardo D. Barrera, Department of Psychology, Univeresity of Vermont, Burlington, Vermont 05405.

(volume/articulation) vocal imitative behavior. Once imitative responses were well developed, specific techniques were used to shift control from the therapist's vocal prompts to the training stimuli. Risley and Wolf accomplished this shift through the use of an "anticipation procedure" whereby the child could receive reinforcement more quickly by anticipating with the correct vocal response than by waiting for the therapist's prompt. Fading of vocal prompts was then used to complete this shift. In contrast, Lovaas et al. (1973) obtained this change through a "volume cueing" procedure in which the actual volume of the vocal prompt was systematically faded while the volume of the therapist's questions concurrently increased.

Although total communication training has been demonstrated effective in teaching basic expressive language skills to mute autistic children (Barrera, Lobato-Barrera, & Sulzer-Azaroff, 1980; Benaroya, Wesley, Ogilvie, Klein, & Meany, 1977; Bonvillian & Nelson, 1976; Carr, Binkoff, Kologinsky, & Eddy, 1978; Fulwiler & Fouts, 1976; Konstantareas, Webster, & Oxman, 1979; Creedon, Note 1), application of these procedures with echolalic children has been slow in coming. For the most part, delays in the widespread application of this technology have resulted from (a) a desire by many therapists to avoid training in less functional sign language and (b) what would initially appear to be a contradiction in the results of total communication and stimulus overselectivity research with autistic populations.

Although early studies by Lovaas and his colleagues suggested that the problem of stimulus overselectivity posed a significant obstacle in the use of multiple cue training with autistic children (Lovaas & Schreibman, 1971; Lovaas, Schreibman, Koegel, & Rehm, 1971), researchers have more recently demonstrated that overselective responding is in fact related to mental age (MA) and is significantly less pronounced in the higher functioning verbal subset of this population (Kovattana & Kraemer, 1974; Schover & Newsom, 1976; Wilhelm & Lovaas, 1976). As such, overselective responding may be seen as representative of a general cognitive delay rather than a specific deficit.

Even more recently, researchers have found that it is possible to address directly the overselectivity problem by teaching autistic children to respond to simultaneous multiple cues (Koegel & Schreibman, 1977; Schover & Newsom, 1976; Schreibman, Koegel, & Craig, 1977). In each of these reports initial patterns of overselective responding were overcome after training with simultaneously presented multiple cues. In fact, Koegel and Schreibman (1977) noted that after multiple cue training on a series of conditional discriminations, one child appeared to form a set for responding to new discriminations on the basis of multiple cues. It thus appears that the higher MA echolalic subset of this population may, in reality, stand to benefit from an intensive multiple cue training model such as total communication.

Only recently have researchers investigated the use of total communication systems with echolalic populations. In a study comparing the relative effectiveness of oral, total, and purely nonvocal training strategies in teaching receptive language skills to an echolalic autistic child, Brady and Smouse (1978) reported a significantly greater degree of success on words taught using the total communication model. In a similar comparison of these three training models, Barrera (Note 2) found total communication training of speech by far more successful than oral speech training or nonverbal sign training in teaching basic expressive labels to an echolalic retarded child. In the analysis of their findings, both authors suggested that the improved performance with total communciation systems may result from the additional visual, tactile, and kinesthetic cues intrinsic to the model. Such supplementary information may then serve to assist the child in processing and recalling words and thereby facilitate the development of effective stimulus control.

Notably, in a study evaluating the effectiveness of a parent-based communication training

program, Casey (1978) found the total communication training model to be a highly successful format for teaching basic expressive language skills to four echolalic autistic children.

In light of the prevalence of echolalic disturbances in autistic children, and the paucity of comparative research designed to investigate this issue, the present study was undertaken. Given the concerns voiced by many therapists regarding the training of less functional sign language skills to this highly verbal population, this study was designed to compare the relative effectiveness of oral training of speech (using only vocal cues) with total communication training of speech (using combined vocal and gestural cues) in teaching expressive labeling skills to three echolalic autistic children. It was hoped that this research would provide not only additional clinical information regarding the comparative effectiveness of these two language training models, but also additional insights into the importance and usefulness of multiple cues in the treatment of this population.

METHOD

Subjects

Three female children between the ages of 6-9 years participated in the study. All three resided in a private specialized residential treatment center in Massachusetts, and were selected on the basis of the following: (a) a formal diagnosis of early infantile autism according to Rutter's (1978) criteria, (b) immediate echolalic verbal behavior, (c) a functional expressive vocabulary (words or signs used spontaneously and reliably in an appropriate manner) of under 10 words, (d) no known hearing or vision impairments, and (e) no known gross or fine motor impairments in the use of the upper extremities.

Lee

Lee was a healthy 9-year-old girl who lived at home until the age of 3 when she was placed in this facility. Early records described her infancy as normal with all major developmental milestones (with the exception of language) acquired within normal limits. A comprehensive evaluation conducted at age 2 years established a diagnosis of early infantile autism. Throughout her life, the areas of expressive and receptive language, however, remained a major concern. Notes of the most recent yearly review conference described her as a child whose speech was primarily echolalic and who displayed no spontaneous language.

To minimize the effects of any previous language training on the current program, her teachers and direct care staff were consulted, revealing no truly functional expressive skills. Although Lee frequently spoke spontaneously, this speech could best be described as "delayed echolalia," and consisted of a variety of contextually meaningless words and phrases. Infrequently, however, she was heard to utter three words spontaneously and in the correct context—hi, ballala (banana), pihkol (pickle).

May

May was a healthy 6-year-old child who had been admitted to the facility at age 5. Prior to this she had lived at home with her family. Early medical records depicted a fairly normal infancy with developmental delays appearing only in the areas of language and bladder control (first words at 30 months, bladder control at 36 months). Parental and medical reports, however, substantiated early signs of pathology such as lack of interest in people, erratic sleep patterns, and the late development and subsequent loss of language by age 3½. At the start of the project, May's communication skills were characterized by high frequency echolalic verbal behavior (immediate echolalia) and minimal functional speech. With the aid of her teachers and direct care staff, a comprehensive list of May's functional expressive vocabulary was constructed. This list revealed a functional vocabulary of only five words—shoe, T.V., go to bed, phone, peanut (peenough). Receptive language skills, on the other hand, appeared to be substantially better, with May demonstrating an

understanding of a number of simple one-step commands (e.g., stand up, sit down, wash your hands, come here, put on your shoes).

Pam

Pam was a healthy 7-year-old girl who had lived at home until age 4 when she was admitted to her current placement. Early records indicated a normal infancy with all developmental milestones reached within normal limits. Parents reported that they first detected a problem at age 24 months. Until then, language had progressed normally; she was speaking in complete phrases. At approximately age 2, however, Pam's spontaneous language suddenly disappeared, and she began to "repeat phrases over and over again without any meaning and parrot whatever was said to her." A psychological evaluation conducted at age 3 resulted in a diagnosis of psychosis and early infantile autism. In addition to these language deficits, occasional aggressive and self-abusive behaviors were reported.

Since her admission to her present placement, Pam had received formal training in both sign language and speech. Despite this training, an initial assessment revealed a functional expressive vocabulary of only four spoken words—toilet, cookie, no, pickle—and four signs—eat, drink, more, toilet.

A battery of pretraining assessments was conducted to obtain measures of each child's social, communication, and reasoning skills. Results of these assessments showed that the children comprised a fairly homogeneous sample. On the Vineland Social Maturity Scale, social age equivalents were as follows: Lee—3.65; May—2.03; Pam—3.02. On the Meecham Language Assessment, all three girls scored below the 2-year level (Lee—1.73; May—1.56; Pam—1.35). Five subscales of the Uzgiris-Hunt Ordinal Scales of Psychological Development were also administered (Visual Pursuit & Permanence of Objects, Operational Causality, Means-Ends Relationships, Imitation-Gestural and Imitation-Vocal). Lee's performance on each of these scales reached ceiling levels at Stage VI. May's performance, however, was quite variable, ranging from Stage III on Means-Ends Relationships to Stage VI on Gestural Imitation. Pam, on the other hand, performed consistently between Stage V and VI on all scales. (A detailed description of the results of formal testing is available from the first author.)

Procedure

The study was conducted in four separate phases, with all phases run in a small private treatment room at this facility. During Phase I (Adaptation) the child was allowed some time to adjust to the new environment, and edible reinforcers were sampled and selected. Phase II (Prerequisite Attending Training) centered on the operant training of two essential attending skills, namely quiet sitting and eye contact. Training on these skills was conducted for two, 30-min sessions per day using a discrete trial format, and continued until a criterion of 90% correct trials was reached on each of the behaviors for two consecutive sessions.

Prior to conducting Phases III and IV, lists of approximately 100 nouns representing familiar and common objects from the children's environment were constructed with the assistance of the teachers, parents, and direct care staff. Any words that had been observed to be (a) within the child's current repertoire or (b) recorded as previously known or worked on in therapy were deleted. Each list was then independently rated by three language specialists on the basis of (a) difficulty in pronunciation (based on normative data on phoneme acquisition by normal children (Dale, 1976), (b) number of syllables, and (c) potential conditioned reinforcing qualities.

In addition to this analysis, two 45-min expressive and receptive tests were conducted on the remaining words in each child's list. These analyses were conducted in the training environment using real objects from the children's environment as stimuli. Two 45-min receptive and

two 45-min expressive pretests were run with each child. In this way, the child's baseline level of responding on each of the potential training words was assessed. The expressive test consisted of presenting each of the objects five times, in random order, while varying each of three locative questions ("What is this?" "Tell me the name of this," "this is a _____"). The receptive test was conducted by the therapist presenting three objects to the child on a small table placed directly between them. The therapist then requested a response by asking the child to "Give me (one of the objects)." Position and order of presentation of the objects was randomized. If the child correctly labeled an object one or more times during the expressive test, the name of that object was eliminated from the word pool.

Based on these ratings, 20 words from each list were matched for difficulty, divided into evenly matched groups of five, and paired with one of the two training models. (A breakdown of individual word ratings and group matchings is available from the first author.)

Phase III of the study was directed specifically at increasing the frequency, accuracy, and reliability of the children's vocal imitative responses. This was done to establish a stable and clear vocal repertoire and thereby to facilitate subsequent training for stimulus control during the next phase.

Using a list of some 100 words, selected from the Peabody Articulation Series (excluding training words), the therapist met with each child twice per day, for 30 minutes each session. During these sessions, the therapist said each of the words, and differentially reinforced only clear vocal imitative responses. Clarity of responses was judged subjectively by the therapist on the basis of both loudness and accuracy of articulation. Training continued in this fashion until a level of 80% or higher of the child's responses were judged to have been clearly imitated in two successive sessions. (The formal measures used to independently rate clarity of response and monitor daily progress toward completion of Phase III objectives are available from the first author.)

During Phase IV, the actual training models were compared by giving each child 30-45 minutes of direct language training with each model four days per week. To conduct this comparison a single subject alternating treatment design was used (Barlow & Hayes, 1979; Ulman & Sulzer-Azaroff, 1975). Sessions were always of equal length and were arranged so that each day of training consisted of one morning and one afternoon session. Sequence and interaction effects were minimized by randomizing the order of presentation of the training categories. To facilitate generalization, real objects from the children's environments were used as training stimuli. To balance the number of trials across categories, all training during this phase was conducted on the basis of discrete trials which began with the presentation of the training stimuli (paired with the therapist's question), and ended with the response of the child. Within each category, words were trained concurrently in a stepwise progression with the therapist subjectively attempting to equalize the number of trials and amount of time spent working on each word. The two lanaguage training models were defined as follows:

Oral language training procedure. In this treatment condition, the therapist used only vocal cues. Training began with the therapist presenting the training stimulus (object), and requesting a response ("What is this? This is a _____." Then the desired vocal response was modeled for the child. At first, all clearly imitated vocal responses were reinforced. As training continued, however, modeled prompts were gradually and systematically faded to develop independent responses. In an attempt to encourage independent responding, an "anticipation procedure" was used. This procedure involved systematically increasing the delay between the request for a response (locative question) and the presentation of the vocal prompt. Thus, anticipating the correct response would result in reinforcement

sooner than if the child waited for the prompt. Paired social and edible reinforcement was delivered contingent on appropriate, clear vocal responses. In contrast, a 15-sec time-out procedure was used contingent on all incorrect responses. The therapist would stop temporarily, turning away from the child and sitting quietly until the 15-sec period had elapsed (see Lovaas, 1966). To differentiate between correct and incorrect responses, all correct responses were immediately rehearsed by the therapist (e.g., "Good, this is book.").

Total communication language training procedure. Using simultaneous vocal and gestural cues, the therapist used virtually the same training procedure described above. During training in this condition, the therapist began each trial by presenting the training stimulus to the child. Then, after requesting a response (e.g., "What is this?"), the therapist modeled the appropriate vocal response, while simultaneously presenting the corresponding American Sign Language (ASL) gesture. Again, reinforcement was delivered contingent on correct vocal responses. In addition, all correct vocal responses (including those accompanied by an incorrect sign) were followed by the therapist repeating the correct response while fully guiding the child's hand through the corresponding ASL gesture. As described above, all incorrect vocal responses resulted in a 15-sec time-out. If, however, the child responded with the correct sign alone, or with the correct sign and incorrect vocalization, only verbal praise specific to the sign was delivered, and the therapist immediately modeled the correct vocal and gestural response.

Training thus began with the first two word groups (O_1, TC_1) and continued in this manner until the child's responses reached the criterion for acquistion (15 consecutive correct responses) for all five words within one of the categories. A trial was considered correct only if the response was spontaneous, complete, accurate, and initiated within 10 sec. Although the acquisition criterion was defined as 15 consecutive correct responses, a word was not considered to have reached criterion unless these 15 responses were intermixed with responding on at least two other words. Thus, simple massed repetition was avoided.

Once acquisition criterion had been reached on all five words within one of the training categories, training was extended for one day. On this day, a criterion verification test was conducted to verify the words that had been learned. This test consisted of two additional 30-min sessions on each of the two word groups (O_1, TC_1). During these sessions, the therapist tested the children's responses to each of the training stimuli by presenting each item 10 times in a mixed order. To assess all the words within a 20-min period, a criterion for verification was set at five consecutive (intermixed) correct responses.

Following this criterion verification test, training was discontinued on the first group of words, and new groups of words (TC_2, O_2) were assigned to each category. Training then proceeded, as before, until the acquisition criterion was reached on all the words within one of the two treatment categories. (It should be noted that due to time restrictions, only three words were included in each category during the replication comparisons with May and Pam.)

Dependent Measures

During all Phase IV sessions a trained observer recorded discrete trial data on (a) the therapist's cue(s), (b) the level of prompting used (i.e., FV-full vocal, PV-partial vocal, FG-full gestural, PG-partial gestural), and (c) the child's vocal and gestural response(s). Later, vocal responses were coded into the following categories: (a) clear, spontaneous, complete vocal, (b) either unclear, prompted, or incomplete vocal, (c) complete spontaneous gestural, and (d) either incomplete or prompted gestural. Quantitative analyses were then conducted on the following factors: the number of trials to criterion for each word, the percentage of cor-

rect vocal and gestural responses per word/per session, the percentage of unprompted (spontaneous) correct vocal or gestural changes made in discriminating from one word to another, and the percentage of correct unprompted combined responses (simultaneous vocal and gestural) made during Phase IV total communication training. In addition, on each day of training a daily probe was taken of each child's responses to each of the words being trained. These probes consisted of a 2- to 3-min noncontingent reinforcement period in which reinforcers were delivered independent of the correctness of the response.

Videotape recordings were taken periodically throughout Phases III and IV to provide an estimate of observer reliability. All videotaping was done through a small window which faced an adjoining office. These tapes were independently scored and then compared on a trial-by-trial basis with the data collected by the research assistant. A trial was scored as an agreement if (a) the record of the cue(s) given by the therapist agreed with the data based on the videotape, (b) the record of the child's response(s) (both vocal and gestural) were in agreement with those based on the videotape data, and (c) the two descriptions of the level of promoting (i.e., FG, PF, FV, PV) matched.

Mean observer reliability across subjects and training categories was 86% agreement, and ranged from a mean of 82% agreement on total communication sessions with Pam to a mean of 91% agreement on oral sessions with Lee.

RESULTS

Despite attempts to balance the number of trials presented in each category, variability did occur (perhaps because an oral presentation was characteristically more simple). Data on the number of trials per category during Phase IV training show that generally more oral than total communication trials were presented. This pattern was most pronounced in training with May where an average of 82.4 trials were presented during oral sessions and an average of 60.1 trials were presented in total communication sessions. Similarly, during training with Pam an average of 13 more trials were run during oral sessions (mean total communication = 52.8 trials, mean oral = 65.7 trials). In contrast, balance in the number of trials across categories during Lee's training remained fairly close with an average of 6 more trials during total communication sessions (mean total communication = 88.2 trials, mean oral = 82.4 trials). (A more detailed analysis/breakdown of the number of trials across categories is available from the first author.)

As indicated in Figure 1, a total of 16 sessions was required for Lee to complete training on the first groups of words. By Session 11, Lee had not reached criterion on any of the words in either of the two categories. By Session 16, however, she had learned all the words in the total communication category, and none in the oral group. A similar pattern of acquisition was found in the results of training on the first group of words with each of the other children. Although May required three more sessions to complete training, Pam and May both acquired all five words in the total communication category and one of the words in the oral group. This pattern of superior performance within the total communciation training was again noted in the second comparisons with Lee and May. In both these replications all the words in the total communciation groups were learned whereas none of the words in the oral groups were. (It should be noted that because total communication training progressed so rapidly in each of these comparisons, work had not yet begun on some of the words in the oral category.)

Training on the second groups of words was never completed with Pam, because she had developed a number of disruptive behaviors (ruminating, grabbing, slapping) which frequently interrupted the later stages of training.

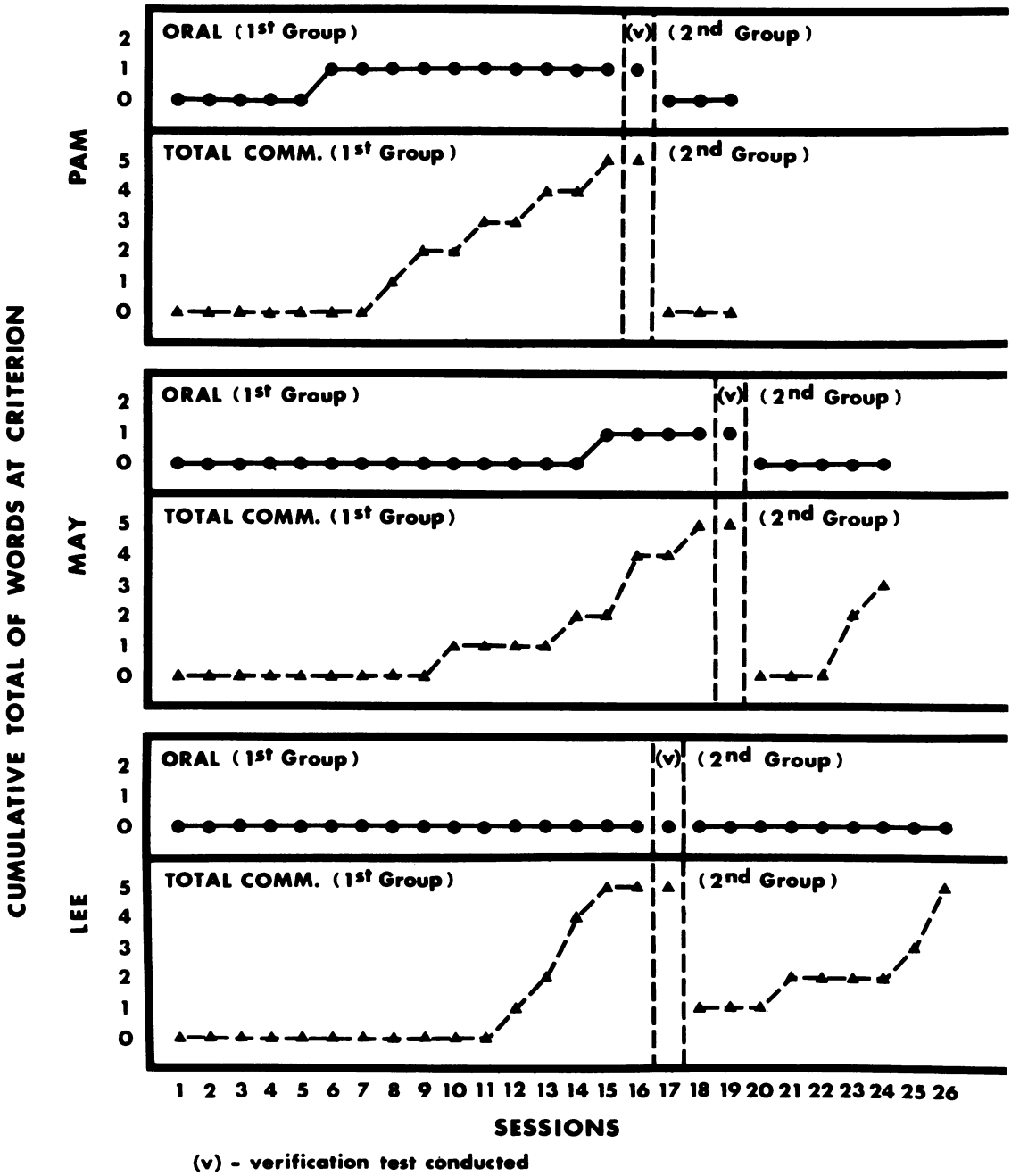

Fig. 1. Word acquisition comparisons across categories for all three children.

As discussed earlier, data on the spontaneous or unprompted correct changes made by each child when moving from one word to another, provided an even more critical measure of acquisition. The data on spontaneous change are presented in Figure 2, in which the percentage of vocal spontaneous changes across categories is plotted over the course of Phase IV training sessions.

Again, the results of this analysis with each

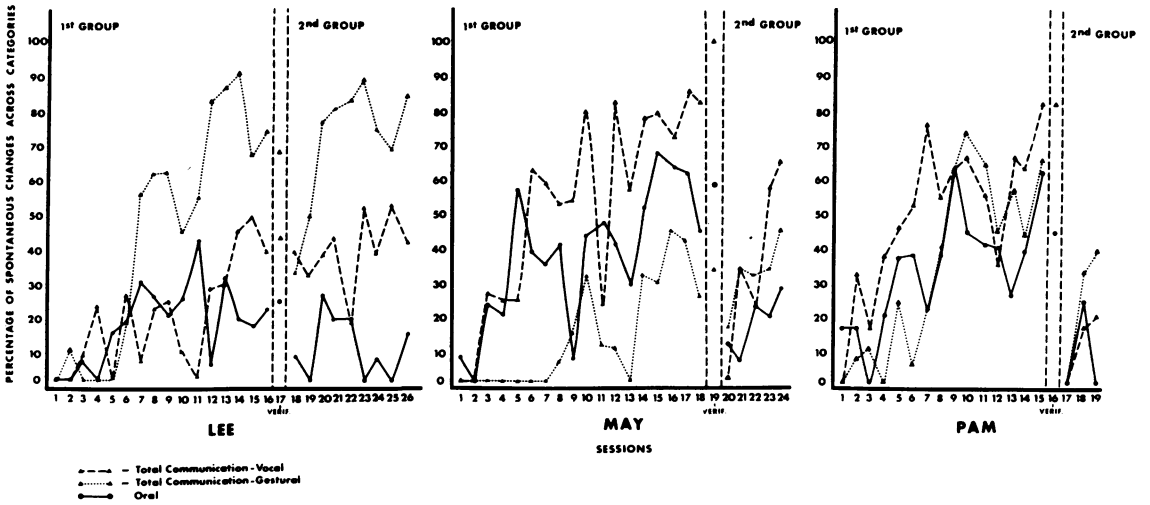

Fig. 2. Percentage of vocal and gestural spontaneous changes across categories for all three children.

of the children point to a markedly superior pattern of performance within the total communication category, especially in the performance of May and Pam. With each of these children, performance within the total communication category was consistently higher than performance in the oral model. Although the initial stages of Phase IV training with Lee show a great deal of variability in responding across categories, by Session 14 a consistently higher pattern of vocal performance within the total communication category emerged. This pattern continued throughout the remainder of Phase IV training on the second groups of words with Lee. Although this analysis failed to show a separation in performance across categories until Session 14, an analysis of Lee's gestural spontaneous changes during this period demonstrated what appears to be a significantly better ability to respond through gestural systems. Interestingly, Lee was the only child who reached higher levels of gestural than vocal spontaneous changes during total communication training (see Figure 2). With each of the other children, however, a steady increase in the percentage of spontaneous gestural changes was noted over the course of Phase IV training.

Data on the percentage of correct unprompted combined responses (simultaneous vocal and gestural) during Phase IV total communication training further demonstrate the importance of the additional gestural input provided by the model. As indicated in Figure 3, each of the children showed a steady increase in their use of simultaneous vocal and gestural (sign) responses, over the course of Phase IV total communication training. Although increases in "combined form" responding were found in each of the children, anecdotal observations during Phase IV training revealed characteristic differences in the manner in which the children responded. "Combined form" responding of May and Pam was characterized by *simultaneous* vocal and gestural responses. In contrast, Lee would typically respond first with the appropriate sign, and then after a second or two with the correct vocal response.

Within the training categories, differences in performance on specific words were noted (see Figures 4, 5, and 6); however, these differences appeared to be most directly related to the child's relative familiariaty with the model at the time the word was introduced into training. Results on the mean number of trials to criterion per word for both Lee and May directly support this finding by demonstrating a marked decrease in the means from first to second word groups

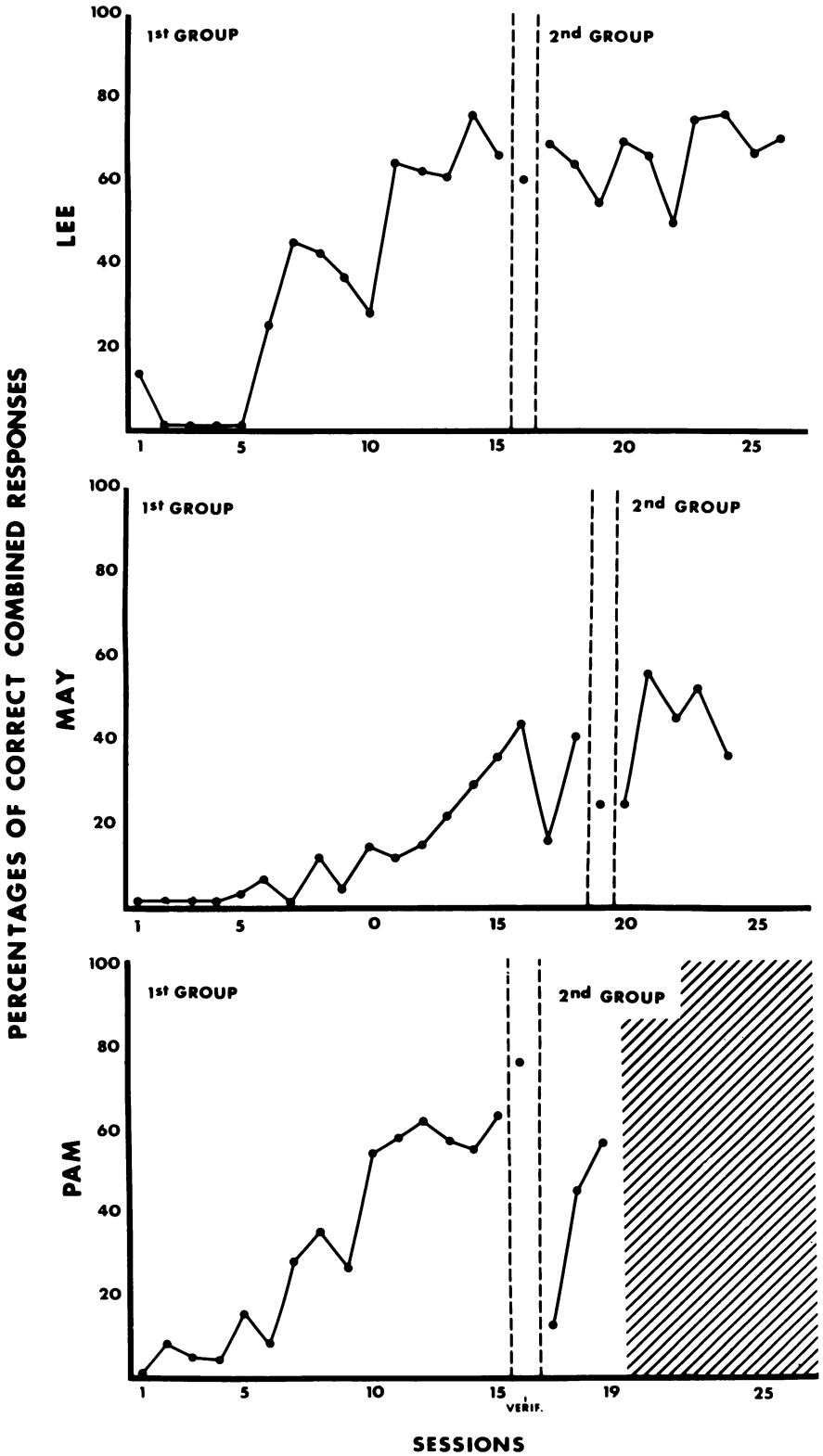

Fig. 3. Percentage of each child's responses during total communication training which involved the simultaneous use of correct gestural *and* vocal responses.

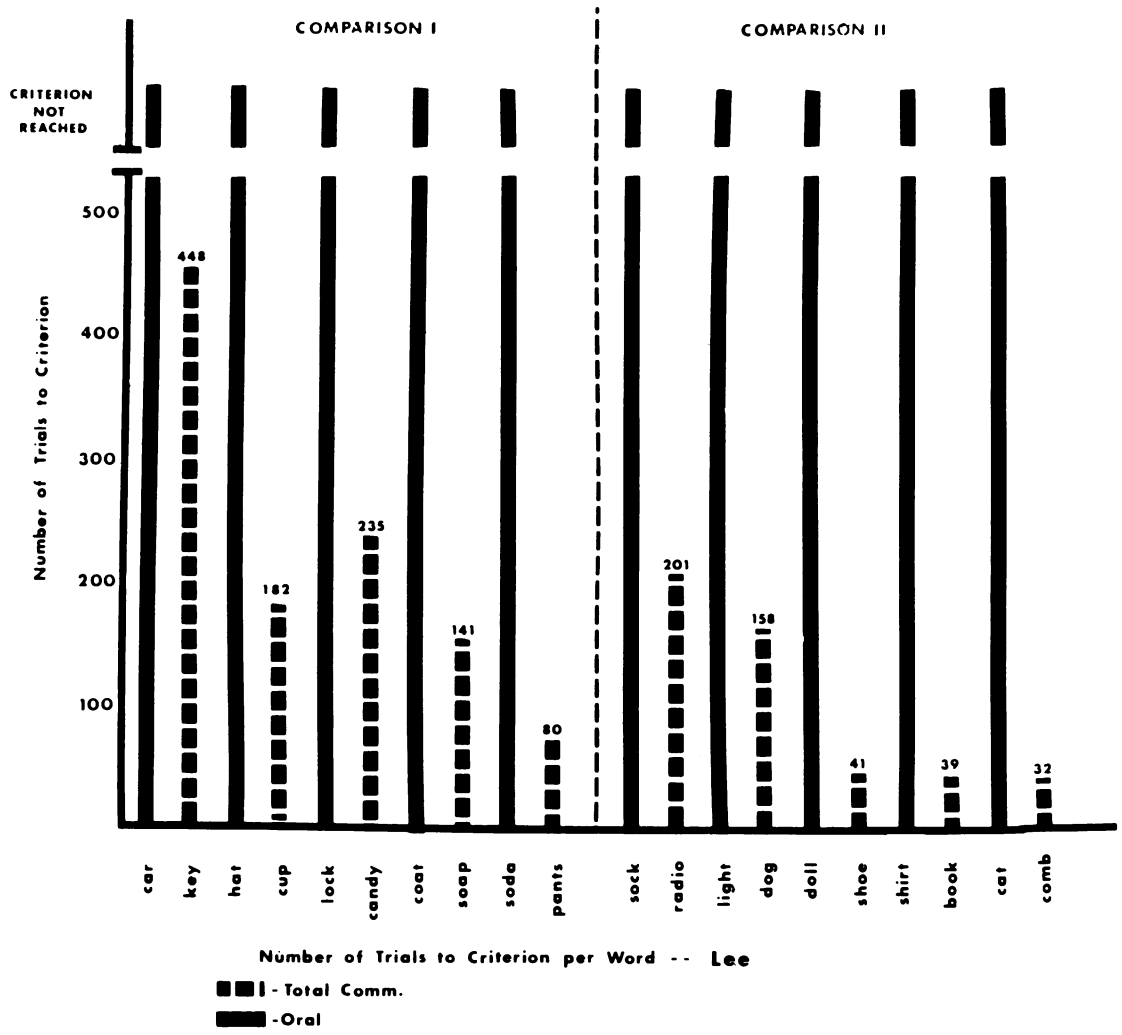

Fig. 4. Breakdown of number of trials required to reach acquisition criterion for all words trained during Phase IV—Lee.

(Lee, mean $TC_1 = 217$ trials, mean $TC_2 = 94$ trials; May mean $TC_1 = 180$ trials, mean $TC_2 = 89$ trials). (An analysis of each child's performance comparing words by assigned difficulty level is available from the first author.)

DISCUSSION

The results of this research comparison demonstrate clearly that total communication training was the most effective strategy for teaching expressive vocal labeling skills to each of the three children. Moreover, the replication of these findings both within and across subjects suggests that total communication may be, in general, the most effective of these two treatment approaches for working with echolalic children. The results of this research are in agreement with other comparative studies evaluating the relative effectiveness of oral and total communication training models (Brady & Smouse, 1978; Barrera, Note 2), but further replication and extension of these findings to include long-term maintenance and generalization data are necessary before any firm conclusions can be drawn.

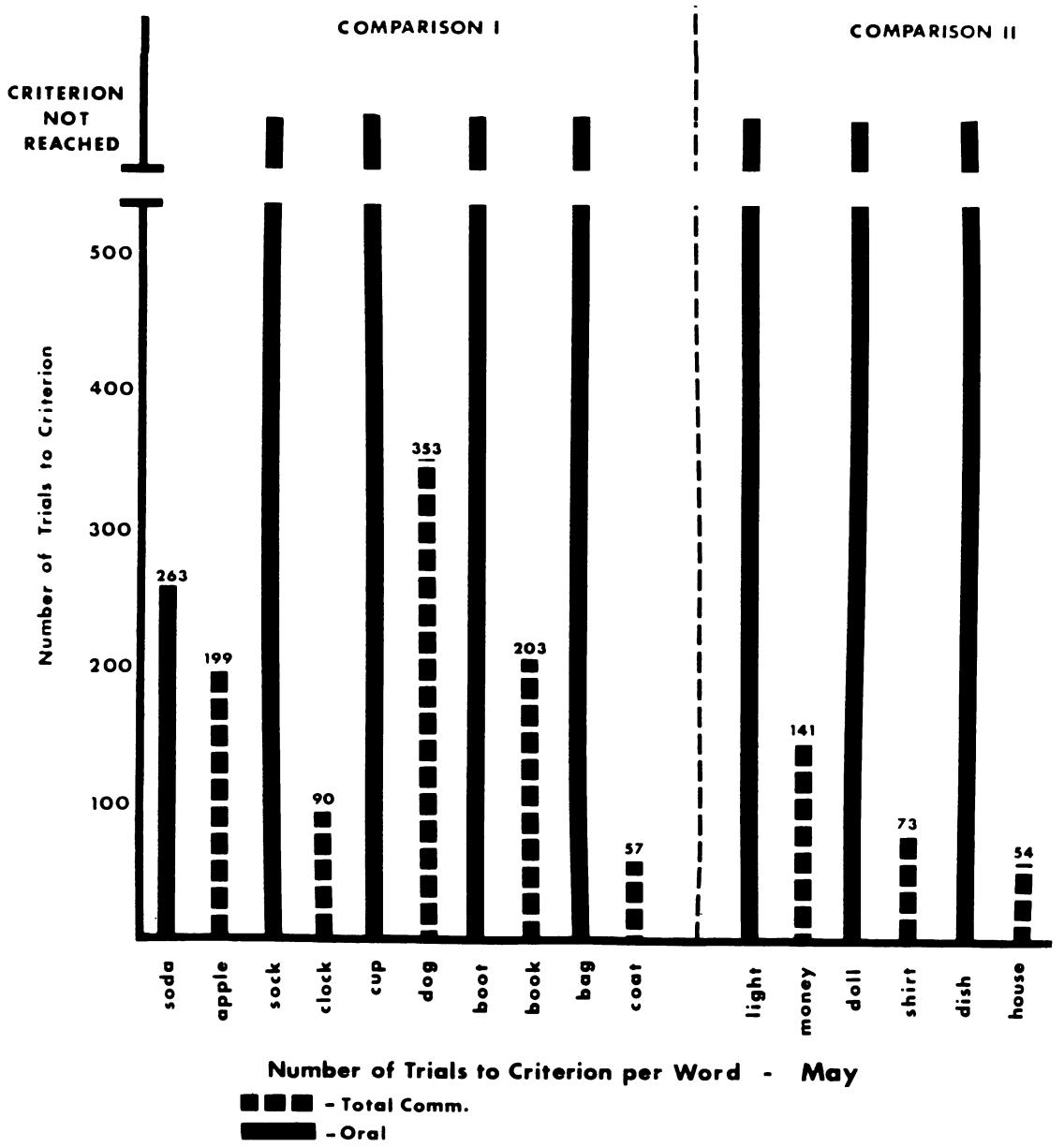

Fig. 5. Breakdown of number of trials required to reach acquisition criterion for all words trained during—Phase IV—May.

In evaluating these results, it is unlikely that the differential effects obtained can be attributed to order of presentation, difficulty of words, or number of training trials because special attention was placed on controlling for the potentially confounding effects of each of these variables. In fact, despite the unintentional presentation of a somewhat greater number of oral trials, that method remained less effective.

A number of specific factors may have indeed contributed to the marked success of the total communication model. Perhaps the most significant of these factors relates to the system of multiple cues which is characteristic of this

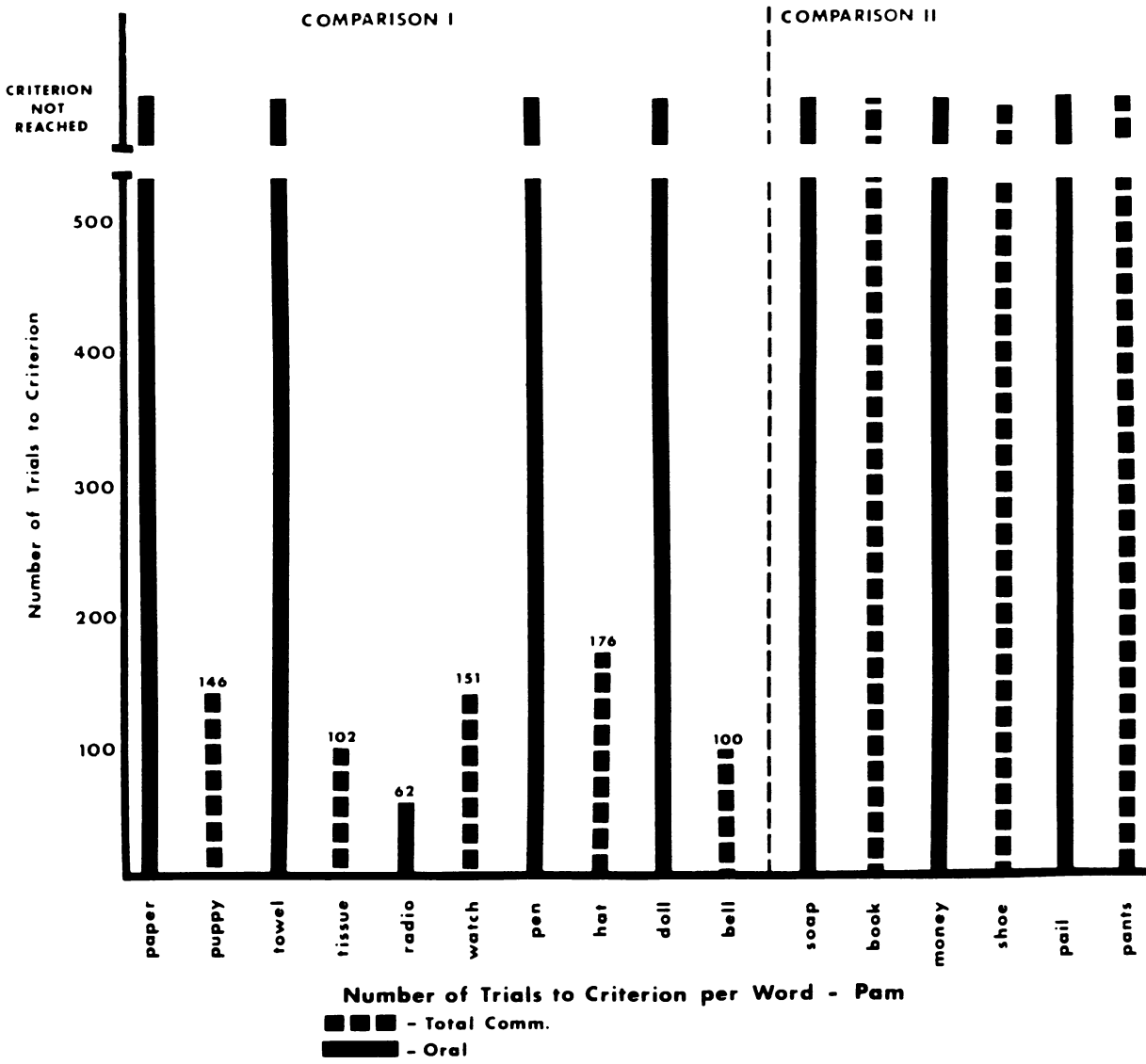

Fig. 6. Breakdown of number of trials required to reach acquisition criterion for all words trained during Phase IV—Pam.

approach to training. Given the demonstrated relationship between overselective responding and mental age (MA) (Kovattana & Kraemer, 1974; Schover & Newsom, 1976; Wilhelm & Lovaas, 1976), it would be expected that overselective attention difficulties would be significantly less pronounced in this higher functioning verbal subset of the autistic population. However, if residual overselective responding patterns did exist, even to a limited degree, the multiple cue training format of total communication may have facilitated learning by providing the child with a wide variety of sensory cues, thereby increasing the likelihood that training would include input from the child's preferred or most accessible sensory system. If this were the case one would expect to see different individual patterns in each child's use of cues.

Although the present study does not allow for a detailed analysis of the relative importance of the individual cues (visual, auditory, tactile, kinesthetic), gestural spontaneous change data indicate clear differences in the degree to which each child used and learned gestures.

At a second level, total communication training may have served to facilitate learning through the consistent pairing of salient sensory cues with other initially less functional sensory cues thereby expanding the number of functional cues and fostering a more comprehensive level of stimulus control. Such an explanation would be in agreement with previous research that has demonstrated that multiple cue training can be an effective strategy for overcoming overselective responding patterns (Koegel & Schreibman, 1977; Schreibman et al., 1977). The observed increases in each child's use of "combined form" responses as well as the marked reduction in the mean number of trials to criterion per word from first to second total communication training groups for both Lee and May suggest that such an expansion of functional cues may have indeed occurred over time. Moreover, this apparent increased fluency within the total communication training indicates that the children may have developed a set for responding to new words presented at the later stages of total communication training on the basis of multiple cues.

Yet another related interpretation of these findings suggests that the obtained differences in performance across training categories may be based in the development of chains of vocal and gestural reseponding which might serve to interrupt echolalic behavior and thereby allow the child to focus attention on the accurate production of appropriate vocalizations. By providing the child with additional sensory cues that may, for whatever reasons, be more salient or functional, an albeit limited level of comprehension may be achieved. Based on previous research examining the effects of comprehension on echolalic behavior (Carr et al., 1975; Schreibman & Carr, 1978), it follows that with comprehension enhanced echolalic responding should dissipate. As such, total communication training may be viewed as serving to "interrupt" or allay echolalic behavior and thereby allow the child to focus attention more effectively. Anecdotal observations of Lee's "combined form" responses during Phase IV total communication training suggest that she had indeed developed such a chain of responses which began with the appropriate sign and was followed several seconds later by the correct vocal response. Notably, however, the relative importance of this factor remains unclear given the fact that neither of the other children displayed such chains of responding.

Although the results of this study suggest that the additional sensory input provided by the inclusion of signs into the training explains the marked difference in performance across categories, this may in fact not be the case. Rather, it may be that the simple inclusion of an additional motor response served to increase the children's involvement with the task and thereby facilitate learning. To resolve this issue further research is needed. In addition, future research should focus on the relative importance of individual sensory cues as well as on the qualitative dimensions of each of these variables in an attempt to isolate those characteristics that might assist best in learning.

The results of the present study are in agreement with a growing body of research in which total communication training has been found to be an effective strategy for teaching receptive and expressive gestural labels to mute retarded (Bricker, 1972; Topper, 1975), brain damaged (Snell, 1974), and both mute and echolalic autistic children (Barrera et al., 1980; Bonvillian & Nelson, 1976; Brady & Smouse, 1978; Casey, 1978; Fulwiler & Fouts, 1976; Salvin, Routh, Foster, & Lovejoy, 1977). Unfortunately, research is still lacking to demonstrate the usefulness of total communication training in promoting conversational speech. This extension of the previous research is of particular importance because it draws from the findings of the litera-

ture on total communication that have demonstrated the importance of the role of multiple cues in learning. In addition, however, by emphasizing the development of vocal responses during training, this research sought to maintain and expand on the existing vocal repetoire of the echolalic child.

REFERENCE NOTES

1. Creedon, M. P. *Language development in nonverbal autistic children using a simultaneous communication system.* Paper presented at the biennial meeting of the Society for Research in Child Development, Philadelphia, March 1973.
2. Barrera, R. *A simultaneous treatment comparison of oral, total communication and nonverbal language training programs for teaching expressive language skills to three nonverbal children.* Unpublished master's thesis, University of Massachusetts, 1980.

REFERENCES

Barlow, D., & Hayes, S. Alternating treatment designs: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis,* 1979, **12,** 199-210.

Barrera, R., Lobato-Barrera, D., & Sulzer-Azaroff, B. A simultaneous treatment comparison of three expressive language training programs with a mute autistic child. *Journal of Autism and Developmental Disorders,* 1980, **10,** 21-37.

Benaroya, S., Wesley, S., Ogilvie, H., Klein, L. S., & Meany, M. Sign language and multisensory input training of children with communication and related developmental disorders. *Journal of Autism and Child Schizophrenia,* 1977, **7,** 23-33.

Bonvillian, J. D., & Nelson, K. E. Sign language acquisition in a mute autistic boy. *Journal of Speech and Hearing Disorders,* 1976, **41,** 339-347.

Brady, D. D., & Smouse, A. D. A simultaneous comparison of three methods for language training with an autistic child: An experimental single case analysis. *Journal of Autism and Child Schizophrenia,* 1978, **8,** 271-279.

Bricker, D. D. Imitative sign training as a facilitator of word-object association with low functioning children. *American Journal of Mental Deficiency,* 1972, **76,** 509-516.

Carr, E. G., Binkoff, J. A., Kologinsky, E., & Eddy, M. Acquisition of sign language by autistic children. I. Expressive labeling. *Journal of Applied Behavior Analysis,* 1978, **11,** 489-501.

Carr, E. G., Schreibman, L., & Lovaas, O. I. Control of echolalic speech in psychotic children. *Journal of Abnormal Child Psychology,* 1975, **3,** 331-351.

Casey, L. O. Development of communicative behavior in autistic children: A parent program using manual signs. *Journal of Autism and Child Schizophrenia,* 1978, **8,** 45-59.

Dale, P. *Langauge development: Structure and form.* New York: Holt, Rinehart and Winston, 1976.

Fay, W. H. On the basis of autistic echolalia. *Journal of Communication Disorders,* 1969, **2,** 31-41.

Fay, W. H. On the echolalia of the blind and of autistic children. *Journal of Speech and Hearing Disorders,* 1973, **38,** 478-489.

Fulwiler, R., & Fouts, R. Acquisition of sign language by a noncommunicating autistic child. *Journal of Autism and Child Schizophrenia,* 1976, **6,** 43-51.

Hingtgen, J. N., & Bryson, C. Q. Recent development in the study of early childhood psychoses: Infantile autism, childhood schizophrenia, and related disorders. *Schizophrenia Bulletin,* 1972, **5,** 8.

Koegel, R. L., & Schreibman, L. Teaching autistic children to respond to simultaneous multiple cues. *Journal of Experimental Child Psychology,* 1977, **24,** 299-311.

Konstantareas, M. M., Webster, C. D., & Oxman, J. Manual language acquisition and its influence on other areas of functioning in autistic and autistic-like children. *Journal of Child Psychology and Psychiatry,* 1979, **20,** 337-350.

Kovattana, P. M., & Kraemer, H. C. Response to multiple visual cues of color, size and form by autistic children. *Journal of Autism and Childhood Schizophrenia,* 1974, **4,** 251-261.

Lovaas, O. I. A program from the establishment of speech in psychotic children. In J. K. Wing (Ed.), *Early childhood autism: Clinical, educational and social aspects.* London: Pergamon, 1966.

Lovaas, O. I., Koegel, R., Simmons, J., & Long, J. Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis,* 1973, **6,** 131-166.

Lovaas, O. I., & Schreibman, L. Stimulus overselectivity of autistic children in a two stimulus situation. *Behaviour Research and Therapy,* 1971, **9,** 305-310.

Lovaas, O. I., Schreibman, L., Koegel, R., & Rehm, R. Selective responding by autistic children to multiple sensory input. *Journal of Abnormal Psychology,* 1971, **77,** 211-222.

Risley, T., & Wolf, M. Establishing functional speech in echolalic children. *Behaviour Research and Therapy,* 1967, **5,** 73-88.

Rutter, M. Concepts of autism: A review of the research. *Journal of Child Psychology and Psychiatry,* 1968, **9,** 1-25.

Rutter, M. Diagnosis and definition of childhood autism. *Journal of Autism and Childhood Schizophrenia,* 1978, **8,** 139-161.

Salvin, A., Routh, D., Foster, R., & Lovejoy, K. Acquisition of modified American sign language by a mute autistic child. *Journal of Autism and Child Schizophrenia,* 1977, **7,** 359-371.

Schover, L., & Newsom, C. Overselectivity, developmental level and overtraining in autistic and normal children. *Journal of Abnormal Child Psychology,* 1976, **4,** 289-298.

Schreibman, L., & Carr, E. G. Elimination of echolalic responding to questions through the training of a generalized verbal response. *Journal of Applied Behavior Analysis,* 1978, **11,** 453-463.

Schreibman, L., Koegel, R. L., & Craig, M. S. Reducing stimulus overselectivity in autistic children. *Journal of Abnormal Child Psychology,* 1977, **5,** 425-436.

Snell, M. Sign language acquisition and total communication. In L. Kent (Ed.), *Langauge acquisition programs for the severely retarded.* Champaign, Ill.: Research Press, 1974.

Topper, S. T. General language for a nonverbal severely retarded male. *Mental Retardation,* 1975, **13,** 30-31.

Ulman, J. D., & Sulzer-Azaroff, B. Multielement baseline design in educational research. In E. Ramp & G. Semb (Eds.), *Behavior analysis: Areas of research and application.* Englewood Cliffs, N.J.: Prentice-Hall, 1975.

Van Riper, C. *Speech correction: Principles and methods* (3rd ed.). Englewood Cliffs, N.J.: Prentice-Hall, 1963.

Wilhelm, H., & Lovaas, O. I. Stimulus overselectivity: A common feature in autism and mental retardation. *American Journal of Mental Deficiency,* 1976, **81,** 227-241.

Wing, L., & Wing, J. Multiple impairments in early infantile autism. *Journal of Autism and Child Schizophrena,* 1971, **1,** 256-266.

Zipf, G. K. *Human behavior and the principle of least effort.* New York: Jafner Publishing Co., 1949.

Received May 26, 1982
Final acceptance April 21, 1983