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A comparison of language treatment programs with echolalic autistic children.

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A COMPARISON OF LANGUAGE TREATMENT PROGRAMS WITH ECHOLALIC AUTISTIC CHILDREN

A Dissertation Presented

By

RICARDO D. BARRERA, JR.

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To Debra Jane and Our Child

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ABSTRACT

A Comparison of Language Treatment Programs
with Echolalic Autistic Children

(September 1980)

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

When Leo Kanner first described the syndrome of early infantile autism in 1942, one of the major diagnostic characteristics he presented was a gross disturbance in the development of language. Since then, many other researchers have emphasized the importance of these language deficits (Rutter, 1968; Wing and Wing, 1971; Rutter and Bartak, 1971; DeMyer, 1975) with some going as far as to suggest that these severe language delays are the central problem of the autistic disorder (Rutter, 1968; Churchill, 1972).

Although "the gross disturbance in the development of language" is seen as a major diagnostic characteristic of the autistic syndrome (Creak, 1963; Rimland, 1964; Ritvo and Freeman, 1978; Rutter and Schopler, 1978), a number of more specific disorders have been identified in the literature which more clearly describe the particular language characteristics of autistic children. These include mutism (the marked absence of any attempt to communicate), echolalia (the meaningless repetition of a word or words spoken by another), literalness (the inability to accept different meanings of the same sound), and pronoun reversal (the inability to appropriately use pronouns). As such, these disorders depict what has been described by Fay (1969) and others as a continuum of delayed language acquisition with autistic children. This continuum is most frequently marked by an initial extended period of mutism, and followed by a period of echolalia which generally

disappears as the child matures and approaches adolescence (Pollack and Spencer, 1959). During subsequent stages along this continuum, rudimentary forms of language develop, and along with this, semantic disorders (literalness, pronoun reversal).

Of all the language disorders of autism, echolalia has been found to be the most common characteristic of those autistic children who do speak (Hingtgen and Bryson, 1972). In two separate research reviews, Rutter (1968) and Wing (1971) both reported that more than three-quarters of the autistic children they studied were echolalic.

Although echolalia represents a serious and frequent language impairment within this population, a number of researchers have contended that echolalia is, of itself, part of a normal developmental phase which peaks at thirty months of age (Van Riper, 1963; Zipf, 1949). In contrast, Fay (1969) found that autistic echolalia is most common at preschool and school ages. It is precisely this persistence of echolalic behavior, past 3-4 years of age, which has been described as pathological (Darley, 1964; Fay, 1967; Ricks and Wing, 1975). In further differentiating between autistic and non-autistic echolalia, Fay (1973) noted that autistic echolalia is characterized by the existence of both immediate and delayed forms of the disorder, longer utterances, and a greater percentage of echolalic utterances. Immediate echolalia is described as the immediate meaningless repetition of a word or group of words just spoken by another. In delayed echolalia, on the other hand, this form of repetition occurs hours, days or even months afterward.

Despite our knowledge of the prevalence and characteristics of autistic echolalia, the function or purpose of this peristent language anomaly remains unclear. This fact is clearly evidenced in a review of the highly discrepant hypotheses presented in the literature.

Autistic echolalia or "echoprasia" as it is sometimes termed (Luchsinger and Arnold, 1965) was first described by Kanner (1946) as serving the illusive function of "affirmation by repetition." Subsequently it has been described as "hostility dressed in the unique manner of imitation" (Carluccio, Sours and Kalb, 1964), as serving an "autoerotic" function (Ruttenberg and Wolf, 1967), as an "autoerotic and autoaggressive motoric discharge of basic drives" (Griffith and Ritvo, 1967) and as serving the purely asocial function of "mocking" another person (Kugelmass, 1970). While these interpretations provide some interesting clinical impressions of various investigators, it is important to note that they are based primarily on the subjective interpretations of the internal states and feelings of these children.

From a very different perspective, other investigators have evaluated this issue based on a more objective analysis of the function of echolalic behavior. In a report presented in 1964, Stengel described autistic echolalia as a disorder resulting from a serious impairment in understanding, and an attempt at overcoming this difficulty by identifying with the interlocutor through echolalic behavior. In a related vein Fay (1969) contended that echolalia enables the autistic child to maintain social interactions in the face of a severe comprehension problem.

While these contrasting interpretations reflect major differences in the intent of autistic echolalic behavior (i.e., autoaggressive and autoerotic vs. an attempt at primitive interaction), they differ most substantially in their interpretations of whether or not the autistic child is capable of comprehending the language of those around him.

In an attempt to shed some light on this controversy it is important to review the research which has been conducted investigating the perceptual and cognitive abilities of this population.

Perceptual and Cognitive Characteristics of Autistic Children

Both the understanding and speaking of a language depend on: (1) the individual's ability to perceive auditory patterns acccurately; and (2) the ability to effectively interpret that which is heard and relate it with that which is currently seen or has previously been experienced (Kanner, 1946; Frith, 1969). Research investigating these abilities in autistic children suggests that intrinsic difficulties exist in both of these areas.

According to Wing (1971), the capacity to develop a flexible and complex language system is directly dependent on the integrity of the individual's perceptual system and corresponding brain centers which receive and coordinate sensory information into meaning. Systematic investigation of the perceptual abilities of these children, however, have shown a variety of specific problems which may directly interfere with both comprehension and language acquisition.

Auditory and visual perception. Although many autistic children are initially referred for treatment based on what appears to be a serious hearing impairment (Rendle-Short, 1969), the development of more effective and precise audiological assessment techniques such as play audiometry, Conditioned Orienting Response Audiometry (COR) and Electrocochleography (EC) (Lowell, 1976) have assisted researchers in determining that no characteristic hearing loss is associated with the syndrome (although a hearing loss may occur independent of the autistic disturbance).

Recently, however, a number of researchers have demonstrated that autistic children display a marked disability in the area of auditory discrimination. In a study evaluating the auditory control of operant behavior in autistic children, Hingtgen and Coulter (1967) found that these children experience what they termed "severe problems" in discriminating among similar auditory stimuli. After having been operantly conditioned to respond in the presence of a particular auditory signal, these children were subsequently unable to successfully discriminate between similar auditory signals which varied in frequency. Since then, a number of researchers have verified the existence of this particular auditory perceptual deficit in this population (DeMyer, Alpern, Barton, DeMyer, Churchill, Hingtgen, Bryson, Pontius and Kimberlin, 1972; Ornitz, 1976). In a more detailed investigation of this same problem, Hermelin and O'Connor (1967) examined the effects of random versus sequential presentations of both auditory and visual stimuli, comparing autistic and normal children. Their results indicated that while the

normal children displayed competence with both sensory modalities, the autistic children scored significantly better in the visual mode than in the auditory mode. This improved performance with visual stimuli (information) was again demonstrated by O'Connor in 1971. O'Connor found that both autistic and normal children showed a preference for responding to light rather than sound, and that while it was possible to teach the normal children to "prefer" the sound stimuli over the light, this conditioned preference was not possible with the autistic group.

Given the importance of these auditory discrimination skills in the development of expressive, spoken language, these perceptual deficits provided a firm theoretical basis for the severe comprehension problem considered by many authors to be at the root of autistic echolalia. If a child experiences difficulty in discriminating among different auditory stimuli, it would follow that that child would experience severe difficulties not only in understanding the spoken language of those around him/her, but also in internally reproducing these sounds as is required in any spoken expressive language system. In fact, Pronovost, Wakstein and Wakstein (1966) saw these same perceptual problems as "the most significant factors contributing to the autistic child's speech and language behaviors."

Stimulus overselectivity. In an attempt to obtain a clearer understanding of the perceptual and cognitive characteristics of autistic children, Lovaas, Schreibman, Koegel and Rehm (1971) conducted a study in which five mute autistic children, five severely mentally retarded

and five normal children were first exposed to conditioning trials designed to teach them to respond to a compound stimulus which consisted of three cues (auditory, visual and tactile) that were presented simultaneously. Following this training, each child was presented with each cue separately and responses were recorded. Results of this research indicated that, although they had been trained to respond in the presence of all three cues, when presented with singular cues, the autistic group would consistently respond only in the presence of one of the three original cues. In contrast the normal children responded uniformly to all three cues, whereas the mentally retarded group responded between these two extremes. This form of overselective responding to one stimulus component of a compound stimulus was again demonstrated by Lovaas and Schreibman in 1971. In this study nine mute autistic children were compared with chronological age matched normal counterparts in a test for stimulus overselectivity, following training with a two component (visual and auditory) stimulus. More recently, Koegal and Wilhelm (1973) discovered this same form of selective responding to one dimension of a stimulus complex consisting of cues which were all in the same sensory modality (visual). This research was of particular importance since it demonstrated that "stimulus overselectivity" was not necessarily a function of simultaneous stimulation of different sensory modalities, but rather a function of the multiplicity of cues involved.

In subsequent research by Kovattana and Kraemer (1974) a number of other variables pertinent to the stimulus overselectivity issue were addressed. In this study, twenty autistic, twenty Down's Syndrome and

twenty normal children were trained in a discrimination between two visual stimuli which varied in color, form and size. Following discrimination training, each child was tested to determine his/her responses to each of the stimulus dimensions presented separately and then in combinations of two. In contrast with the previous research which has been conducted investigating this phenomenon in autistic children, Kovattana and Kraemer subdivided the autistic group into verbal autistic and nonverbal (mute) autistic categories. Interestingly, their results yielded major differences in the performance of these two sub-groups. No difference was found between the normal group and the verbal autistic group in either overall performance with singular cues or in the effective use of double cues. In contrast, the nonverbal (mute) autistic group displayed a marked pattern of stimulus overselectivity to singular cues, and the poorest performance of all four groups in terms of their ability to use double cues. This separation in performance between autistic subgroups would suggest that these chlidren follow a developmental sequence in terms of their ability to use multiple cues. Indeed, later research by Schover and Newsom (1976) verified the existence of such a sequence. In this study, the authors compared verbal and nonverbal groups of autistic children with normal groups matched for mental age, using a procedure similar to that used by Kovattana and Kraemer (1973). Their results showed no significant difference between autistic and normal groups in terms of either the amount of overselective attention (breadth of learning) observed or in terms of the number of trials required to reach criterion during the initial discrimination training.

Verbal and nonverbal autistic groups, however, differed significantly in the amount of stimulus overselectivity observed, with overselectivity negatively correlated with mental age (MA).

While the research on stimulus overselectivity is of major theoretical importance since it suggests a general developmental lag in the autistic child's ability to attend to and use multiple cues in learning, it is also of particular therapeutic relevance for the implications it has in the design of appropriate educational strategies for mute and verbal autistic children. As Schover and Newsom point out, "If autistic children do not have an irremediably narrow focus of attention, behavior modification procedures, designed to make relevant stimuli salient, should be effective in training behaviors depending on the learning of contiguous cues" (Schover and Newsom, 1976, p. 297).

To summarize, the research which has been conducted investigating the specific cognitive and perceptual abilities in autistic children has yielded some important insights. It has been shown that autistic children experience severe difficulties in discriminating among different auditory stimuli. This deficit, alone, might explain the severe comprehension problem which many researchers believe is at the root of autistic echolalia. Furthermore, research investigating the autistic child's ability to attend to and use multiple cues in learning has demonstrated a clear developmental lag in the autistic population. Of particular importance, however, is the fact that this unique deficit appears to be negatively correlated with mental age and relative verbal ability. As such, the impact of this delay would be most intensely felt by the lower

functioning mute segment of the population and to a much lesser extent by the higher functioning echolalic segment.

Since many of these same issues have been empirically addressed in the literature relating to language acquisition in autistic children, a review of that body of research is warranted.

Language Acquisition in Mute Autistic Children

Traditionally, language training programs for mute autistic children have focused on the development of expressive vocal (oral) communication skills by means of operant training (Hewett, 1965; Lovaas, 1966; Marshall, 1972; Sloan, Johnston and Harris, 1968). While these programs showed limited success in developing expressive vocal skills, a number of problems quickly became evident. Perhaps the most significant problem which faced this form of training was the extensive amount of time required to effectively establish expressive vocalizations. In one of the more well known of these programs, designed by Lovaas (1966), training was conducted six days per week, for an average of seven hours per day. In another program, developed by Hingtgen and Churchill (1969), the children were trained every day, six hours per day, for five consecutive weeks. Given the structure of most residential and day treatment programs, the extensive time commitment and cost of such a language training program would make it virtually impossible to conduct.

Considering the great time investment required for this form of training, acquisition of expressive vocalizations by the mute autistic children participating in these studies was extremely slow and often

relatively unproductive. For example, Lovaas (1966), reported the acquisition of a thirty-four word expressive vocabulary over the course of some two hundred hours of training. Hingtgen and Churchill (1969), reported similar findings with the four children in their study acquiring sixty, twenty-five, sixteen and zero words over the course of two hundred hours of training. Aside from the problems already mentioned, many researchers have found that the expressive vocalizations acquired during this form of training often fail to generalize to situations outside of the therapy room (Schell, Stark and Gidden, 1967; Sulzbacher and Costello, 1970).

In many respects the limited success of these purely vocal training programs are predictable on the basis of the known auditory discrimination deficits of autistic children and the marked problems which mute autistic children experience in terms of stimulus overselectivity.

Realizing that these perceptual and cognitive limitations exist, a number of researchers have recently turned to gestural communication systems as a possible alternative to traditional vocal training methods.

Gestural and sign language communication in mute autistic children. Evidence of the inherent use of gestural communication by autistic children was cited by Ruttenberg and Gordon in 1967. In a study evaluating communication skills, the authors concluded that communicating with these children "would be virtually impossible if gestures and facial expressions were not included in the process." In a longitudinal analysis of language comprehension, Pronovost, et al. reported similar

clinical findings regarding the importance of gestural communication with autistic children. Interestingly, the authors also noted that when gestures were eliminated from the program, the child no longer responded appropriately.

Apart from demonstrating the importance of gestural communication, these studies point to a superior ability, in mute autistic children, to communicate through visual/kinesthetic rather than auditory channels. Recent studies involving the use of total communication training to teach expressive sign language skills to mute autistic children provide further support for these findings (Creedon, 1973; Bonvillian and Nelson, 1976; Fulwiler and Fouts, 1976; Benaroya, Wesley, Ogilvie, Klein and Meany, 1977; Salvin, Routh, Foster and Lovejoy, 1977; Barrera, Lobato-Barrera and Sulzer-Azaroff, 1980). Each of these studies demonstrated that when presented with simultaneous verbal (vocal) and gestural (visual/kinesthetic) cues during training, mute autistic children were highly successful in acquiring basic expressive sign language skills. In contrast, only a few of the children participating in these studies showed any acquisition of speech. In offering a more comprehensive analysis of this form of training, Carr, Binkoff, Kologinsky and Eddy (1978) used a total communication procedure to teach expressive sign language gestures to four mute autistic children. Following the training each child was tested to determine his/her responses to separate vocal (word) and gestural (sign) cues. Results of this research indicated that while all four subjects responded consistently to the

gestural (visual/kinesthetic) cues, only one of the four showed any attention to the vocal (auditory) cues.

In addition to providing a verification of the effectiveness of total communication training with this population this research by Carr et al. provides an important demonstration of the overselective attending and responding of mute autistic children.

In analyzing why total communication has proven to be such an effective strategy for teaching expressive language skills to mute autistic children, a number of hypotheses have been offered. The first of these hypotheses suggests that due to the known auditory perceptual deficits of these children and their known preference for visual information, mute autistic children are intrinsically better equipped to respond and learn through visual/tactile channels (Benaroya et al., 1977; Bonvillian and Nelson, 1976). A second, and perhaps more pragmatic hypothesis, presented by Creedon (1973) suggests that the total communication training procedure may be, at least in part, responsible for the success. Since sign language gestures can be physically shaped by the therapist, the added physical guidance inherent in the procedure may contribute to the demonstrated effectiveness of this approach.

Yet another hypothesis presented by Barrera et al. (1980) suggests that the inclusion of additional sensory cues during training provides the child with important and relevant information which the child uses in the process of learning and recalling words. This hypothesis is in agreement with related research in which it was found that overselective attentional deficits can be overcome through the implementation of

behavioral procedures designed to make relevant stimuli salient (Lovaas et al., 1971; Lovaas and Newsom, 1976). With multiple functional dues to work with, the processing and recall of linguistic information by these children may thus be facilitated.

So far we have considered a number of perceptual and cognitive deficits of autistic children and how these deficits might explain a severe problem in comprehension. We have also considered how these deficits have been evidenced in research on the acquisition of spoken and gestural (sign) language in mute autistic children. We will now consider the effect of these and other vartiables on the acquisition of language in echolalic autistic children.

Language Acquisition in Echolalic Children

Despite the demonstrated success of sign language training programs with mute autistic children, sign language programs have generally not been viewed as a desirable treatment strategy for echolalic children due to their extensive vocal imitative abilities (Carr, 1980). Instead, language training for this population has historically focused on gaining stimulus control over well established vocal imitations (Risley and Wolf, 1967; Lovaas, Koegel, Simmons and Long, 1973). In both of these studies, treatment began with a period of intensive training designed to increase the frequency of vocal imitation (mimicking). Once these imitative responses were well developed and consistent, a number of different techniques were used to shift control from the therapist's vocal prompts to the training stimuli. In the Risley and Wolf study this

shift was obtained through the introduction of an "anticipation procedure" in which a brief, five second, delay was instituted between the presentation of the training stimulus and the therapist's vocal prompt. Through this procedure the child could receive reinforcement more quickly by anticipating with the correct vocal response than by waiting for the therapist's prompt. The fading of vocal prompts was then used to gain further training stimulus control.

In contrast, Lovaas et al. obtained this change through a "volume cueing" procedure, in which the actual volume of the vocal prompt was systematically decreased (faded) while concurrently increasing the volume of the therapist's questions. It should be noted additionally that both studies used a time-out procedure (contingent upon incorrect responding) to further maximixe the effectiveness of the training. These studies have proven relatively effective in developing basic expressive language skills in echolalic children; however, they pose a particularly interesting dilemma to the language researcher. Since evidence exists documenting clear auditory perceptual problems in autistic children, and since clinical research with mute autistic children has shown a strong preference for learning through visual/tactile channels, would it not follow then that echolalic children also experience some difficulty with vocal (auditory) information which would make language acquisition within a purely auditory training system more difficult than training which provided complementary visual/tactile (gestural) cues?

Although researchers have only recently begun to address this question in the literature, a number of related studies help to shed some light on this issue.

In 1979, Dores and Carr found that, unlike mute autistic children, echolalic children attended to both auditory and visual cues when taught a receptive discrimination. This absence of overselective attending in higher functioning autistic children is consistent with the results of Schover and Newsom's (1976) research which showed a high positive correlation between mental age (MA) and overselectivity. Further research by Kovattana and Kraemer (1974) has empirically verified this result by demonstrating that verbal autistic children do not overselectively attend to one stimulus dimension when presented simultaneously with multiple stimuli.

While this research indicates that echolalic children may not experience the overselective attention difficulties experienced by mute autistic children, it also demonstrated that echolalic children are, indeed, attending to and using both auditory and visual information.

Research involving the use of total communication training to establish basic language skills in echolalic children has recently provided us with further information on this issue. In a study comparing the relative effectiveness of oral, total, and purely non-vocal training strategies in teaching receptive language skills to echolalic children, Brady and Smouse (1978) reported significantly greater success with words taught using the total communication training model. Similar success with total communication was reported later by Casey (1978). In

this report, Casey found that total communication training was effective in teaching basic expressive language skills to four echolalic children. Finally, a study conducted by Barrera (1980) simultaneously compared the effectiveness of three training procedures for teaching expressive language skills to an echolalic child. In this research, Barrera compared the effectiveness of: vocal training of speech using only vocal cues, total communication training of speech using both gestural and vocal cues, and nonverbal training of sign language gestures using purely gestural cues. Although this comparison was conducted with only one child, the results of this research indicated clearly that of the three treatment methods, total communication training of speech was, by far, the most successful. In an analysis of these results, Barrera concluded that the additional visual and tactile cues intrinsic to total communication training were central to its success since they provided the child with important and relevant information which the child could then use in processing and recalling words, and thereby assisting in the development of effective stimulus control.

While these studies suggest that a language training system which incorporates the use of combined visual, auditory and tactile cues may assist the echolalic child in overcoming existing perceptual and comprehension difficulties, further research along these lines is necessary before any firm theoretical or therapeutic conclusions can be made.

In light of the prevalence of ecolalic disturbances in autistic children, and the paucity of comparative research designed to investigate this issue, the present study was undertaken. It was designed so

as to systematically compare the relative effectiveness of oral training of speech (using only vocal cues) and total communication training of speech (using combined vocal and gestural cues) in teaching expressive language skills to three echolalic autistic children. It was hoped tht 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 of multiple cues in the treatment of this population.

Given the reported auditory discrimination deficits of autistic children and evidence indicating the absence of a stimulus overselectivity problem in the verbal segment of this population, it was hypothesized that echolalic autistic children should experience greatest success with the total communication training model.

CHAPTER II

METHOD

Subjects

Three children between the ages of 6-9 years participated as subjects in the study. All three were female and all resided in a private specialized residential treatment center for autistic children located in eastern Massachusetts.

In order to locate appropriate children for this study, initial contact was made with the directors of this facility and a project proposal was presented for their approval. Once approval was obtained from the administration and Board of Trustees, the process of selecting children appropriate for inclusion in this project was begun. To assure for a homogeneous group, the following selection criteria were used:

1. A formal diagnosis of early infantile autism
2. Echolalic verbal behavior
3. A functional expressive vocabulary (words/ signs used spontaneously and reliably in an appropriate manner) of under ten words
4. No known hearing impairments
5. No known visual impairments or corrected vision of not less than 20/40 in both eyes
6. No known serious gross or fine motor impairments in the use of the upper extremities

Once appropriate children had been identified, parents were contacted by phone. During these telephone conversations, the program was

carefully explained to them with special attention placed on a description of the procedures to be used and the project goals. Informed consent was subsequently obtained by mail. A copy of the cover letter describing the study and the informed consent form are included in the appendix (see Appendices 1a and 1b). In addition to the consent obtained from the parents and program administration approval for this project was also obtained from the University of Massachusetts Department of Psychology Human Subjects Comittee.

In accordance with Chapter 766 of the Massachusetts laws, arrangements were made to include this program into the individual educational plans of each of the children participating in the study.

Subject #1--F. M. F. M. was a healthy 9 year old girl who had been admitted to this facility in mid 1974, at the age of 3-1/2. Prior to her admission, F. M. resided at home with her mother and four older siblings.

Acccording to the records, F. M. was the product of a normal full term pregnancy. Early medical reports describe her infancy as normal, with all major developmental milestones (with the exception of language) acquired within normal limits. Language also appeared to develop normally until age 14 months, when it suddenly stopped altogether. At about this same point in time, F. M. began to experience poor sleep patterns with what was described as "periods of as long as 3 weeks during which she would sleep for only 1-2 hours per day." Anecdotal reports by her mother, however, indicated signs of problems surfacing at a much

earlier age, "She never cried as an infant, and would not react to loud noises."

In May of 1973, F. M. was referred by her family physician for a full CORE evaluation. During this evaluation she received a diagnosis of early infantile autism. A neurological evaluation, conducted prior to her admission to her present program, revealed a generalized slowing and what was described as "borderline signs of a seizure disorder." At that time, Dilantin was prescribed to treat the condition. This treatment was later discontinued (after two months) with no apparent effect.

Upon admission to her present program, F. M. recived a diagnosis of childhood psychosis--autistic type. Major concerns at that time centered around lack of toilet training, poor interpersonal relationships, hyperactivity and absence of any attempt to communicate. Although oral language training had consistently been included as an integral part of her educational plans while in this program, historically these efforts ended in failure.

Yearly teacher's reports indicated that since her admission in 1974, F. M. has made major advances in the areas of self help skills, motor skills, pre-academic and attending skills and receptive language. The area of expressive language, however, remained a major area of concern. Notes from a yearly review conference held in June of 1978 described F. M. as an affectionate child who displayed no spontaneous language, and whose speech was primarily echolalic. Recent audiological testing conducted in December of 1978 documented her hearing to be normal.

In order to minimize the effects of previous language training on the current program, an attempt was made to construct a complete listing of F. M.'s expressive repetoire, with the assistance of her teachers and direct care staff. This review revealed the existence of no truly functional expressive skills. Although F. M. frequently spoke spontaneously, this speech could best be described as "delayed echolalia." On occasion, however, three words did appear both spontaneously and in the correct context (Hi, ballala (banana), pihkoh (pickle)). Since these words appeared so sporadically, however, it was felt that they could not be considered truly fucntional.

Subject 2--P. B. P. B. was a healthy six year old child who was admitted to this facility in August of 1979. Prior to this P. B. lived at home with her parents and three younger siblings. Birth records indicated that P. B. was the product of a premature, induced pregnancy. Early medical records, however, depict a fairly normal infancy with developmental delays appearing only in the areas of language and bladder control (first words at 24 months, first short sentences at 30 months, bladder control at 36 months).

Although a family intake report, conducted in September of 1978, indicated that a variety of major problems had existed quite early during P. B.'s childhood, no professional services were sought until the child had reached school age. Included in this list of problems were erratic sleep patterns, social withdrawal, self abusive behavior, hyperactivity, and the late development and subsequent loss of language by age 4.

In October of 1978, P. B. was referred by her local school system for a full CORE evaluation. A psychological report, prepared for this evaluation, described P. B. as "an autistic child who is currently experiencing severe delays in the areas of speech and social development." Although the CORE's medical evaluation found no evidence of any physical or neurological disorder, their recommendations included treatment with Mellaril, and placement in a specialized residential care facility. These recommendations were based on what was described as "severe developmental lags and bizarre behavior due to suspected environmental causes."

In the subsequent months, a number of follow-up assessments were conducted. These included full audiological and speech pathology evaluations. Final reports of the assessments describe P. B.'s communication skills as characterized by a marked pattern of echolalia with only minimal functional spontaneous speech. No signs of any hearing impairment, however, were found.

Since her admission to her present program in August of 1979, major program emphasis has been placed on increasing a) appropriate social interactions, b) attending skills and eye contact, c) vocal imitation skills and d) receptive understanding of a variety of simple one-step commands.

In a recent language assessment, conducted in Janaury of 1980, echolalia was again identified as the major characteristics of P. B.'s speech. In addition, it was noted that this echolalic verbal behavior

was frequently difficult to understand due to a number of specific articulation errors and the low overall intensity of vocal responses.

With the aid of her teachers and direct care staff a comprehensive list of P. B.'s functional expressive vocabulary was constructed. This list revealed a functional vocabulary of only five words (shoe, T.V., go to bed, phone, peanut). Receptive language skills, on the other hand, appeared to be substantially better, with P. B. demonstrating a understanding of an number of simple one-step commands (e.g., stand up, sit down, wash your hands, come here, put on your shoes, etc.).

Subject 3--R. C. R. C. was a healthy 7 year old girl who was admitted to her present residential program in October of 1977. Prior to this, R. C. lived at home with her parents as an only child. According to her records, R. C. was the product of a full term pregnancy and induced delivery. All early records indicated a normal infancy and early childhood, with all developmental milestones reached well within normal limits. In a social services evaluation, conducted in August of 1977, it was reported that R. C.'s parents first detected a "problem" when R. C. was 24 months of age. Until then, language development had progressed normally to the point where R. C. was speaking in complete phrases. At approximately this time, however, R. C.'s spontaneous language suddenly disappeared. According to her mother, R. C. would "only repeat phrases over and over again without any meaning, and parrot whatever was said to her."

In mid 1976, R. C. received an initial evaluation at a regional mental health center and was diagnosed as psychotic. In a subsequent

psychological report, prepared in January of 1977, R. C. is described as "an essentially nonverbal, severely disturbed child with behaviors similar to those seen in autism."

From December 1976 to July of 1977, R. C. was enrolled in a local specialized preschool program. Initial reports from that program indicated that R. C.'s general functioning was at a retarded level, and that she exhibited occasional aggressive outbursts. Major program emphasis, through this period, focused on gross motor activities and at attempting to build eye contact and more consistent vocal imitation. While in this preschool program, a comprehensive audiological examination was conducted which revealed normal hearing.

Prior to her admission into her current residential placement, R. C. received a comprehensive evaluation at The Fernald State School. Results of neurological testing showed borderline signs of seizure activity. However, no treatment was recommended. Speech pathology consultations, conducted at that time, describe her as functioning at an 18-24 month age level with her speech being characterized by meaningless jargon and echolalia. Upon admission into her current program, a full psychiatric consultation was conducted. At this time R. C. received a diagnosis of childhood psychosis--autistic type with related global retardation.

During her first year at her current placement, major program emphasis was placed on self-help skills, developing social interactions and motor activities. In September of 1978, R. C. began training in American Sign language. By February of the next year it was reported

that R. C. had developed a sign vocabulary of only four words (drink, eat, more, toilet). In light of the relatively poor progress in signing and the fact that R. C. was able to imitate speech quite well, a decision was made to shift the focus of training to increasing spontaneous verbalizations. For the most part, other major program emphasis, since then, has been on improving self-help skills and on decreasing the frequency of aggressive and disruptive outbursts.

Initial observations and interviews with teachers and direct care staff revealed that although R. C. displayed a significant amount of spontaneous verbal behavior and jargon, a functional expressive vocabulary of only four spoken words (toilet, cookie, no, pickle) and four signs (eat, drink, more toilet) could be identified. In contrast, receptively R. C. could understand a variety of simple one and two step commands (come here, take off your coat, sit down, stand up, pick up the towel and wipe your face, etc.).

Preliminary Testing and Arrangements. In order to obtain some preliminary measures of linguistic, cognitive and social abilities, a battery of standardized tests were administered to each of the three children. These included The Vineland Social Maturity Scales, The Uzgiris-Hunt Ordinal Scales of Psychological Development and The Meecham Language Assessment. Results of this testing are presented in Table 1. In addition to these, attempts were made to administer The McCarthy Scales of Child Development and The Peabody Picture Vocabulary Test to each of the children. Unfortunately, due to a number of behavioral and comprehension problems, these tests could not be completed successfully.

TABLE 1

RESULTS OF STANDARDIZED TESTING

Vineland Soc. Maturity Scale

	Basal Score	Total Score	Age Equiv.	Soc. Quotient	Chronol. Age
F. M.	30	48 1/2	3.65	41	9.0
R. C.	18	36	2.03	28	7.25
P. B.	26	43 1/2	3.02	48	6.33

Meecham Language Assessment

	Basal Score	Total Score	Lang. Age Equivalent
F. M.	11	13.5	1.73
R. C.	11	12	1.56
P. B.	10	10	1.35

Uzgiris-Hunt Ordinal Scales of Psychological Development

	F. M.	R. C.	P. B.
Visual Pursuit & Permanence of Objects	Stage VI (ceiling)	Stage V (ceiling)	Stage V (ceiling)
Development of Operational Causality	Stage VI (ceiling)	Stage IV	Stage VI (ceiling)
Development of Means-Ends Relationships	Stage VI (ceiling)	Stage III	Stage V
Development of Imitation-Gestural	Stage VI (ceiling)	Stage VI (ceiling)	Stage V
Development of Imitation-Vocal	Stage VI (ceiling)	Stage V	Stage VI (ceiling)

In order to prevent any confounding training from occurring during this project, arrangements were made to terminate all other language training, both in the classroom and residence, for the duration of the

study. To further control for the effects of any prior training, a list of all words previously known or worked on in class or the residence was gathered. These words were then eliminated from the word selection pool prior to the selection of the words to be used during training.

Setting

The study was conducted in its entirety at a private residential treatment center located in eastern Massachusets. This facility provided specialized services for approximately forty autistic children from the New England area. A small, uncluttered private room, approximately 3.2 meters by 2.0 meters, was used to conduct all preliminary and training phases of the project. This room contained only three chairs, a desk, a small table, a microphone, and a built-in one way mirror (approximately 1 meter x 1 meter). Four windows which ran across half the length of one of the walls were covered with opaque curtains. All other potentially distracting items in the area were removed. All training was conducted with only the child, experimenter and observer present, and with the child seated directly in front of the experimenter. The observer was seated off to the side in a position where clear unimpeded observation of both therapist and child was possible.

Materials

Observation and recording materials included: (a) attending training data sheet (see Appendix #2); (b) phase III recording checklist (see Appendix #3); (c) phase IV treatment recording sheet (see Appendix #4);

(d) a Casio MQ11 stopwatch and timer, which was used to record the duration of attending responses and compute the length of sessions; (e) a Teac A-150 cassette recorder which was used to record all language training sessions; (f) an Akai ACM-100 condenser microphone,; and (g) a Sony portable video camera and tape recorder. Random sessions were videotaped in order to obtain a measure of observer reliability.

Training materials included: (a) a variety of edible reinforcers (e.g., yogurt, applesauce, juice, soda, mints, etc.); (b) an assortment of games and toys (e.g., lotto. cars, blocks, puzzles, stuffed animals, etc.) which were used during an initial adaptation period; and (c) a number of specific objects (training stimuli), the names of which were taught during phase IV language training.

Staff

The program required one full-time therapist who conducted all language training. This person was a doctoral candidate in psychology at the University of Massachusetts having an extensive background in the use of operant language training programs.

In addition to the therapist, one research assistant was required for the project. This assistant was responsible for observing and recording data during all attending and language training sessions, and received undergraduate credit for her participation in the study.

Observation Training

Prior to conducting the study, the research assistant underwent a two week long intensive observation and recording period. During thistwo week period, the assistant was trained specifically on the skills required to accurately observe and record the behaviors being measured. This training involved not only classroom instruction, but also extensive practice by means of videotapes and direct observation of sample training sessions with other children. In addition, practice audio tapes were used to develop fluency in transcription. Training continued until a level of 90% accuracy was achieved. This was measured by comparing the research assistant's recorded data with an independently scored record. Throughout the training, random sessions were videotaped in order to provide a check on observer accuracy and assure a consistently high level of reliability (see section on observer reliability, below).

Measures of Behavior

The study was broken down into four distinct phases, each with a different purpose and objective. Phase I (Adaptation) and Phase II (Prerequisite Attending Skill Training) served primarily as introductions to the actual language training which was conducted during phases III and IV. Consequently, data collection began with phase II.

Phase II: Prerequisite Attending Training. The objective of this phase of the project was to develop two prerequisite attending behaviors

(eye contact, sitting quietly) prior to the language training. During this phase, the attending training data sheet was used by the research assistant to record the frequency and duration of the child's responses to the therapist's instructions to "look at me" and "sit nicely." Operational definitions of each of these behaviors are included in the Appendix (see Appendix #5).

Phase III: Vocal Imitation Training. Phase III of the project was directed specifically at increasing the frequency, accuracy, and reliability of vocal imitative resposnes. Throughout this phase, the assistant recorded (a) all therapist cues (word or words spoken by the therapist), (b) each vocal response made by the child, and (c) a rating on the intensity of the response (i.e., low, medium or high). Later, these responses were coded into the following categories: (a) echolalic or non-echolalic, (b) clear or unclear echoed response, and (c) error of completeness or pronunciation. Clarity of echoed responses was defined as follows:

a. Response must be audible at a distance of one meter

b. One-syllable responses must be clearly articulated

   Two syllable responses - both first and second syllables clearly articulated

   Three or more syllable responses - first syllable and majority of all syllables must be clearly articulated

Phase IV: Language Training Comparison. During this phase, two different treatment conditions were administered each day, in a randomized order. Different matched word groups were taught in each treatment

condition. All training was conducted on the basis of discrete trials which began with the therapist's cue (presentation of training stimulus and question), and ended with the child's vocal response. Using the Phase IV Treatment Recording Sheet (see Appendix #4), the assistant recorded 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 correct vocal and gestural responses per word/per session, and the percentage of unprompted correct vocal or gestural changes made from one word to another.

Daily treatment probes. At random times during each session of phase IV training a two to three minute probe of the child's responses to the presentation of the training stimuli was conducted. Reinforcement, during these probes, was delivered contingent upon appropriate attending, but not contingent upon the correctness of the response. Again, therapist's cue(s) and the child's vocal and gestural responses were recorded.

Observer reliability. In order to assure a consistently high level of observer accuracy, videotape recordings were taken periodically throughout phases III and IV. These tapes were independently scored

and then compared, on a trial to 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

(c) The two descriptions of the level of promoting (i.e., FG, PG, FV, PV) matched

Reliability data for each child are presented in Tables 2, 3, and 4.

Design

A single-subject alternating treatment design (Ulman and Sulzer-Azaroff, 1975; Barlow and Hayes, 1979), with replication within and across subjects, was used to conduct a comparison of the relative effectiveness of the two treatment models. Sequence and interaction effects were minimized by the randomization of the order of presentation of treatment conditions within sessions.

Procedure

Phase I: Adaptation. While the main function of this phase was to allow the child some time to adapt to the therapist, observer and new therapy environment, it also offered the therapist some time to become more familiar with the child. During this phase, the therapist and observer met with the children, in the same room in which training was to be conducted over five days, for two 30-minute sessions per day. Although this time was primarily devoted to establishing rapport with

TABLE 2

RELIABILITY DATA - SUBJECT #1 - F. M.

Phase III: Vocal Imitation Training

	Session 3	Session 8	Overall
Agreements	58	119	177
Disagreements	7	6	13
% of Agreements	89%	95%	93%

Phase IV: Language Training Comparison

	Oral	Total Comm.	Combined
Day 4			
Agreements	42	73	115
Disagreements	2	9	11
% of agreements	96%	89%	91%
Day 9			
Agreements	83	52	135
Disagreements	7	12	19
% of agreements	93%	81%	88%
Day 14			
Agreements	104	102	206
Disagreements	14	17	31
% of agreements	88%	86%	87%
Day 19			
Agreements	78	75	153
Disagreements	8	7	15
% of agreements	91%	92%	91%
Day 23			
Agreements	57	79	136
Disagreements	7	10	17
% of agreements	89%	89%	89%
Overall			Total Combined
Agreements	364	381	745
Disagreements	38	55	93
% of agreements	91%	88%	89%

TABLE 3

RELIABILITY DATA - SUBJECT #2 - P. B.

Phase III: Vocal Imitation Training

	Session 6	Session 14	Session 21	Session 27	Overall
Agreements	73	113	121	139	446
Disagreements	9	10	9	5	33
% of Agreements	90%	92%	93%	96%	93%

Phase IV: Language Training Comparison

	Oral	Total Comm.	Combined
Day 4			
Agreements	74	45	119
Disagreements	7	7	14
% of agreements	92%	87%	90%
Day 8			
Agreements	55	44	99
Disagreements	16	9	25
% of agreements	78%	83%	80%
Day 12			
Agreements	70	54	124
Disagreements	13	13	26
% of agreements	84%	81%	83%
Day 18			
Agreements	67	595	126
Disagreements	12	5	17
% of agreements	85%	92%	88%
Day 22			
Agreements	75	77	152
Disagreements	12	5	17
% of agreements	87%	89%	87%
Overall			Total Combined
Agreements	341	279	620
Disagreements	60	44	104
% of agreements	85%	86%	86%

TABLE 4

RELIABILITY DATA - SUBJECT #3 - R. C.

Phase III: Vocal Imitation Training

	Session 6	Session 13	Session 20	Overall
Agreements	71	85	105	261
Disagreements	5	9	9	23
% of Agreements	93%	90%	92%	92%

Phase IV: Language Training Comparison

	Oral	Total Comm.	Combined
Day 3			
Agreements	51	31	82
Disagreements	7	6	13
% of agreements	88%	868%	86%
Day 8			
Agreements	100	51	151
Disagreements	24	14	38
% of agreements	81%	79%	80%
Day 13			
Agreements	75	49	124
Disagreements	4	9	13
% of agreements	95%	84%	91%
Day 18			
Agreements	51	435	94
Disagreements	10	9	19
% of agreements	84%	83%	83%
Overall			Total Combined
Agreements	277	174	451
Disagreements	45	38	83
% of agreements	86%	82%	85%

the child via unstructured play with a number of simple games and activities (e.g., puzzles, lotto, cars, blocks, stuffed animals, etc.), it also offered the therapist some time to evaluate the primary (edible) reinforcers which would be used during later attending and language training phases.

When the subject appeared comfortable and relaxed within this new environment, and willing to interact freely with the therapist, phase II of the study was begun.

Phase II: Prerequisite Attending Training. During this phase, each child was trained on two specific attending skills which were deemed central to effective and efficient language training, namely, eye contact and sitting quietly. As in phase I, the therapist met with the child for two 30 minute ssessions per day.

Using a graduated guidance model (Foxx and Azrin, 1972), the therapist systematically shaped each attending behavior. In both instances this process began with the therapist giving a combined vocal and gestural command, and then physically guiding the subject through the desired response (operational definitions of attending behaviors are included in Appendix #5). At the start of this training, each fully guided trial was immediately followed by paired social (hugs, kisses, touching) and edible reinforcement. As training progressed, however, the therapist gradually faded the physical guidance and systematically reinforced more independent responses. Eye contact training continued until the child responded appropriately on 85% or more of the trials, in two successive sessions. Training on "sitting quietly," however,

continued until the main duration of the response was 30 seconds or longer, on two successive sessions.

Word selection procedure. Prior to conducting phase III and IV language training, lists of approximately one hundred nouns were constructed with the assistance of the teachers and direct care staff. These lists included only words representing familiar and common objects from the child's environment, and did not include any words which had been observed to be (a) within the child's current repetoire, or (b) recorded as previously known or worked on in therapy. These lists were 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, 1968)), (b) number of syllables, and (c) potential conditioned reinforcing qualities. In addition to this objective analysis, two 45-minute expressive and receptive tests were conducted prior to all language training. In this way, the subject's baseline level of receptive and expressive 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 were randomized. If the child responded

correctly on a word one or more times during the expressive test, that word was eliminated from the word pool.

Based on these ratings twenty of the words were matched for difficulty, divided up into evenly matched groups of five, and paired with one of the two training models (see Master Word Lists, Tables 5, 6, 7).

Phase III: Vocal Imitation Training. As described earlier, phase III of the study was directed specifically at increasing the frequency, accuracy and reliability of the children's vocal imitative responses. Traditionally, this form of intensive vocal imitation training has been seen as an important preliminary step in operant language training programs, for establishing a stable and clear vocal repetoire. This would then facilitate subsequent stimulus control training (Risley and Wolf, 1967; Lovaas et al., 1973).

Using a list of some one hundred words, selected from the Peabody Picture Vocabulary Test, the therapist met with each child twice per day, for thirty minutes each session. During these thirty minute sessions, the therapist vocally presented the names of each of these words (or as many as were possible within the thirty minute session), and differentially reinforced only those clear vocal imitative responses emitted by the child. Clarity of responses was defined in terms of both intensity of vocalization, and accuracy of articulation. (For specific operational definition see Measures of Behavior section, above.) Training continued until a level of 80% or higher of the therapist's prompts were clearly imitated within two successive sessions.

TABLE 5

MASTER WORD LIST - F. M.

First Groups:

Oral (O_1)	diff. rating	Total Comm. (TC_1)	diff. rating
car	1.0	key	1.0
hat	1.0	cup	1.5
lock	1.5	pants	2.0
soda	2.0	candy	1.5
coat	2.0	soap	2.0
	7.5		8.0

Second Groups:

Oral (O_2)	diff. rating	Total Comm. (TC_2)	diff. rating
sock	3.0	shoe	2.0
light	2.0	dog	1.0
doll	1.5	radio	3.0
shirt	2.0	book	1.5
cat	1.0	comb	2.0
	9.5		9.5

TABLE 6

MASTER WORD LIST - P. B.

First Groups:

Oral (O_1)	diff. rating	Total Comm. (TC_1)	diff. rating
bag	1.0	dog	1.0
boot	1.5	book	1.5
cup	1.5	coat	2.0
soda	2.0	apple	1.5
sock	3.0	clock	3.0
	9.0		9.0

Second Groups:

Oral (O_2)	diff. rating	Total Comm. (TC_2)	diff. rating
doll	1.5	money	2.0
dish	2.0	shirt	2.0
light	2.5	house	2.0
	6.0		6.0

TABLE 7

MASTER WORD LIST - R. C.

First Groups:

Oral (O_1)	diff. rating	Total Comm. (TC_1)	diff. rating
pen	1.0	hat	1.0
doll	1.5	bell	1.5
paper	2.0	puppy	2.0
towel	3.0	tissue	3.0
radio	3.0	watch	3.5
	10.5		11.0

Second Groups:

Oral (O_2)	diff. rating	Total Comm. (TC_2)	diff. rating
pail	1.5	shoe	2.0
soap	2.0	book	1.5
money	2.0	pants	2.0
	5.5		5.5

Phase IV: Language Training Comparison. During this phase the actual comparison between oral (vocal) and total communication training models was conducted. This comparison was carried out by first randomly assigning each of the matched word groups to one of the two treatment conditions and then administering each of these treatments, in a randomized order, during each day of training. The two language training models were defined as follows.

(0) Oral language training using purely vocal cues. Using only vocal cues, the therapist would present an object (training stimulus the name of which was being taught), and then train the appropriate vocal response.

(TC) Total communication language training. Using a combination of vocal and gestural (sign) cues, the therapist would present an object and then train the corresponding appropriate vocal response.

General training procedure. Training with each child was conducted four days per week (Tuesday through Friday) for a total of 60-90 minutes per day. Each day of training consisted of one morning session in one treatment condition and one afternoon session in the other condition. The sessions were of equal length, lasting between 30 and 45 minutes. Order of presentation of the two treatment conditions was randomized to control for sequence effects, and, therefore, varied from day to day. It should be noted that the length of sessions with Subject #2, P. B., were systematically decreased during phase IV training. This decrease was instituted due to observed attentional limitations. Beginning on Day 12 of phase IV with P. B. four 15 minute sessions (two per condition) were run in place of the two 30 minute sessions.

Although the two language training models differed substantially from one another in terms of the cues presented by the therapist, they were similar in terms of the general format in which they were conducted. All training was conducted on the basis of individual trials which began with the presentation of the training stimulus (object) and question (what is this, etc.) and ended with the child's response. In the event that the child failed to respond within ten seconds, the trial was considered ended. Operant training techniques including positive reinforcement, fading, time out and an anticipation procedure (Risley and Wolf, 1967) were used in both treatment conditions.

Oral language training procedure. In this treatment condition, the therapist used only vocal cues. Training began with the therapist presenting the training stimulus (object), requesting a response (what is this, this is a _____, etc.), and then modelling the desired vocal response for the child. At first, all clearly imitated vocal responses were reinforced. As training continued, however, modelled prompts were gradually and systematically faded in order to develop independent responses. In an attempt to further 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 (hugs, kisses, praise, etc.) and edible reinforcement was delivered contingent upon appropriate, clear vocal responses. In contrast, a fifteen second time out procedure was used contingent upon all incorrect responses. This time out procedure consisted of the therapist temporarily stopping, turning away from the child and sitting quietly until the fifteen second period had elapsed (see Lovaas, 1966). In order to further emphasize the difference between correct and incorrect responses, all correct responses were immediately rehearsed by the therapist (e.g., good, this is book, etc.).

Total communication language training procedure. Using simultaneous vocal and gestural cues, the therapist employed 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 (i.e., what is this, etc.), the therapist modelled the appropriate vocal response while simultaneously presenting the corresponding American Sign Language (ASL) gesture. Again, both social and edible reinforcement was delivered contingent upon correct vocal responses. In addition, all correct vocal responses were followed by the therapist's repeating the correct response while fully guiding the child's hands through the corresponding ASL gesture. As described above, all incorrect vocal responses resulted in a fifteen second 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 modelled 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 acquisition criterion (fifteen consecutive correct responses) on all five words within one of the categories. A trial was considered correct only if the response was spontaneous, complete and accurate, and initiated within ten seconds. Although acquisition criterion was defined as fifteen consecutive correct responses, criterion was not considered to have been reached unless these fifteen responses were intermixed with responding on at least two other words. Thus, simple massed repetition was avoided.

Once acquisition criteria had been reached on all five words within one of the training categories, training was extended for one day during which a criterion verification test was conducted. This

verification test consisted of two regular thirty minute training sessions and was designed to verify which of the words had been learned by that point. In order to assess all of the words within a twenty minute 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 acquisition criterion was reached on all of the words within one of the two treatment categories. It should be noted that due to time restrictions, it was necessary to include only three words in each category during the replication comparisons with subject #2-P. B. and subject #3-R. C.

CHAPTER III

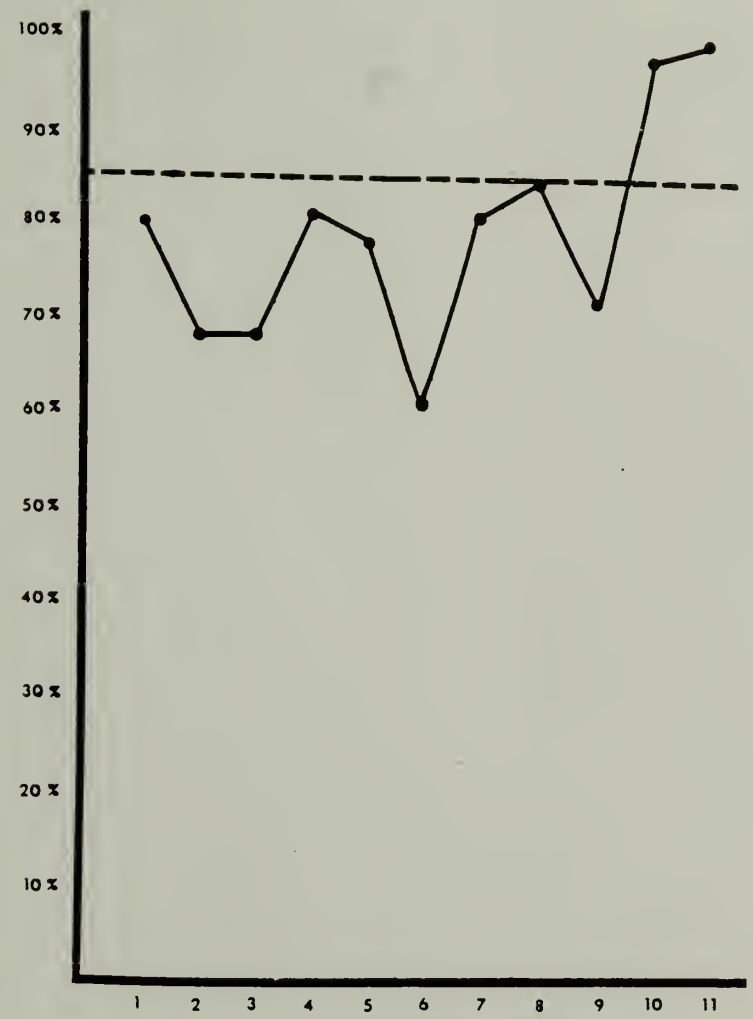
RESULTS

Phase II: Prerequisite Attending Training

Due to different entering abilities, the length of the attending skill training phase of the study varied from child to child. At the start of training, Subject No. 1-F. M. demonstrated that she was able to sit quietly for almost the entire length of the thirty minute session. Consequently, the major focus of attending training, with this child, was placed on developing a reliable response to the command "Look at me." Although F. M. demonstrated a fairly high level of responding at the start of training (80% correct responses in session No. 1), a total of eleven sessions were required to bring this behavior up to acceptable levels. (See Figure 1).

Figures 2 and 3 display the results of attending training with subject No. 2-P. B. These data indicate that only nine sessions were required to reach acceptable levels on each of the two behaviors. Data on appropriate sitting (see Figure 2) showed a fairly steady and rapid increase, with acceptable levels being reached by the third session. In contrast, P. B.'s responding to the instruction "Look at me," was quite variable and required a total of nine sessions to reach the present criterion level.

Of the three children who participated in the project, Subject No. 3-R. C. demonstrated, by far, the poorest entering attending skills. As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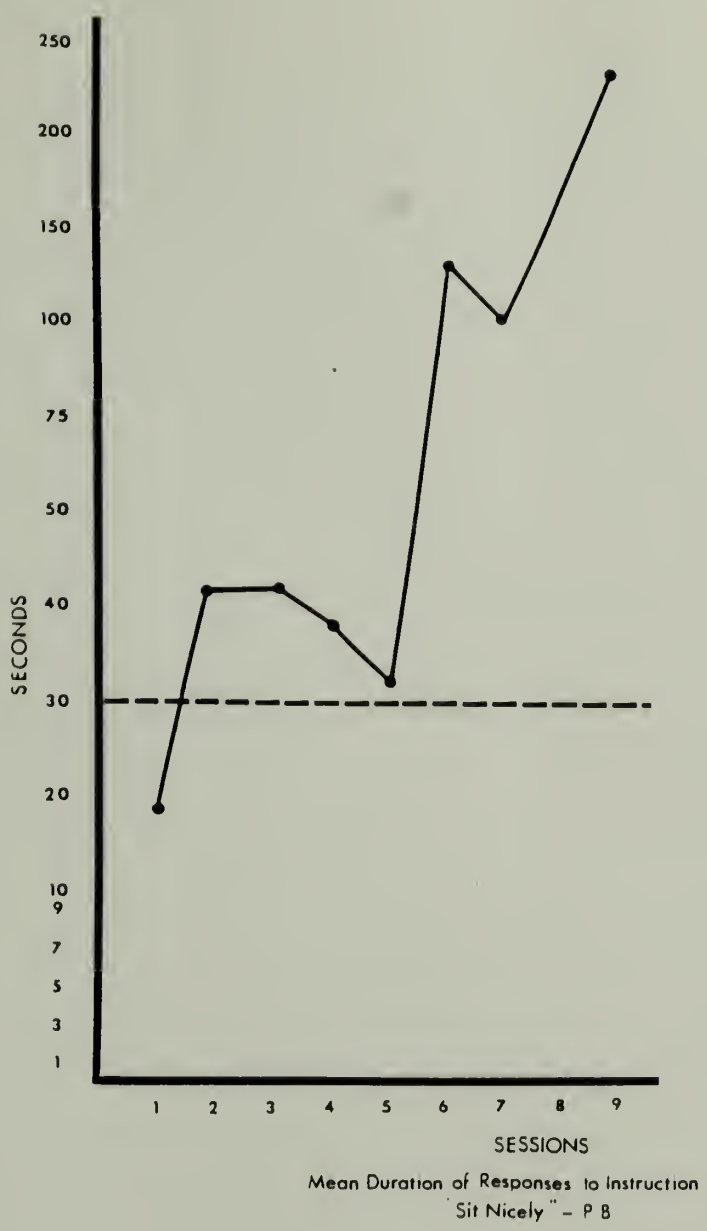
SESSIONS
PERCENTAGE OF CORRECT RESPONSES TO INSTRUCTION
"LOOK AT ME" - F.M.

Figure 1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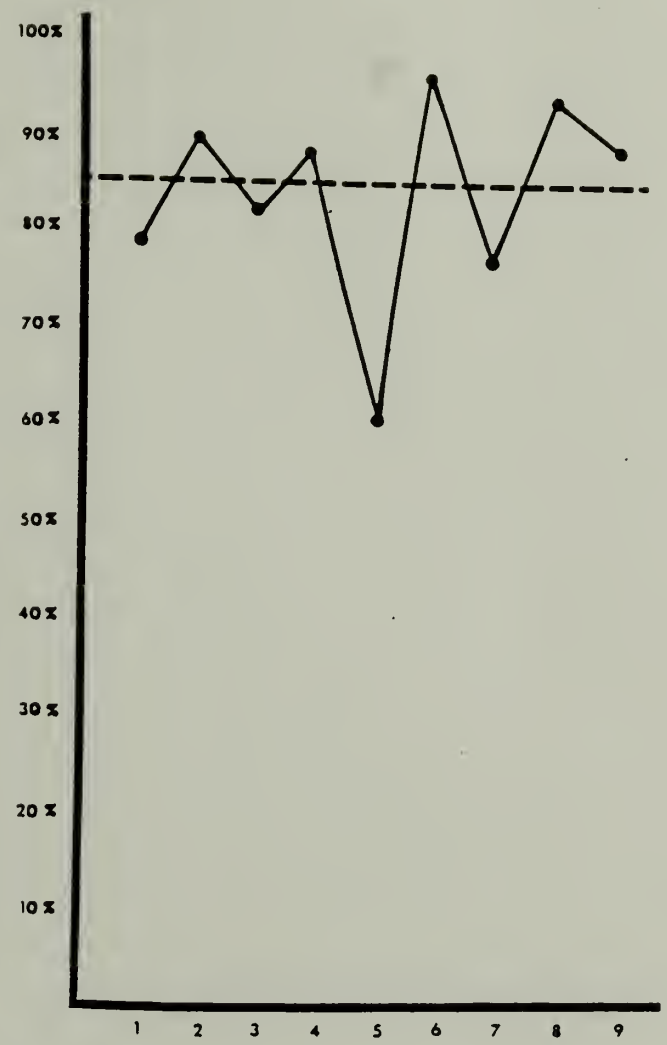
SESSIONS
Mean Duration of Responses to Instruction
"Sit Nicely" – P B

Figure 2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SESSIONS
PERCENTAGE OF CORRECT RESPONSES TO INSTRUCTION
"LOOK AT ME" - P.B.

Figure 3

is indicated in Figure 4, mean duration of the appropriate sitting responses was only four seconds, during the first session. R. C.'s responding, however, improved steadily over the course of training. By Session No. 16, the appropriate sitting response had increased to a mean duration of 140 seconds. Eye contact training (see Figure 5), while showing a generally more erratic pattern of acquisition, reached acceptable levels much more quickly.

Phase III: Vocal Imitation Training

The initial results of phase III training indicated that some major differences existed between the children in terms of their entering vocal imitative abilities. These differences were reflected not only in the individual subject data on percentage of clearly echoed trials, but also in the anecdotal reports of phase III training which addressed the more qualitative parameters of articulation and intensity of response.

Of the three children who participated in the study, Subject No. 1-F.M. displayed, by far, the most advanced entering vocal imitation skills. As indicated in Figure 6, throughout five phase III training sessions, F. M.'s imitative responding never fell below the 80% criterion level. This consistently high level of responding is in sharp contrast with the results of phase III training with each of the other two subjects.

As is indicated in Figure 7, P. B.'s responding during the initial phase III sessions was at approximately the 30% level. With variable

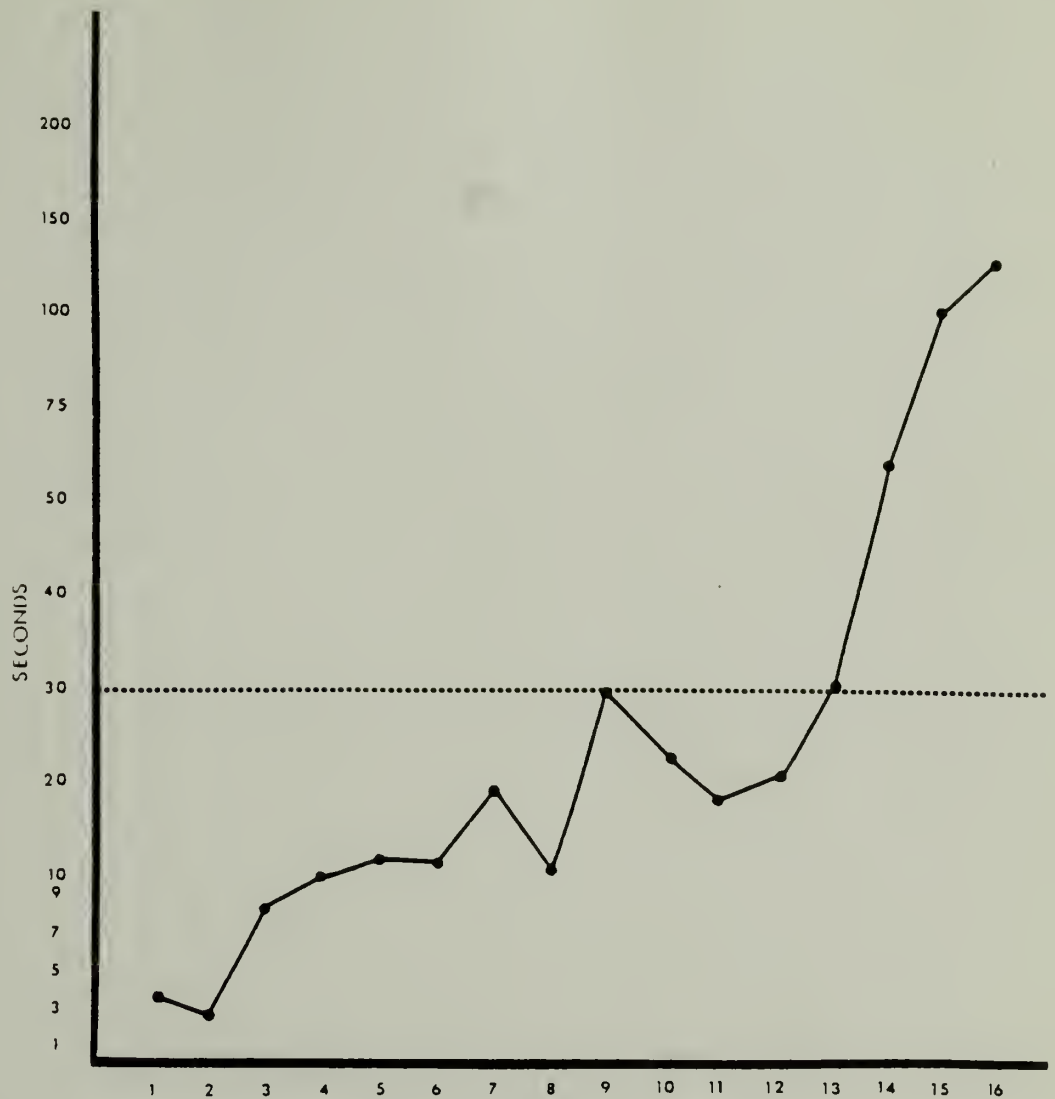

200
150
100
75
50
40
30
20
10
9
7
5
3
1
SECONDS
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
SESSIONS
Mean Duration of Responses to Instruction
Sit Nicely - R C

Figure 4

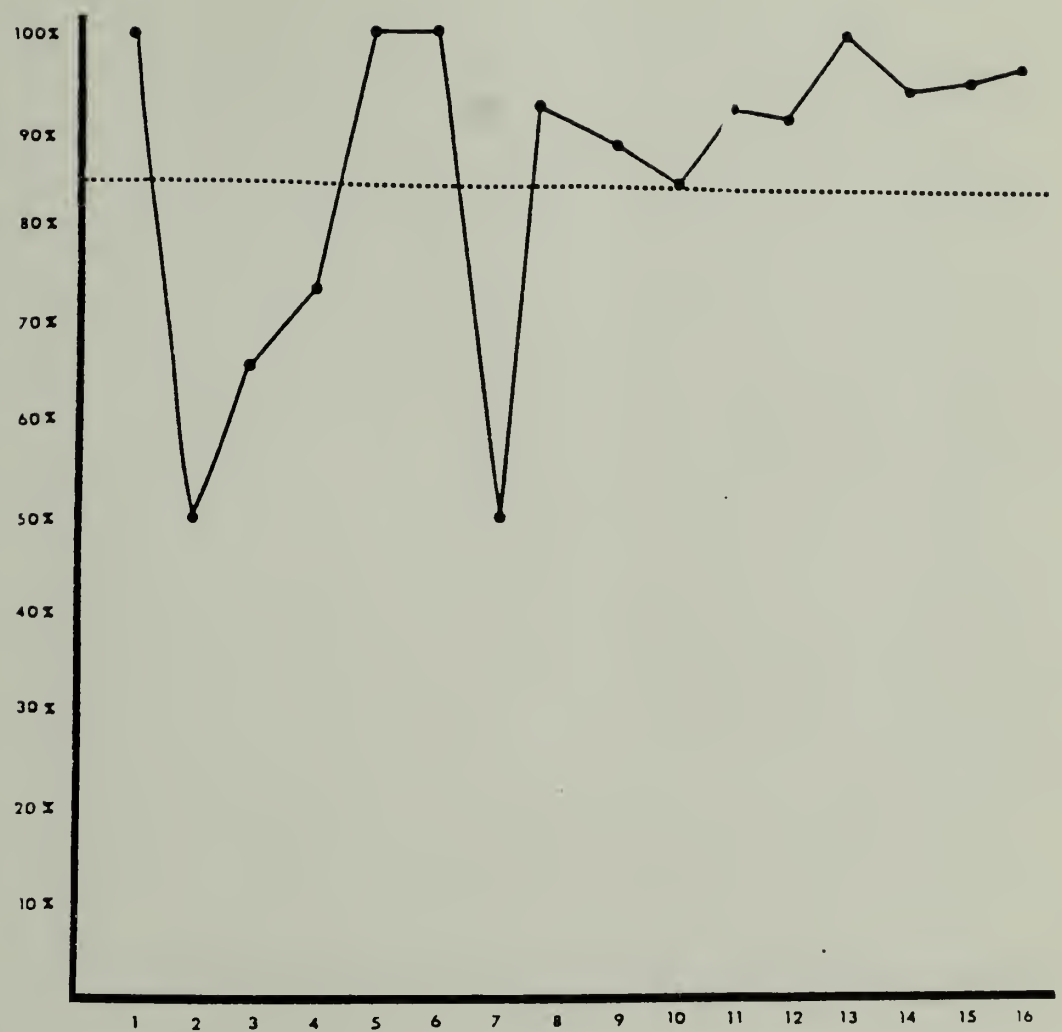
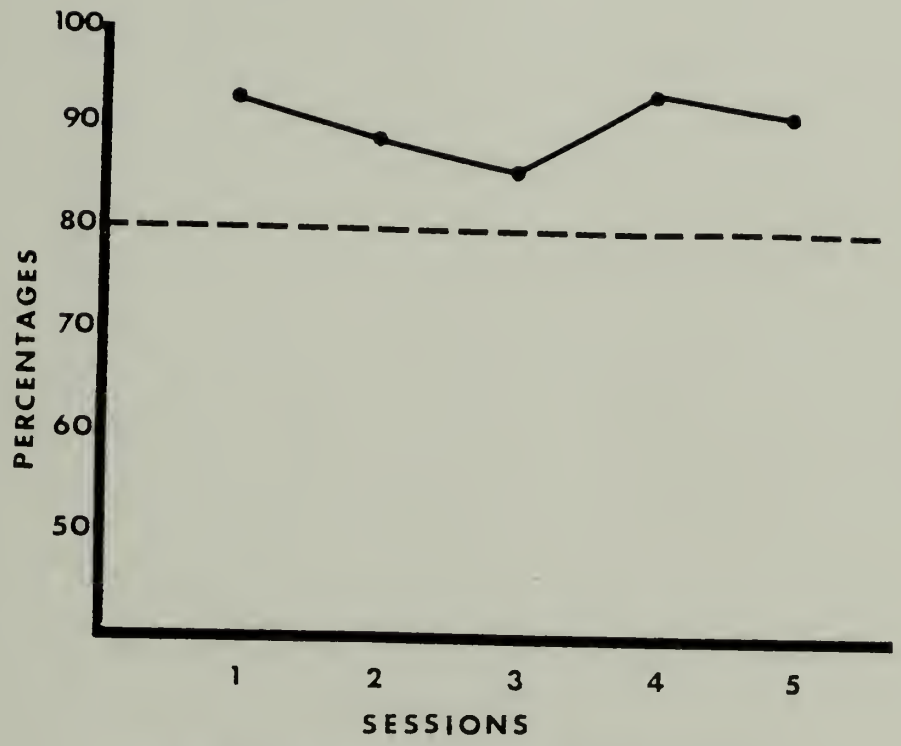

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
SESSIONS
PERCENTAGE OF CORRECT RESPONSES TO INSTRUCTION
"LOOK AT ME" - R C

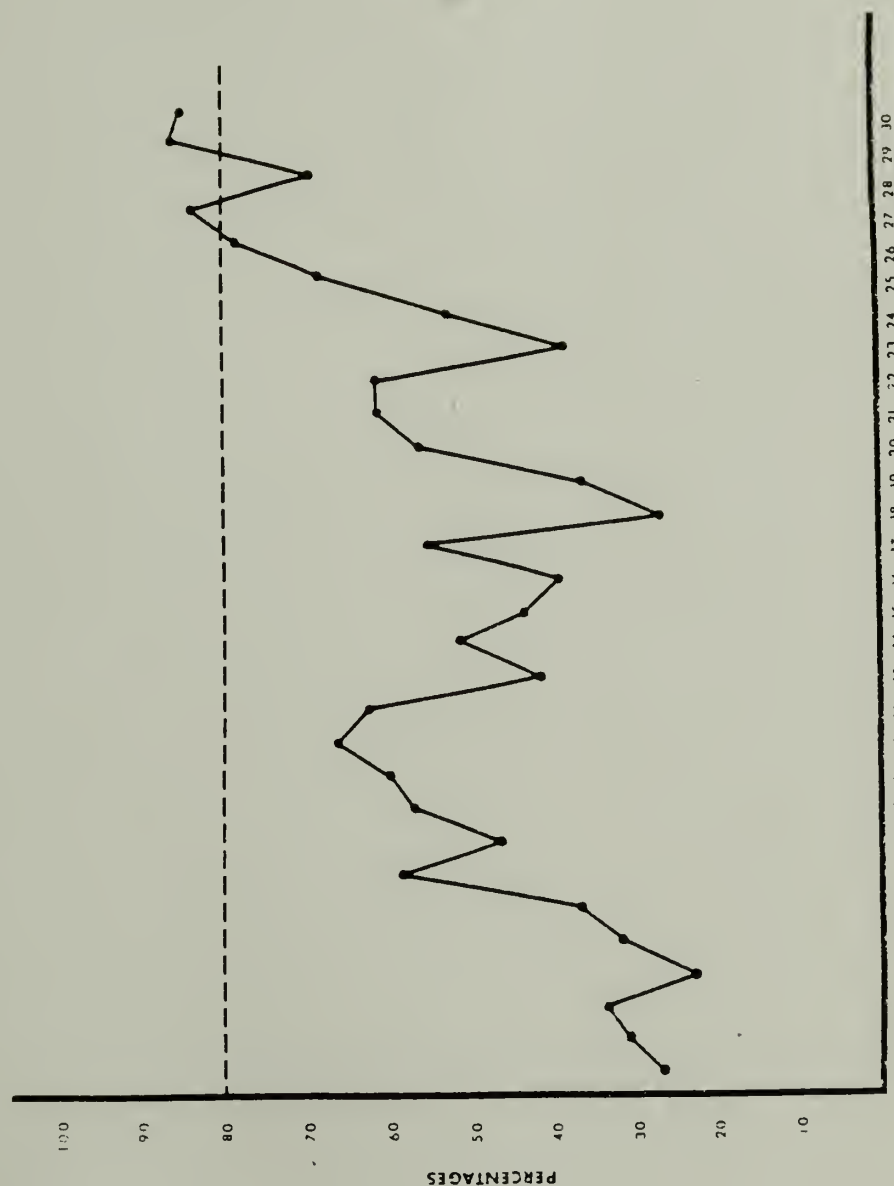
Figure 5



Percentage of Clearly Echoed Trials

Phase III - F.M.

Figure 6

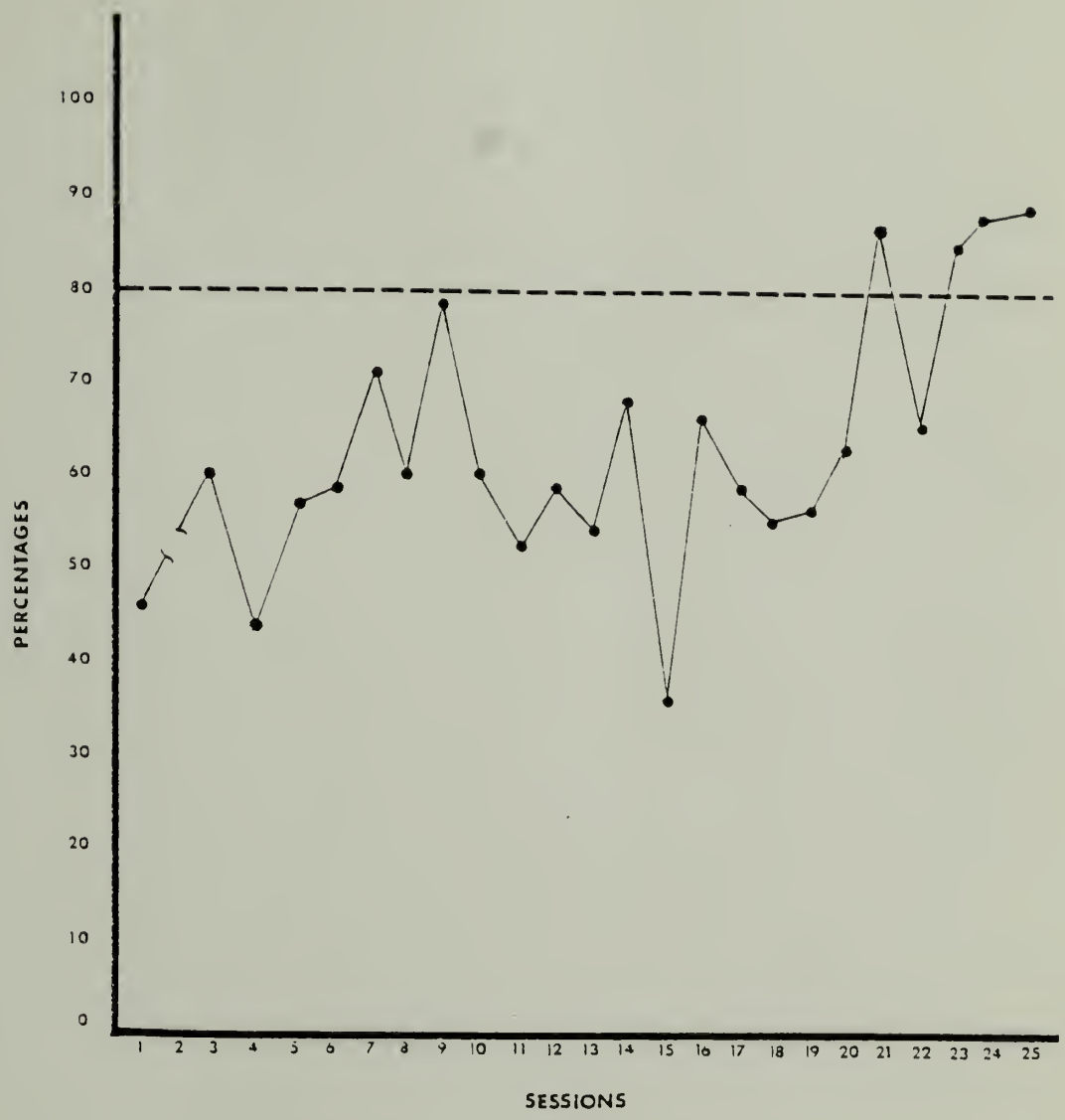

PERCENTAGES
100
90
80
70
60
50
40
30
20
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
SESSIONS
PERCENTAGE OF TRIALS ECHOED CLEARLY PHASE III

P.B.
Figure 7

yet steady progress. Acceptable levels were reached after a total of thirty training sessions. For the most part, the major focus of phase III training with this child was placed on systematically shaping more clearly articulated vocal imitative responses. For example, at the earlier stages of P. B.'s phase III training, vocal imitative responses were frequently characterized by the inclusion of a final "oogh" sound (e.g., "boogh" in place of "bee" or "pupoogh" in place of "puppy," etc.). By the final stages of phase III training, however, P. B. was consistently articulating final sounds clearly (e.g., cheese, money, bottle, table, fork, etc.). Phase III training with subject No. 3- R. C. also progressed slowly. As indicated in Figure 8, a total of 25 training sessions were conducted before acceptable levels of responding were reached. Although R. C.'s articulation skills were consistently quite good, the low intensity of her vocal imitative responses frequently made it difficult to understand her. Consequently, the major focus of phase III training with R. C. was placed on systematically shaping louder responses.

Phase IV: Language Training Comparison

Data on the number of trials per category during phase IV training are presented in Table 8. Although training was broken down into discrete trials so as to attempt to balance the number of trials across categories, variability did occur. Results of training on the first groups of words with F. M., showed a fairly close balance between the two categories, with an average of five more trials per session in



PERCENTAGE OF CLEARLY ECHOED TRIALS — PHASE III

R.C.

Figure 8

TABLE 8

	First Group		Second Group		Combined First and Second Groups	
	Total No. of Trials	$\bar{X}$ No. of Trials	Total No. of Trials	$\bar{X}$ No. of Trials	Total No. of Trials	$\bar{X}$ No. of Trials
Subject No. 1-F.M.						
ORAL	1291	80.7	769	85.4	2060	82.4
TOTAL COMM.	1451	85.4	842	93.5	2293	88.2
Subject No. 2-P.B.						
ORAL	1481	78.0	410	78.8	2060	82.4
TOTAL COMM.	1090	57.4	352	70.4	1442	60.1
Subject No. 3-R.C.						
ORAL	991	66.1	192	64.0	1183	65.7
TOTAL COMM.	844	52.3	159	53.0	1003	52.8

the total communication group. Results from the other two subjects, however, showed significantly more trials conducted in the oral category (i.e. P. B.--an average of 21 more trials per session in oral, R. C.--an average of 14 more trials per session in oral.). The results of training on the second groups of words showed a similar pattern with each subject. However, the differences between categories for both P. B. and R. C. were not as large (i.e., P. B.--an average of twelve more trials in oral, R. C.--an average of eleven more trials in oral).

Figures 9, 10, and 11 present each subject's progress, across categories, over the course of Phase IV training. Words presented in lower case reflect that training was conducted on that word, on that day. Words presented in upper case reflect that, during training, responding reached criterion. Initial acquisition criterion was set at fifteen consecutive (intermixed) responses. In subsequent sessions, however, verification criterion was designated as a 60%, or higher, level of correct spontaneous responding during the session.

As indicated in Figure 9, a total of 16 days was required to complete training on the first groups of words with F. M. By day eleven, F. M. had not reached criterion on any of the words in either of the two categories. By day sixteen, however, all of the words had been learned in the total communication category, whereas none of the words had been learned in the oral group. A similar pattern of acquisition was found in the results of training on the first groups of words with each of the other subjects (see Figures 10 and 11). Although R. C. required three more days to complete training, both R. C. and P. B.

FIGURE 9

Daily Training Summary Sheet - F. M.

Oral 1st Comparison

lock hat car	lock hat car	hat car	hat car	hat car	soda hat car	soda hat car	hat car	coat soda hat car	coat hat car	soda hat car	soda hat car	soda hat car	soda hat car	coat soda hat car	coat soda hat car	coat soda lock hat car

Total Comm. 1st Comparison

cup key	cup key	cup key	cup key	pants cup key	candy key	candy cup key	soap candy pants cup key	soap candy key	soap candy cup key	soap candy cup key	SOAP candy pants cup key	SOAP CANDY pants cup key	SOAP CANDY PANTS CUP KEY	soap CANDY PANTS CUP KEY	SOAP CANDY PANTS cup KEY	SOAP CANDY PANTS CUP KEY

verification 17

FIGURE 9
(continued)

Daily Training Summary Sheet - F. M.

Oral Second Comparison	light sock	light sock	doll light sock	light sock	light sock	light sock	doll light sock	light sock	doll light sock	
Total Comm. Second Comparison	radio dog SHOE	radio dog shoe	radio dog SHOE	radio DOG SHOE	book DOG shoe	radio DOG SHOE	book radio DOG SHOE	comb BOOK radio DOG shoe	COMB BOOK RADIO DOG shoe	
	18	19	20	21	22	23	24	25	26	Days of Training

FIGURE 10

Daily Training Summary Sheet - P. B.

Oral 1st Comparison

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	verification 19
cup sock	soda cup sock	boot soda cup	boot soda cup	boot soda cup sock	boot soda cup sock	soda cup sock	soda cup sock	boot cup sock	boot soda cup sock	soda cup sock	soda cup sock	boot cup sock	boot soda cup sock	boot soda cup sock	boot SODA cup sock	boot SODA sock	boot SODA cup sock	boot SODA cup sock

Total Comm. 1st Comparison

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	verification 19
apple book	dog apple	dog apple	dog apple	dog apple book	dog apple book	coat dog apple book	dog apple	coat dog apple book	APPLE book	dog APPLE book	dog APPLE book	coat dog APPLL book	COAT dog APPLL book	COAT dog book	clock COAT DOG APPLL BOOK	clock COAT DOG APPLE BOOK	CLOCK COAT DOG APPLI BOOK	CLOCK COAT DOG APPLE BOOK

FIGURE 10
(continued)

Daily Training Summary Sheet - P. B.

Oral Second Comparison

	doll	light doll	light doll	light doll	light doll

Total Comm. Second Comparison

	money	shirt money	shirt money	house SHIRT MONEY	HOUSE SHIRT MONEY
Days of Training	20	21	22	23	24

FIGURE 11

Daily Training Summary Sheet - R. C.

Oral 1st Comparison

paper doll	pen paper doll	towel paper doll	radio pen paper doll	radio paper doll	RADIO pen paper doll	radio pen paper doll	radio paper doll	pen paper doll	towel pen paper doll	RADIO pen paper doll	RADIO pen paper doll	radio pen paper doll	RADIO paper doll	radio pen paper doll	radio towel pen paper doll

Total Comm. 1st Comparison

puppy hat	puppy hat	watch tissue puppy hat	watch tissue puppy hat	watch tissue puppy hat	watch tissue puppy hat	watch tissue puppy hat	TISSUE puppy hat	watch PUPPY hat	watch TISSUE PUPPY hat	bell watch TISSUE PUPPY HAT	bell watch tissue PUPPY	bell WATCH TISSUE PUPPY HAT	bell WATCH TISSUE PUPPY HAT	BELL WATCH TISSUE PUPPY HAT	BELL WATCH TISSUE PUPPY HAT
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	verification 16

FIGURE 11
(continued)

Daily Training Summary Sheet - R. C.

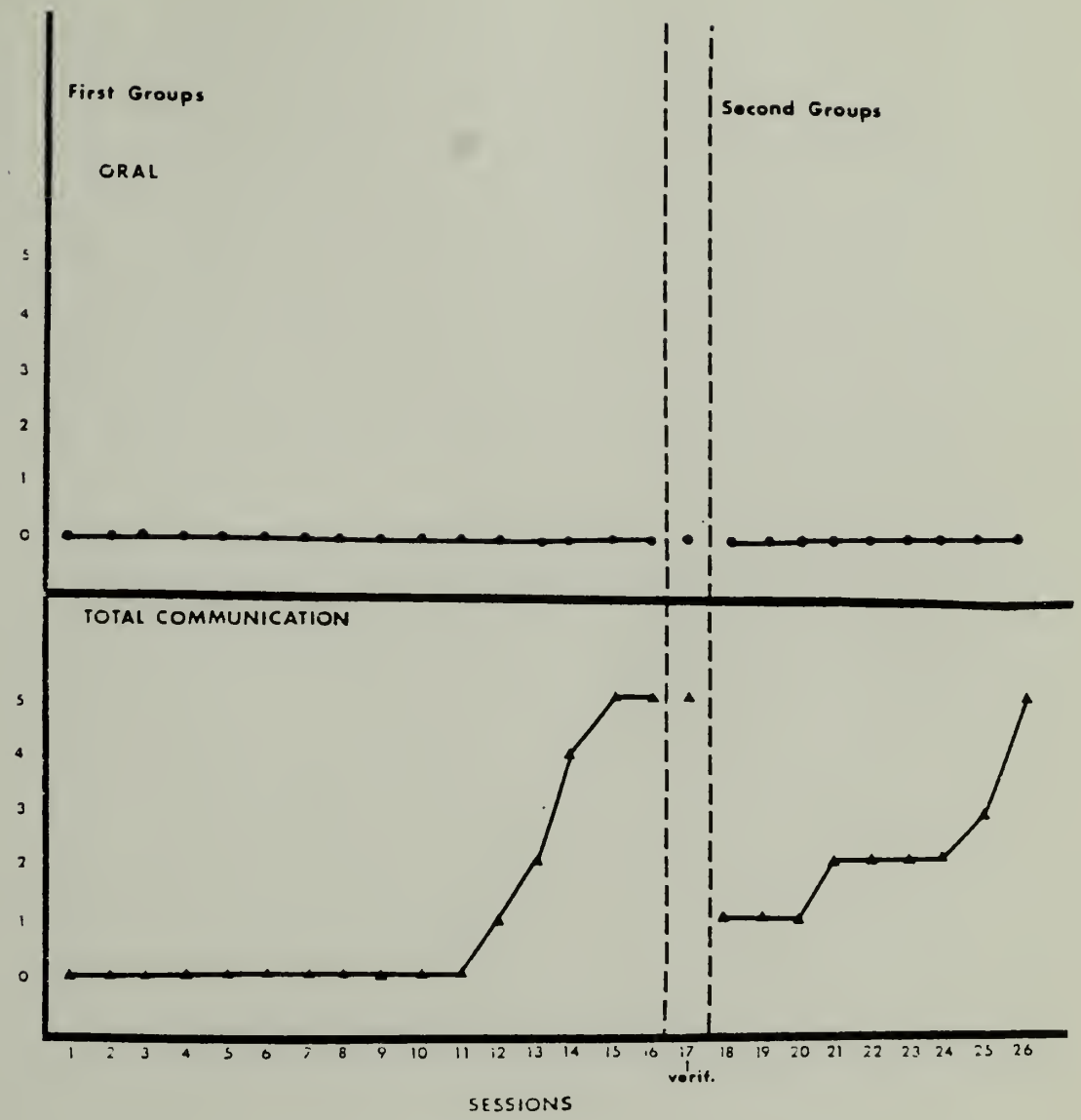
Oral Second Comparison				
	money soap	money soap	money soap	
Total Comm. Second Comparison				
	shoe book	shoe book	shoe book	
	17	18	19	Days of Training

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 communication training was again noted in the second comparison groups of subject No. 1-F. M. and subject No. 2-P. B. In both of these replications all of the words in the total communication groups were learned in contrast with none of the words in the oral groups. It should be noted that since total communication training progressed so rapidly in each of these comparisons, work had not yet even begun on some of the words in the oral groups.

Despite the fairly stringent acquisition criterion used (fifteen consecutive (intermixed) correct responses), post acquisition responding occasionally fell below acceptable levels. This drop in responding was noted most frequently with Subjects 1 and 3 (F. M.--six instances, R. C.--5 instances), and only once with Subject No. 2.

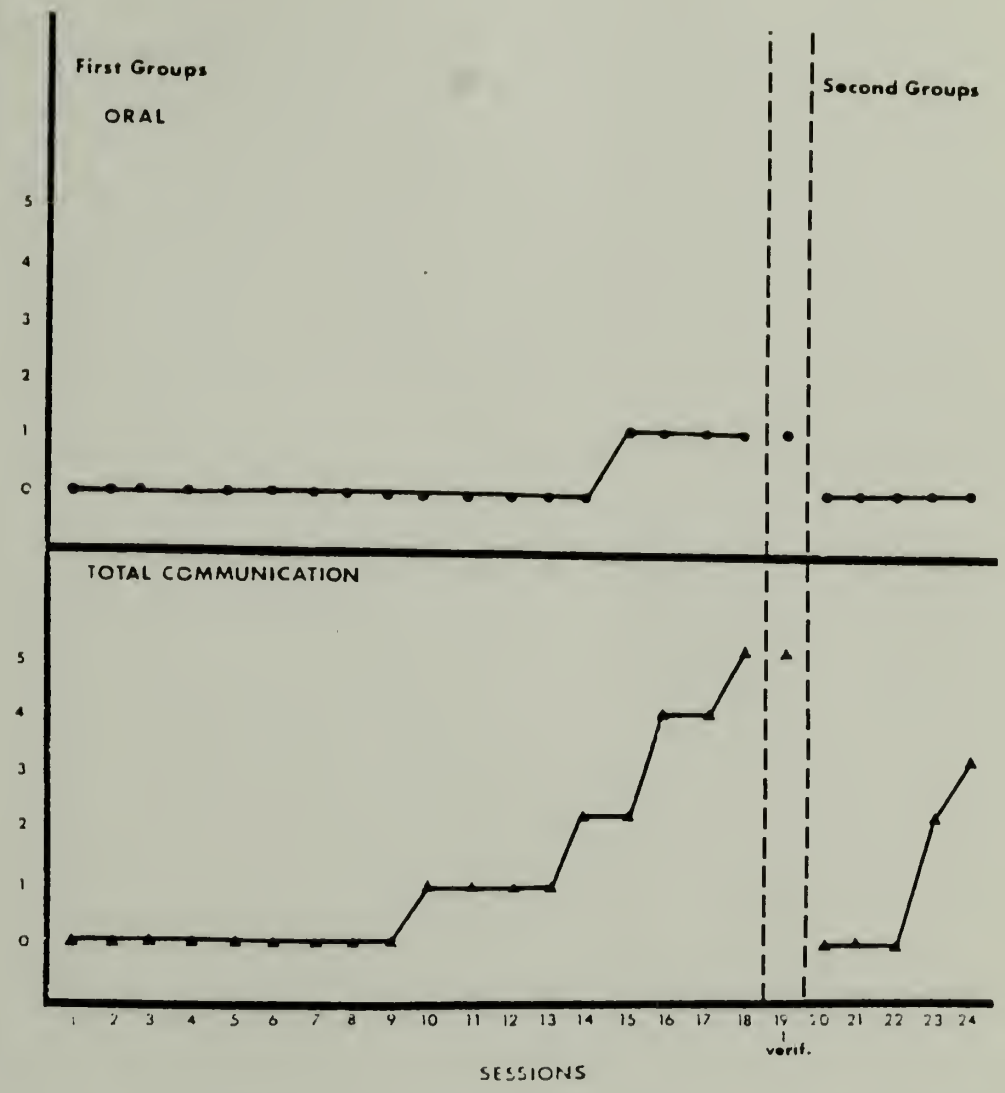
Training on the second groups of words was never completed with Subject No. 2. This was, in part, due to the fact that R. C. had developed a number of behavior problems which frequently made training impossible (i.e., ruminating, spitting, hitting and grabbing).

A comparison of each subject's performance across categories can, perhaps, be seen more clearly in Figures 12, 13 and 14, which display the cumulative totals of words at criteria across phase IV training. In addition to displaying a clear pattern of superior performance within the total communication category, data from subjects 1 and 2 (F. M. and P. B.) also depict a rapidly increasing acquisition curve for words trained within this format.



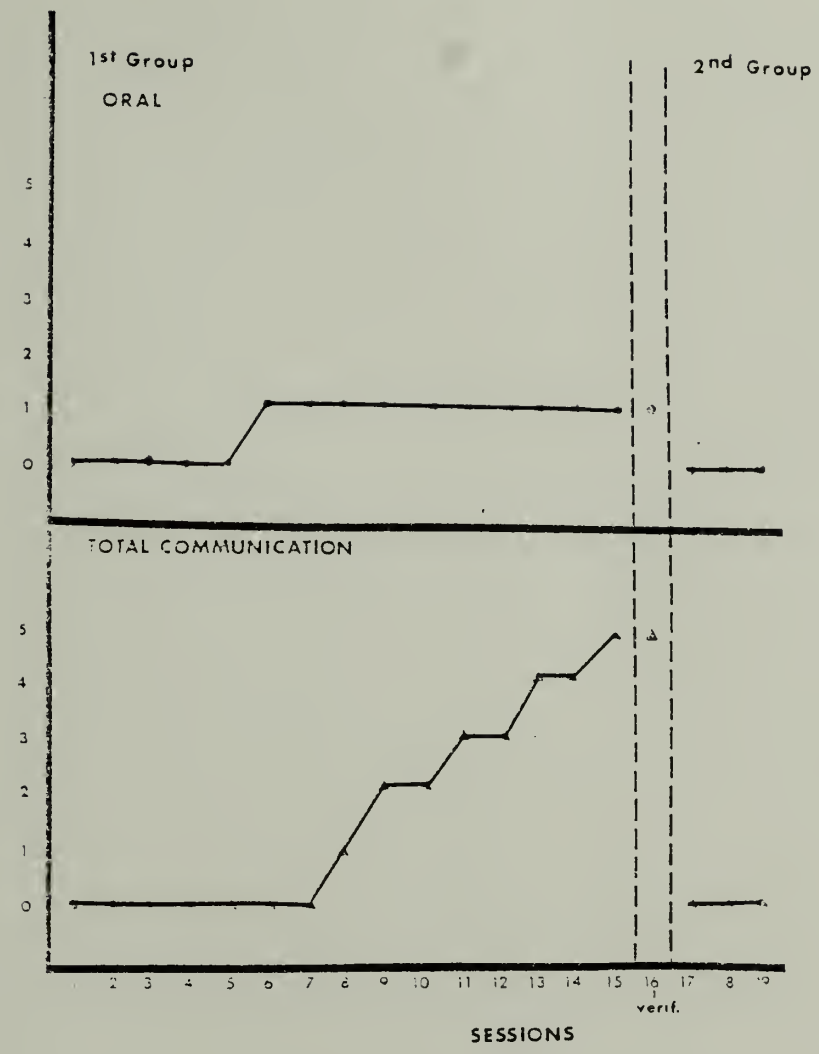
Cumulative Total of Words at Criterion — F.M.

Figure 12



Cumulative Total of Words at Criterion — P. B.

Figure 13

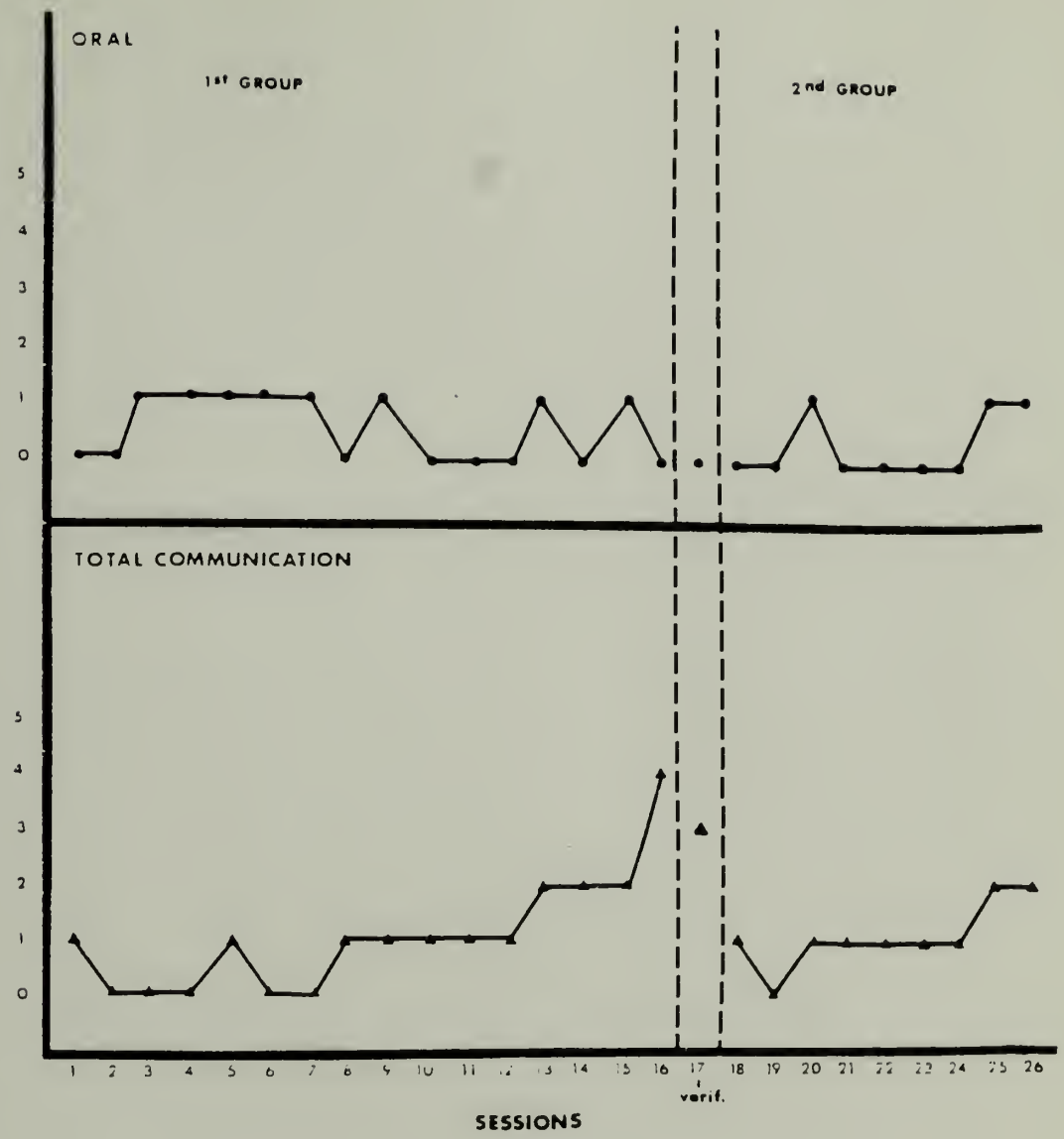


Cumulative Total of Words at Criterion — R.C.

Figure 14

Data collected during the daily probe sessions offered yet a more precise barometer of the subjects' progress through phase IV of the study, by assessing their responses to each word under a "non-contingent" reinforcement situation. Figures 15, 16 and 17 display this progress by indicating the number of words "correct" on each day of phase IV (correct = 2 correct spontaneous probe responses). Although these data show a similar pattern of superior performance within the total communication category, this pattern was generally less pronounced. During the first comparison with Subject 1-F. M., a maximum of only four words "correct" was noted in the total communication group (see Figure 15). Results of the second comparison with this subject revealed a maximum of only two words "correct" in the total communication group even though all five words had officially reached criterion. A similar pattern of depressed responding was found in the probe data for subject 3-R. C., where results of the first comparison indicate a maximum of four words "correct" within the total communication category.

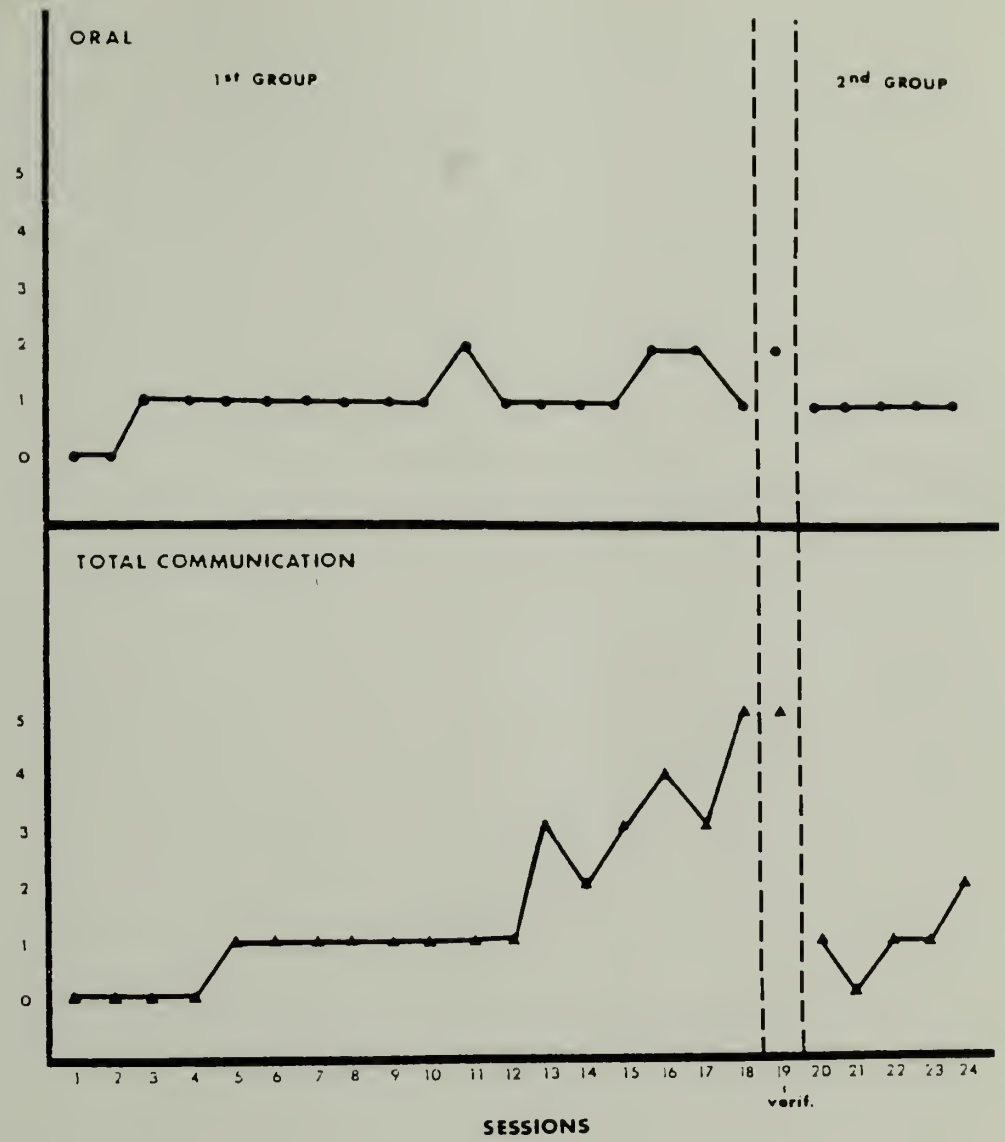
It should be noted here that lower levels of probe responding (i.e., one or two words "correct") were frequently inaccurate due to the occasional perseverative responding by a subject on whatever word was being trained immediately prior to the probe sessions (for example, if the child had just received five trials on the word "hat," and the probe session was then begun, the child would frequently respond with the word "hat" throughout the entire probe). This was found to be particularly true during the early stages of training with all subjects, and throughout oral training with subject 1-F. M.



Record of Words Correct During Probes -- F.M.

Correct 2 Correct Probe Responses

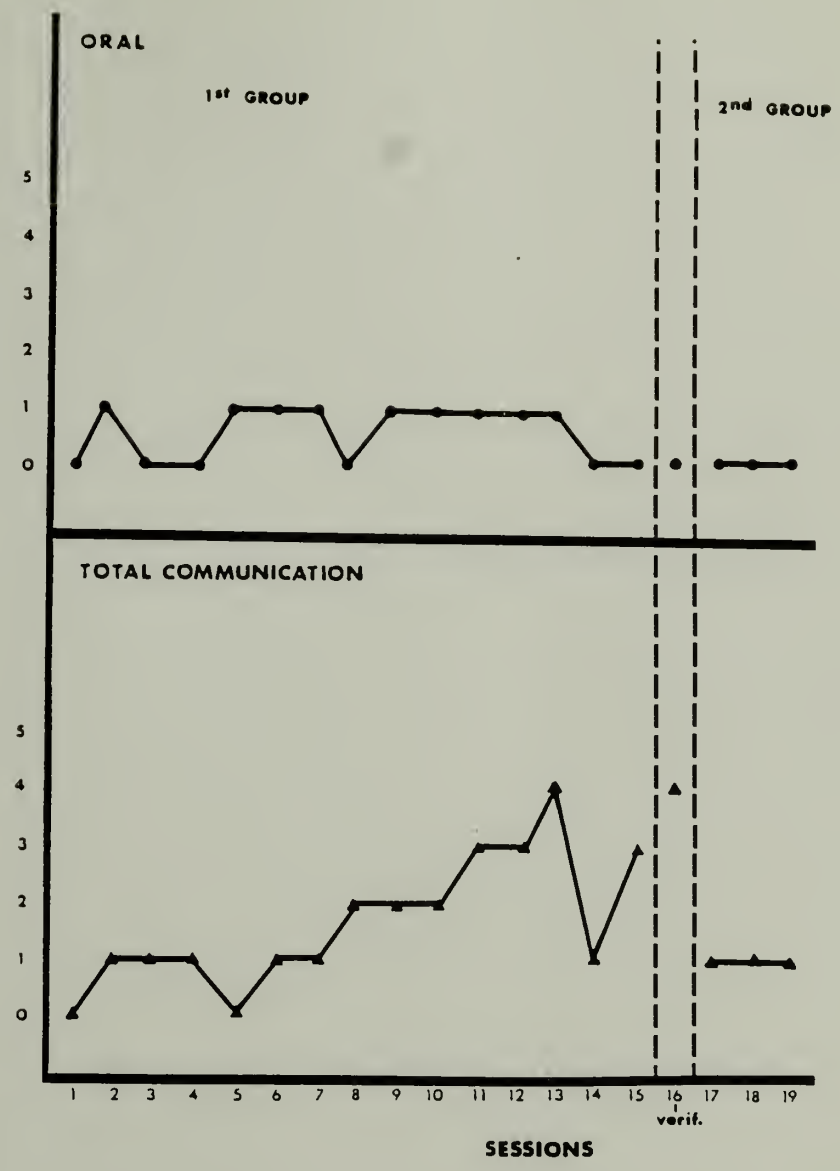
Figure 15



Record of Words Correct During Probes - P. B.

Correct 2 Correct Probe Responses

Figure 16



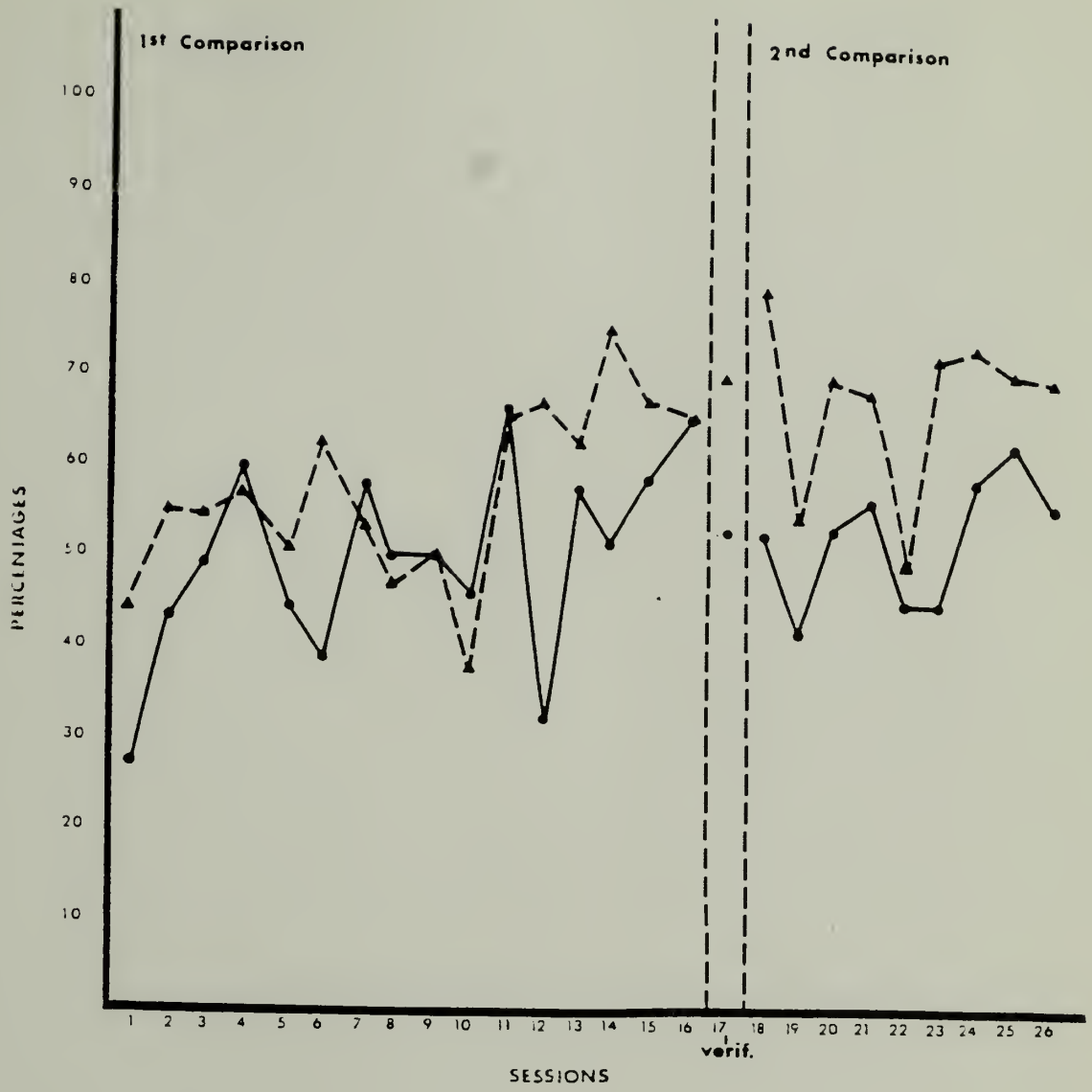
Record of Words Correct During Probes - R.C.

Correct = 2 Correct Probe Responses

Figure 17

Figures 18, 19 and 20 present each of the subjects performance during phase IV in terms of the percentage of correct spontaneous vocalizations across categories. While these data provide a measure of each child's daily performance, it is important to note that these measures were somewhat obscured by a number of procedural factors which directly affected performance on this variable (i.e., the number of words worked on during a session, the introduction of a new word into training, and the number of changes from one word to another during a training session). Despite these problems, responding by each of the subjects on this variable again indicated a general pattern of superior performance within the total communication category.

Although the results of training with subject 1-F. M. initially showed a great deal of variability across categories (see Figure 18, sessions 1-11), by session 12 a pattern of significantly higher performance within the total communication category emerged. This pattern remained clearly evident throughout the remainder of the phase IV training with F. M. Results of phase IV training with subject 2-P. B., displayed a steadily increasing performance in both categories (see Figure 19). It was noted, however, that the highest levels of performance were found in the total communication category. Results of these data with subject 3-R. C. are particularly interesting since they indicate initially higher levels of responding in the oral category, followed by a period of markedly superior performance within the total communication model (see Figure 20).

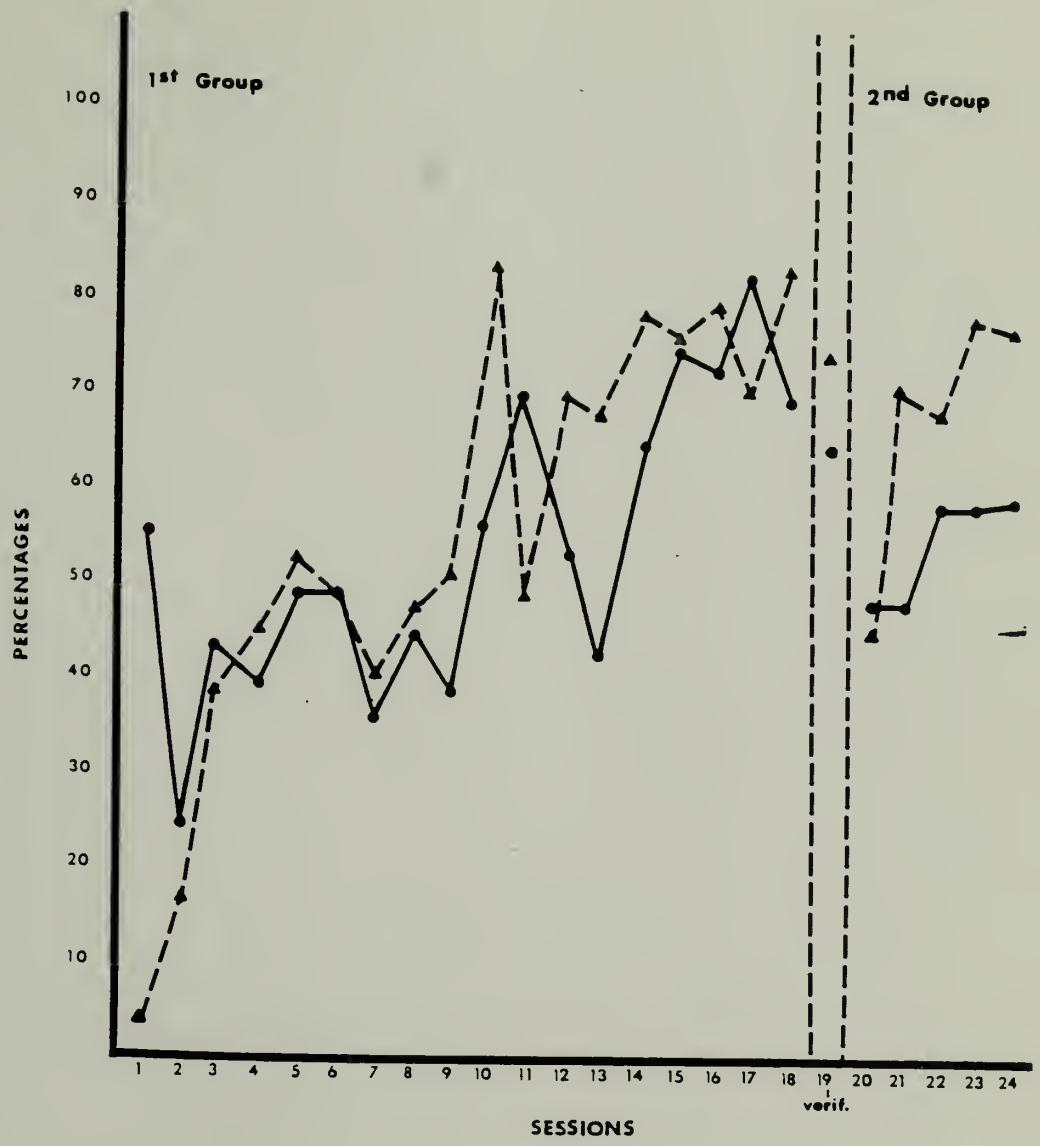


Percentage of Complete Spontaneous Vocal Responses - F.M.

▲ - Total Communication

● - Oral

Figure 18

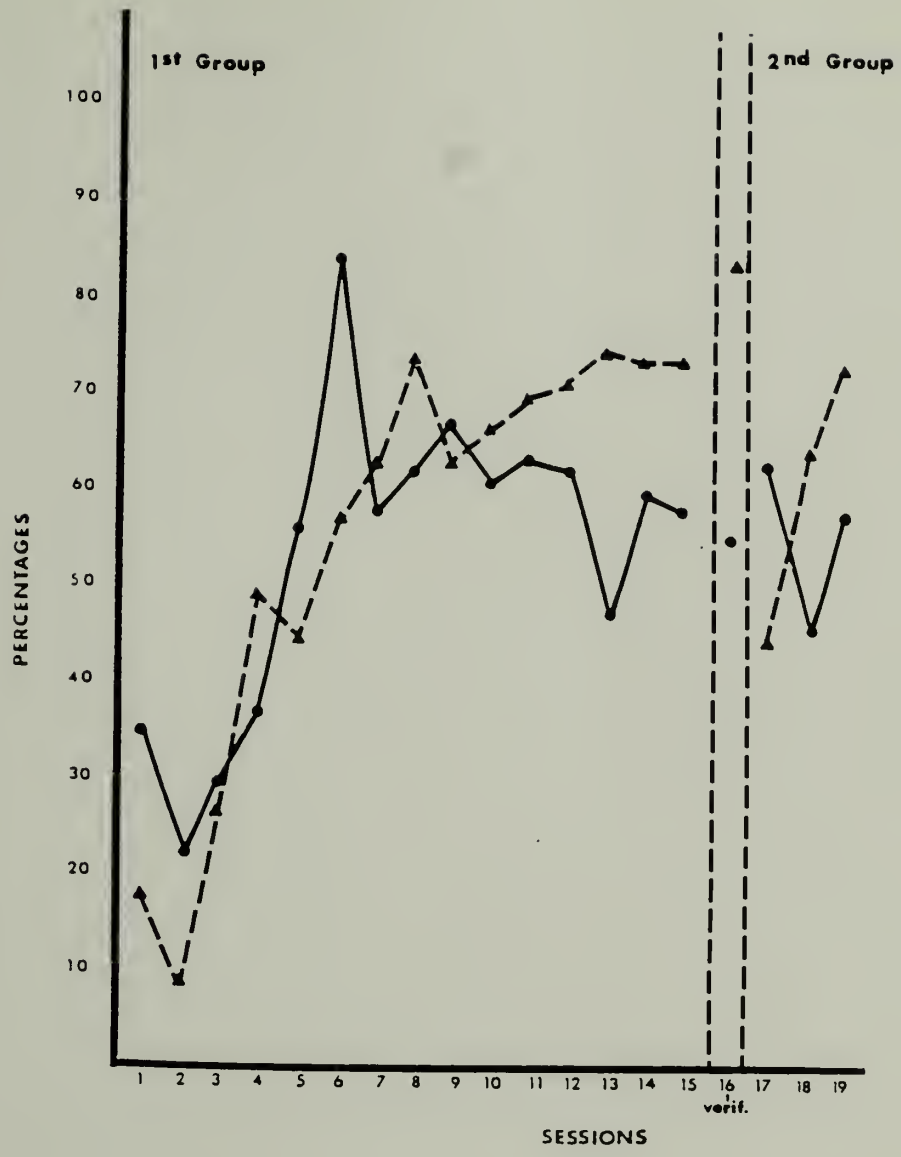


Percentage of Complete Spontaneous Vocal Responses - P.B.

▲ **Total Communication**

● **Oral**

Figure 19



Percentage of Complete Spontaneous Vocal Responses - R.C.

▲ Total Communication

● Oral

Figure 20

Data on the mean percentage of correct spontaneous vocal responses across categories provide further support for these findings. As noted in Table 9, the mean percentage of correct spontaneous vocal responses was higher in the total communication category in each comparison with all three subjects. In addition, it was noted that during training on the second groups of words with each child, the superiority of the total communication model became even more pronounced.

TABLE 9

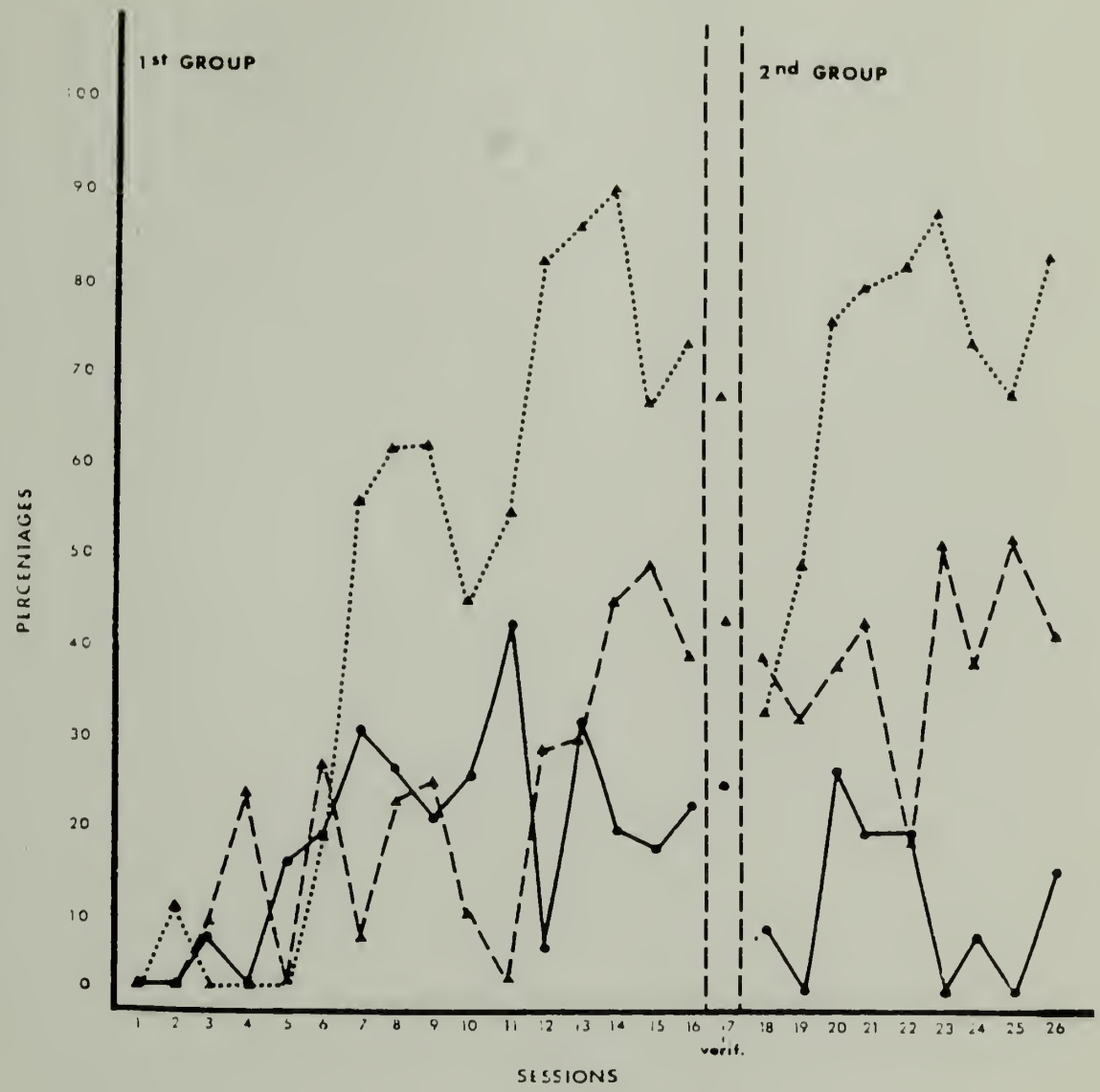
MEAN PERCENTAGE OF CORRECT SPONTANEOUS VOCAL RESPONSES ACROSS CATEGORIES--ALL SUBJECTS

	First Groups	Second Groups	Combined
Subject 1--F. M.			
Oral	50%	54%	52%
Total Comm.	59%	68%	63%
Subject 2--P. B.			
Oral	55%	55%	55%
Total Comm.	57%	71%	60%
Subject 3--R. C.			
Oral	55%	56%	55%
Total Comm.	58%	64%	59%

Since effective language acqusition is defined by an individual's ability to discriminate between objects and label each appropriately, a

measure was taken of each subject's ability to spontaneously change (without prompting) from one word to another. These data are presented in Figures 21, 22 and 23, in which the percentage of vocal spontaneous changes across categories are plotted over the course of phase IV training sessions.

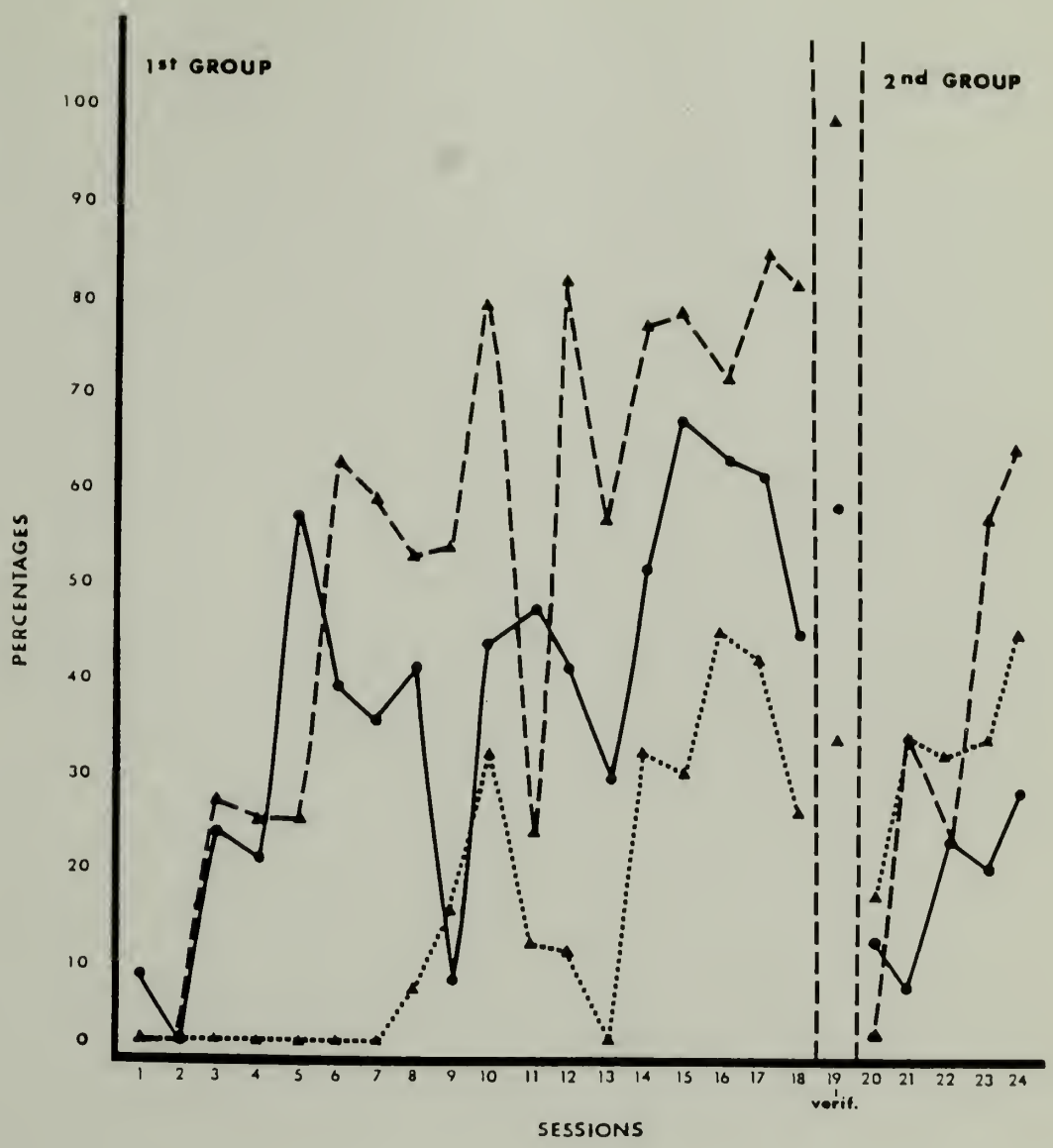
Again, the results of this analysis with each of the subjects point to a markedly superior pattern of performance within the total communication category. This separation in performance across categories was most pronounced in the results of this analysis with subjects 2 and 3 (P. B. and R. C.). With each of these subjects, performance within the total communication category was consistently higher than performance in the oral model (see Figures 22 and 23). While the initial stages of phase IV training with subject 1-F. M. show a great deal of variability in responding across categories, by day 14 a consistently higher pattern of vocal performance within the total communication category emerged (see Figure 21). This pattern continued throughout the remainder of phase IV training on the second groups of words with F. M. Although this analysis failed to show a separation in performance across categories until day 14, an analysis of F. M.'s gestural spontaneous changes during this period demonstrated what would appear to be a significantly better ability to respond through gestural systems. Interestingly, F. M. was the only subject who reached higher levels of gestural spontaneous changes than vocal spontaneous changes during total communication training (see Figure 21). With each of the other subjects, however, a steady increase in the percentage of spontaneous



Percentage of Vocal Spontaneous Changes Across Categories -- F.M.

Total Communication (Vocal Changes)
Total Communication (Gestural Changes)
Oral

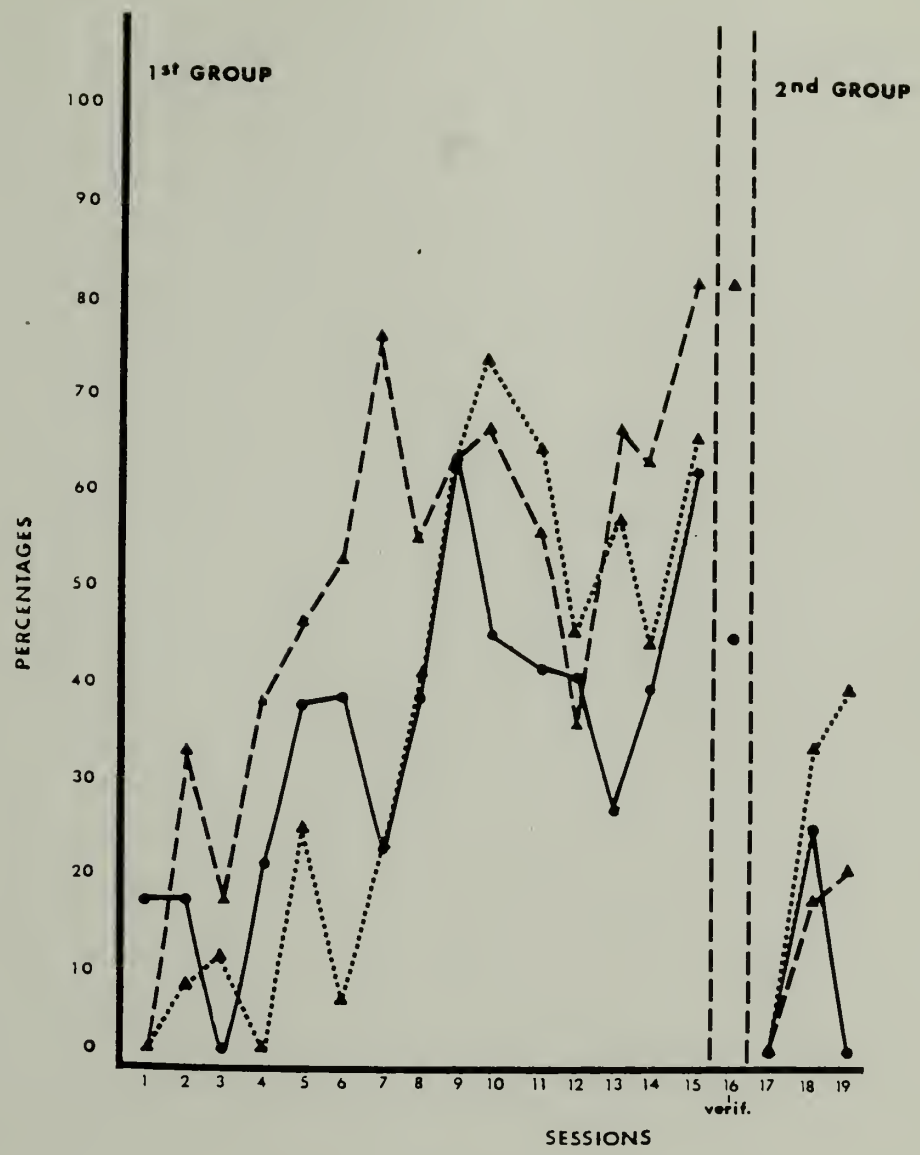
Figure 21



Percentage of Vocal Spontaneous Changes Across Categories - P. B.

— Total Communication (Vocal Changes)
— Total Communication (Gestural Changes)
— Oral

Figure 22



Percentage of Vocal Spontaneous Changes Across Categories - R.C.

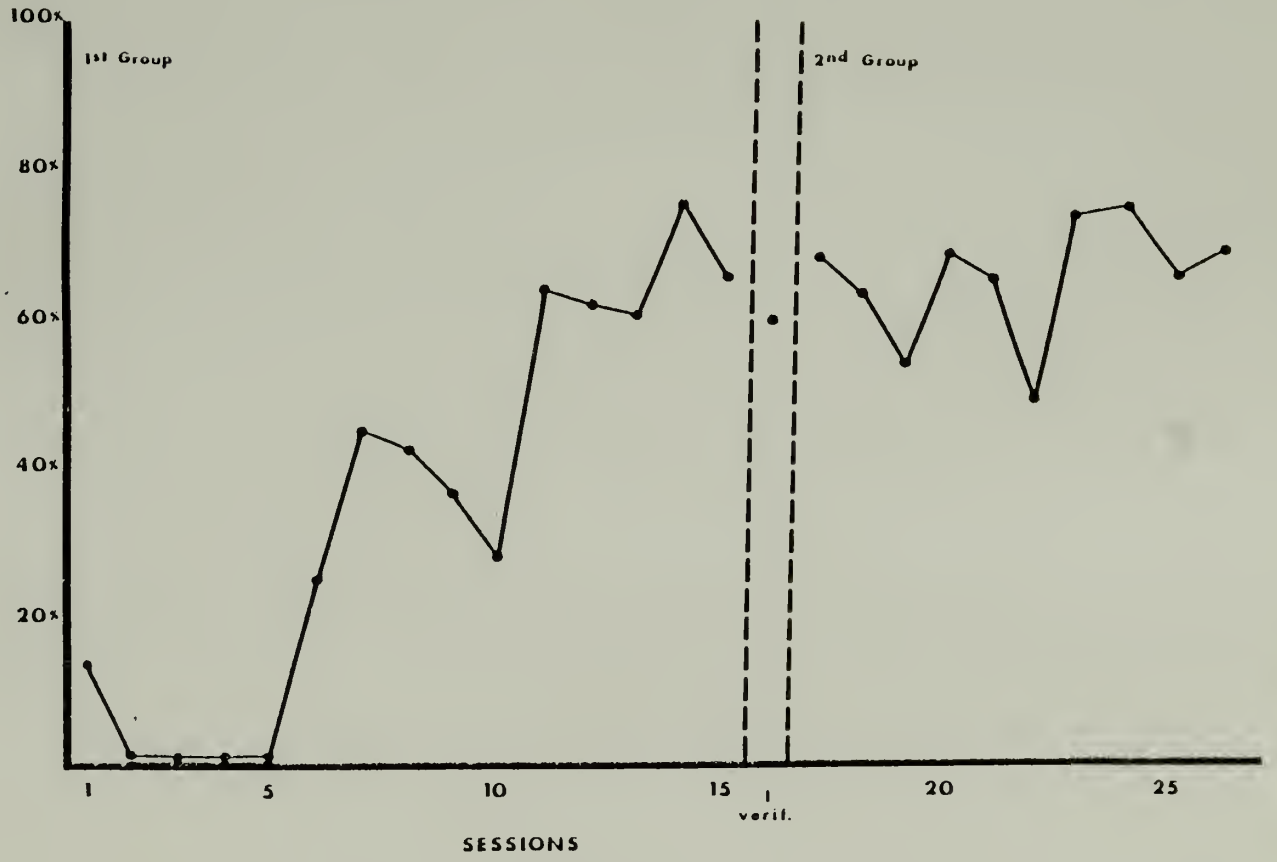
— Total Communication (Vocal)
— Total Communication (Gestural)
— Oral

Figure 23

gestural changes was noted over the course of phase IV training (see Figures 22 and 23).

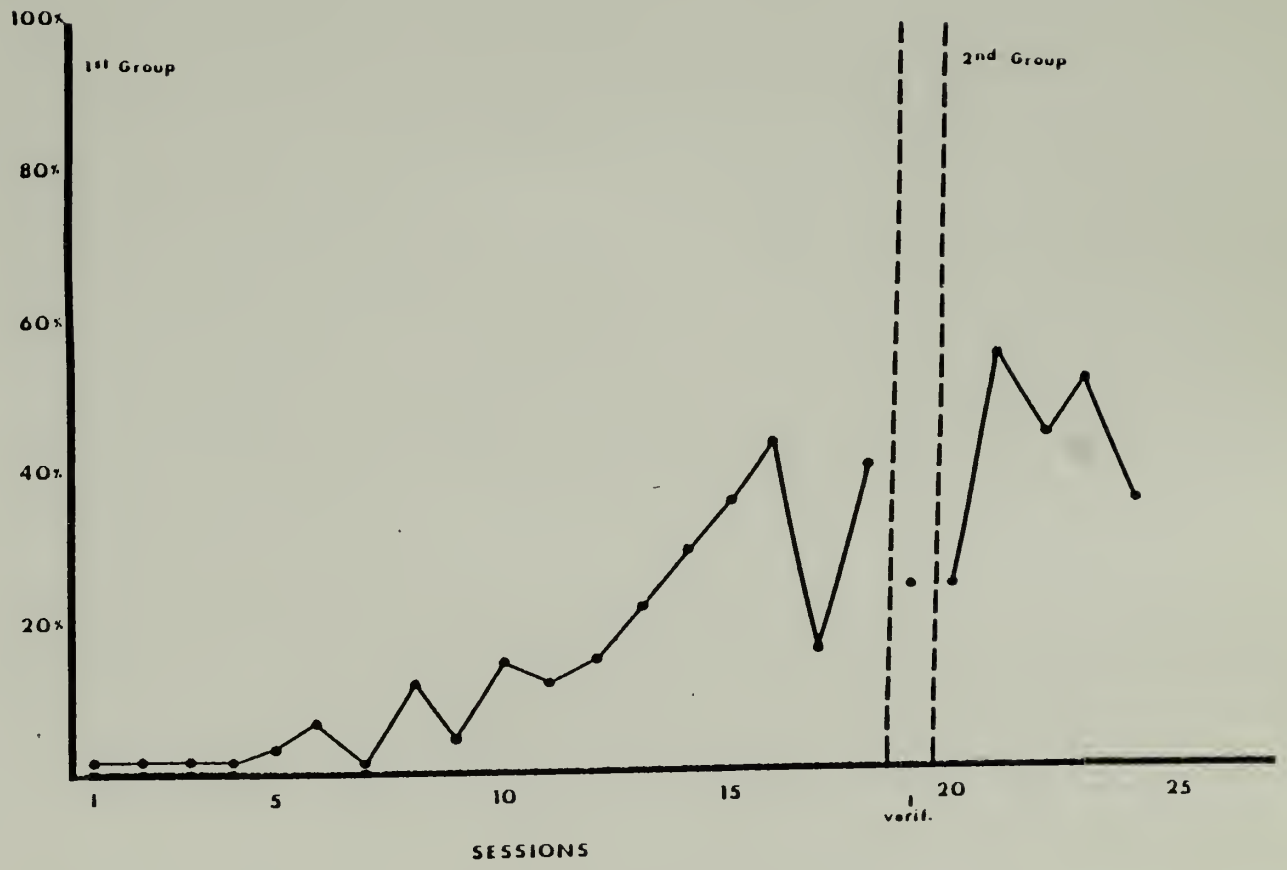
Data on the percentage of correct spontaneous combined responses (simultaneous vocal and gestural) during phase IV total communication training further demonstrate the importance of the additional gestural input provided by the model. As indicated in Figures 24, 25 and 26, each of the subjects showed 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 subjects, anecdotal reports of phase IV training revealed characteristic differences in the manner in which the subjects responded. "Combined form" responding of subjects 2 and 3 (P. B. and R. C.) was characterized by simultaneous vocal and gestural responses. In contrast, subject 1-F. M. typically would respond first with the appropriate sign, and then after a second or two with the correct vocal response.

Within training categories, differences in performance on specific words were noted. Figures 27, 28 and 29 display each subject's performance on all of the words trained during phase IV, by indicating the number of trials to criterion for each word. Figures 30, 31 and 32, on the other hand, offer a brief analysis of these within category differences in terms of the assigned difficulty levels. Results of this analysis, with all three subjects, reflected no systematic separation of performance between words at different difficulty levels. Instead, performance on individual words appeared to be most directly related to the



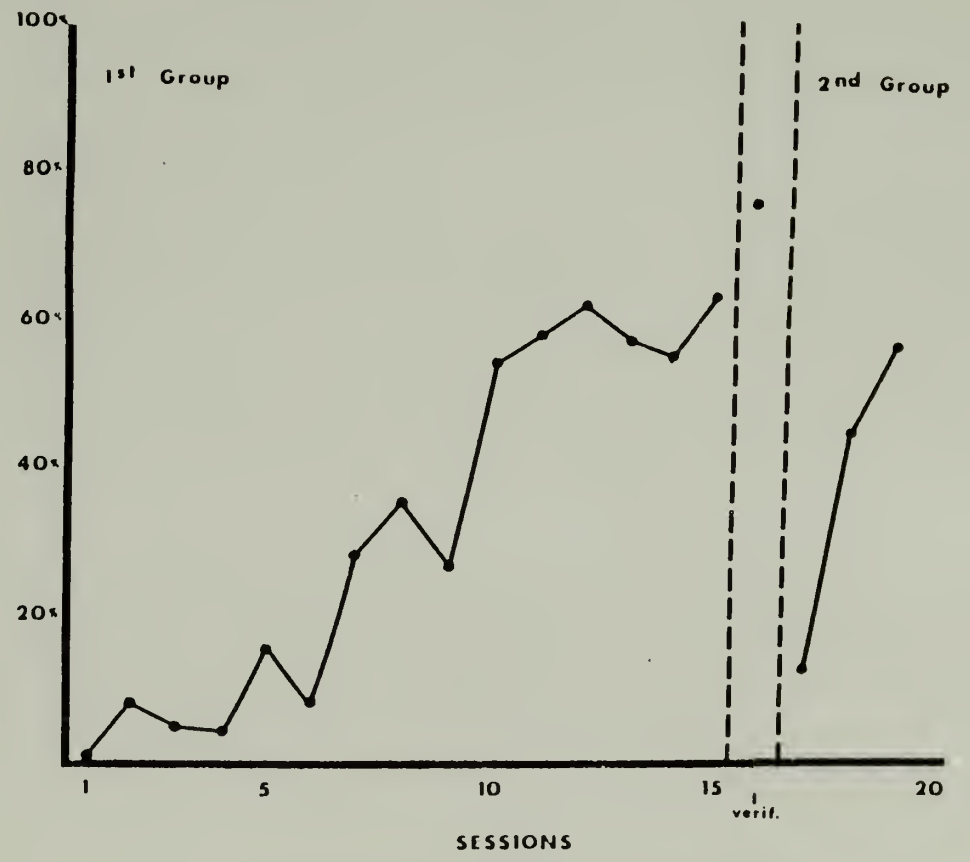
Percentage of Correct Combined Responses - F.M.

Figure 24



Percentage of Correct Combined Responses - P. B.

Figure 25



Percentage of Correct Combined Responses - R.C.

Figure 26

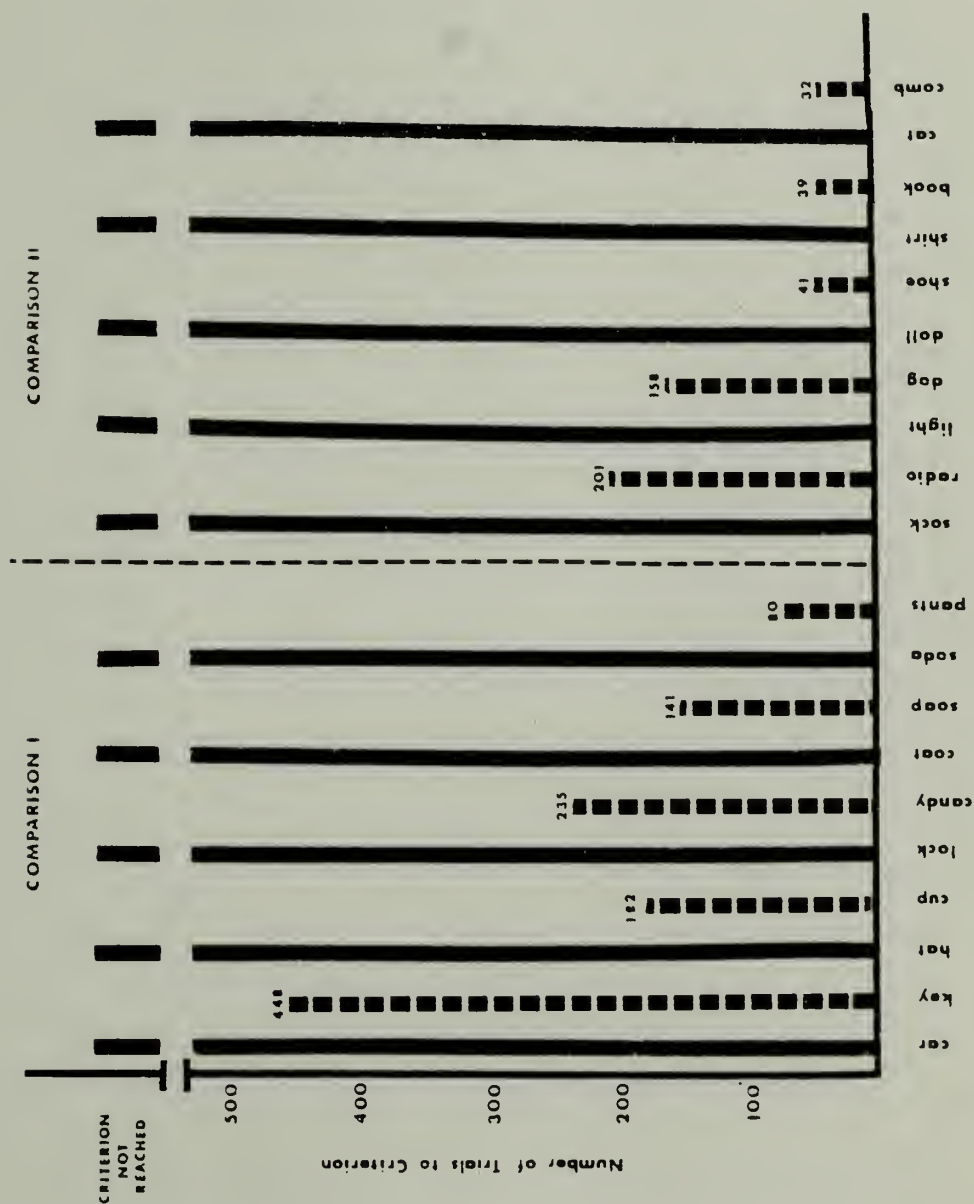

COMPARISON I
COMPARISON II
CRITERION NOT REACHED
Number of Trials to Criterion
500
400
300
200
100
car
key
hat
cup
lock
candy
coat
soap
soda
pants
sock
radio
light
dog
doll
shoe
shirt
book
cat
comb
448
182
235
141
68
201
158
41
39
32
Number of Trials to Criterion per Word -- F.M.
- Total Comm.
- Orol

Figure 27

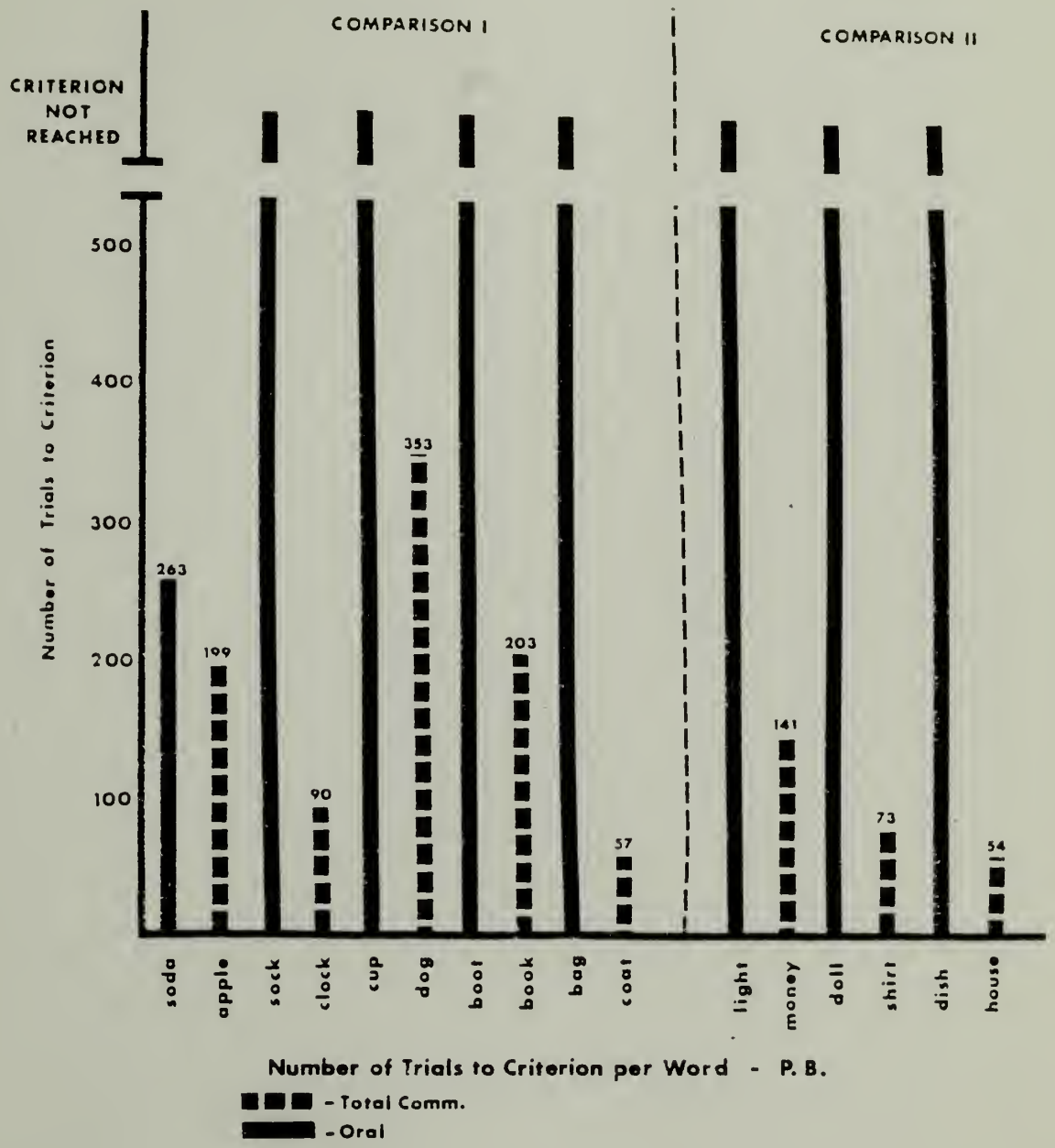

COMPARISON I
COMPARISON II
CRITERION NOT REACHED
Number of Trials to Criterion
500
400
300
200
100
263
199
90
353
203
57
141
73
54
soda
apple
sock
clock
cup
dog
boot
book
bag
coat
light
money
doll
shirt
dish
house
Number of Trials to Criterion per Word - P. B.
- Total Comm.
- Oral

Figure 28

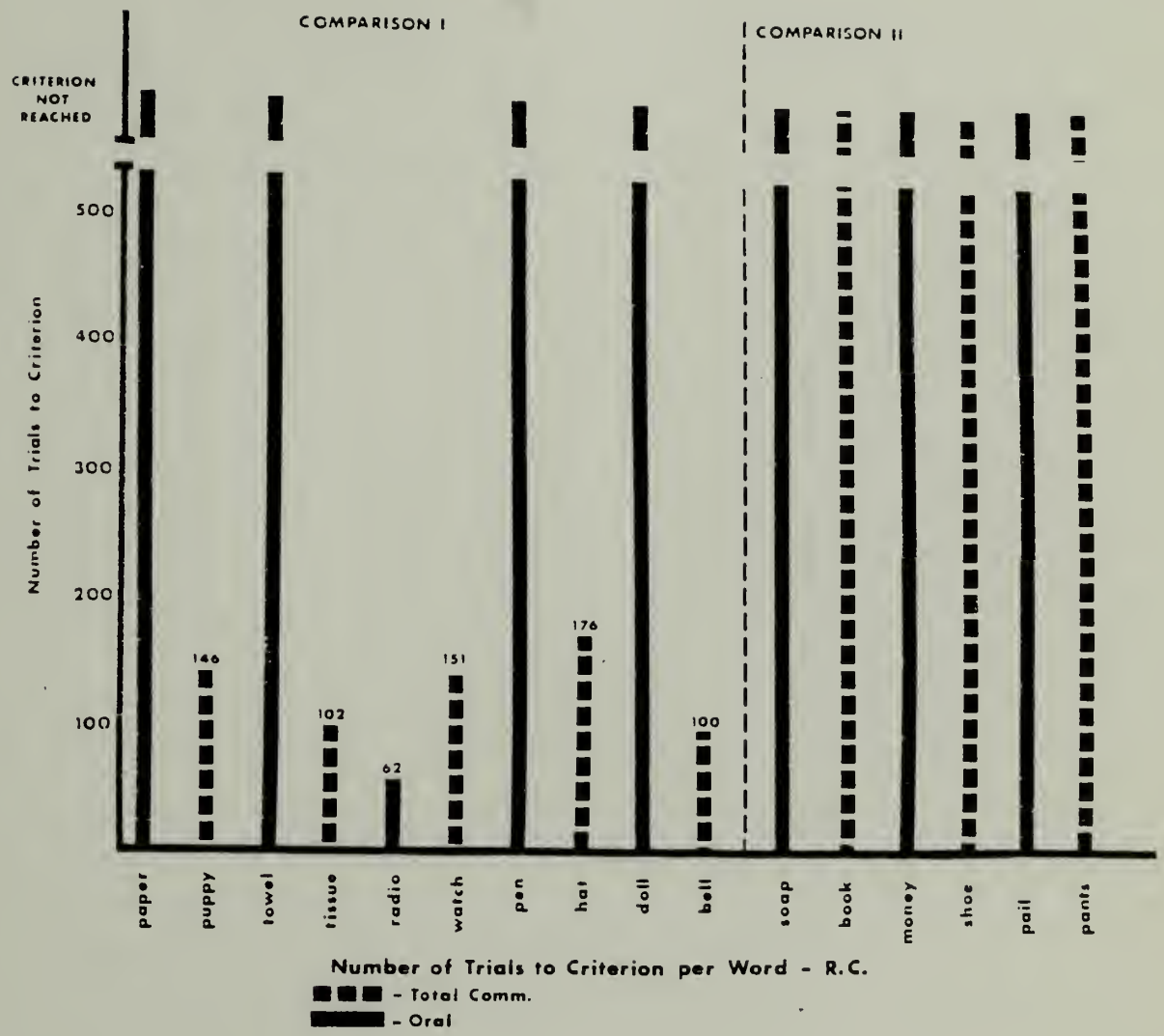

COMPARISON I
COMPARISON II
CRITERION NOT REACHED
Number of Trials to Criterion
500
400
300
200
100
146
102
62
151
176
100
paper
puppy
towel
tissue
radio
watch
pen
hat
doll
bell
soap
book
money
shoe
pail
pants
Number of Trials to Criterion per Word - R.C.
- Total Comm.
- Oral

Figure 29

FIGURE 30

INDIVIDUAL WORD COMPARISON CHART--F. M.

Oral:

Level of Difficulty	Word	Group	No. of Trials to Criterion
1.0 level	car	1	N/C
	hat	1	N/C
	cat	2	N/C
1.5 level	doll	2	N/C
	lock	1	N/C
2.0 level	soda	1	N/C
	coat	1	N/C
	light	2	N/C
	shirt	2	N/C
3.0 level	sock	2	N/C

Total Communication

1.0 level	key	1	448
	dog	2	158
1.5 level	cup	1	182
	candy	1	235
	book	2	39
2.0 level	pants	1	80
	soap	1	141
	shoe	2	41
	comb	2	32
3.0 level	radio	2	201

$\bar{X}$ no. of trials first group = 217.2
$\bar{X}$ no. of trials second group = 94.2

N/C = Criterion not reached

FIGURE 31

INDIVIDUAL WORD COMPARISON CHART--P. B.

Oral:

Level of Difficulty	Word	Group	No. of Trials to Criterion
1.0 level	bag	1	N/C
1.5 level	boot	1	N/C
	cup	1	N/C
	doll	2	N/C
2.0 level	soda	1	263
	dish	2	N/C
2.5 level	light	2	N/C
3.0 level	sock	2	N/C
Total Communication			
1.0 level	dog	1	353
1.5 level	book	1	203
	apple	1	199
2.0 level	coat	1	57
	money	2	141
	shirt	2	73
	house	2	54
3.0 level	clock	1	90

$\bar{X}$ no. of trials first group = 180.4
$\bar{X}$ no. of trials second group = 89.3

N/C = Criterion not reached

FIGURE 32

INDIVIDUAL WORD COMPARISON CHART--R. C.

Oral:

Level of Difficulty	Word	Group	No. of Trials to Criterion
1.0 level	pen	1	N/C
1.5 level	doll	1	N/C
	pail	2	N/C
2.0 level	paper	1	N/C
	soap	2	N/C
	money	2	N/C
3.0 level	towel	1	N/C
	radio	1	62
Total Communication			
1.0 level	hat	1	176
1.5 level	bell	1	100
	book	2	N/C
2.0 level	puppy	1	146
	shoe	2	N/C
	pants	2	N/C
3.0 level	tissue	1	102
3.5 level	watch	1	151

N/C = Criterion not reached

subjects' relative familiarity with the model at the time when the word was introduced into training (i.e., the earliest words trained during the first comparison characteristically required more trials to reach criterion than words introduced into training at a later time). Results on the number of trials to criterion per word for subjects 1 and 2 (F. M. and P. B.) directly support this finding by demonstrating a marked decrease in the mean number of trials to criterion from first to second groups (see Figures 30 and 31).

CHAPTER IV

DISCUSSION

The results of this research demonstrate quite clearly that total communication proved to be by far the most effective strategy for teaching expressive vocal communication skills to each of the three subjects. Before analyzing the factors which may have contributed to the success of this approach, however, it is important to first review the specific measures of performance which demonstrated the superiority of the total communication model.

Although the project involved a total of six separate language training model comparisons, only five of these comparisons were completed (two with subject 1-F. M., two with subject 2-P. B., and one with subject 3-R. C.). In each of the completed comparisons, however, the results revealed substantially better performance within the total communication model. This improved performance during total communication training was, perhaps, made most evident by the fact that in each comparison all of the words in the total communication category were learned, as compared with a maximum of only one word in the oral category. Further evidence of the superiority of this approach was found in the results of total communication training on the second group of words with subjects 1 and 2 (F. M. and P. B.), where a rapidly increasing rate of acquisition was noted. In contrast, acquisition rate during secomd comparison oral training remained consistently poor.

Although the results of the daily probe sessions did not produce as pronounced an effect as did the word acquisition data, these results

did provide additional support for the superiority of total communication training by demonstrating consistently higher levels of correct spontaneous vocal responding. Further supportive evidence was found in the analysis of the percentage of correct vocal responses within each category, over the course of phase IV training. While the results of training with each subject showed a gradual increase in this percentage in both the oral and total communication categories, it was noted that responding was consistently higher during total communication training. In fact, data from each of the subjects on the mean (X) percentage of correct spontaneous vocal responses across categories showed not only consistently higher responding during total communication, but also marked improvements in this form of responding as training progressed. In contrast, no concomitant increases were noted in the oral category.

An analysis of the percentage of vocal spontaneous changes across categories also provided evidence for the superiority of the total communication model. Results of this analysis with subjects 2 and 3 (P. B. and R. C.) revealed a marked separation in performance across categories and a pattern of consistently higher levels of responding in total communication. Although a similar pattern was found in the results of this analysis with subject 1-F. M., no distinguishable separation in performance across categories was noted until day 14 of phase IV training.

In order to obtain a better understanding of why total communication proved to be such an effective and successful approach for teaching expressive vocal language skills to these children, it is necessary to consider a number of specific factors which may have contributed to this

success. For the most part, these factors can be broken down into three major areas: (a) factors relating to the characteristics of the training models, (b) factors relating to the procedures used in training and (c) factors relating to the characteristics of the population. Each of these areas will be considered in the following discussion.

Factors Relating to the Characteristics of the Training Models

Perhaps the most important of these factors relates to the form and number of cues presented to the child during training. Total communication, by definition, involved the use of simultaneous vocal and gestural (sign) cues to teach expressive vocalizations (speech). In reality, however, it involved not only the auditory (vocal) and visual (gestural) cues, but also important kinesthetic cues (motions of the signs) which the child could then use in both learning and recalling words (i.e., sign for dog = slapping right leg twice, sign for shirt = brushing open hands over chest, etc.). Oral training, on the other hand, involved a much more limited cueing system, with only auditory (vocal) cues used during training. Although it is impossible to determine conclusively from this study the extent to which these intrinsic differences alone relate to the success of the total communication model, an analysis of each subject's responding during phase IV total communication training would suggest that they were indeed attending to and using both gestural and vocal cues to learn words in the total communication group. Despite the fact that during total communication training reinforcement was delivered contingent upon correct vocal

responses, steady increases in gestural (sign) responding were found with each of the subjects. In addition to these general increases in gestural responding, similar increases were noted in each of the subjects' use of combined vocal and gestural responses.

Because of their temporal continguity with the reinforced vocal response, gestural responses may have been fortuitiously increased. As such, total communication training of speech may characteristically work to establish a chain of vocal and gestural responding which might also result in increased attention to all relevant training cues. Although this is a hypothetical analysis of the potential effect of multiple cues during training, anecdotal reports of total communication training suggest that each of the subjects was using both the gestural and vocal information. On a number of occasions with each child it was noted that if the child was experiencing difficulty in recalling a specific vocalization, the presentation of even a partial gestural cue would provide enough additional information to occasion the appropriate vocal response (i.e., when presented with the training stimulus of "coat," if P. B. showed that she was experiencing difficulty in recalling the correct vocalization, a partial gestural (sign) prompt would often provide her with enough information for her to recall and produce the vocal response of "coat). Other evidence which might support this analysis was noted during phase IV oral training. It was frequently noted that the subjects' echolalic vocal behavior seemed to directly interfere with their ability to recall words taught during oral training. For example, if F. M. was presented with the training stimulus for "book" and given a

full vocal prompt, she would respond with the word "book" quite clearly. If training was then shifted to another object, however, F. M. would typically continue to respond with the word "book" until another vocal prompt was presented. While this form of perseverative echolalic responding was found during oral training with each of the three subjects, it was not evident during total communication training.

Since the major difference between oral and total communication training was the inclusion of gestural (sign) cues in the total communication model, it was felt that these visual and kinesthetic cues, in some way, served to interrupt the echolalic response and, thereby, allow the subjects to focus their attention on the accurate production of the appropriate vocalization.

Another factor which may have contributed to the success of the total communication model relates to the symbolic/iconic qualities of gestural communication systems. For all practical purposes, vocal communication is a highly symbolic form of expression. That is, very few verbalizations resemble the object, thought or action they are meant to express. Signs, on the other hand, are a highly iconic form of expression insofar as many signs closely resemble, or are closely related to the object, thought or action they are meant to convey (e.g., the sign for shirt is both hands brushing over the chest where the shirt rests on the body, the sign for soap is both hands rubbing back and forth as you would if you were soaping your hands). This iconic quality, however, is not characteristic of all signs (e.g., sign for dog is one hand slapping the leg just above the knee, sign for cracker is one hand closed in a

fist tapping the elbow of the opposite arm). For those signs where it is a factor, the level of iconicity varies greatly from sign to sign. Although it was not a goal of this study to determine the extent to which iconicity alone has affected the results, it is important to recognize it as an important intrinsic chracteristic of gestural communication systems which may serve as a facilitator for language acquisition.

Factors Relating to the Procedures Used in Training

Since rate of word acquisition depends to a great extent on the difficulty of the word being taught, it is important to reexamine the word selection procedure, in light of the final data, to determine if this process might have had some effect on the outcome of the study. It is important to indicate here that this word selection procedure was by no means an exact process. Rather, it was an attempt to carefully and systematically evaluate and rate each word based on a number of subjective and objective measures which might affect the difficulty encountered by the child in learning a word.

If it can be assumed that less complex words should be learned more quickly, it should follow that the more simple the word, the fewer number of trials should be required for criterion to be reached. Interestingly, this premise was not found to be consistent with the results of training in either of the two categories. During oral training with R. C., the only word to reach criterion was "radio," which was rated at the 3.0 level of difficulty. In contrast, none of the words at the

2.0, 1.5 or even 1.0 levels of difficulty ever reached criterion. Similarly, during oral training with subject 2-P. B. only the word "soda" (2.0 level of difficulty) reached criterion, while none of the more simple words at the 1.0 or 1.5 levels did. The fact that each of these words (i.e., "soda" and "radio") may have had many conditioned reinforcing characteristics associated with it, might help to at least partially explain this discrepancy.

An inspection of each subject's acquisition data for words trained within the total communication model also reflected no systematic separation of performance between words at different difficulty levels. Rather, performance on individual words appeared to be directly related to the subject's relative familiarity with the model at the time when the word was introduced into training. Since all of the subjects succeeded in acquiring even the most difficult words in the total communication category, and since the same word rating procedure was used for all of the words trained during phase IV, it was felt that the word selection process could not have had a significant effect on the outcome of the study.

Another procedural issue which warrants discussion here relates to the distribution of trials across training categories. This issue was a particularly difficult one to address at first, since in conducting a comparison of language programs, one would ideally want to evaluate these programs in their natural form. Intrinsic differences, however, existed between training models which made this type of "natural form" comparison very difficult. For example, the amount of time required to

model a vocal (oral) response was much shorter than the amount of time needed to simultaneously model both vocal and gestural responses. Consequently the number of trials possible during an oral training session was intrinsically greater than the number of trials possible during a total communication session. In an attempt to balance, somewhat, the number of trials presented per category each trial was extended for a ten second period. Despite these efforts, however, results of phase IV training with subjects 2 and 3 (P. B. and R. C.) showed consistently fewer trials conducted per session in the total communication category. Since an increased number of trials, ideally, should have facilitated word acquisition, these differences between oral and total communication categories were seen as additional evidence supportive of the superiority of the total communication model. Results of training with subject 1-F. M., however, showed a fairly close balance across categories, with an average of six or more trials conducted in the total communication model. For the most part, this difference was due to F. M.'s exceptionally poor performance in the oral category which led to a general slowing of training within that model (of the three subjects, F. M. demonstrated the lowest levels of oral spontaneous changes). It was felt, however, that this relatively small difference in the number of trials per category was not significant enough to account for the very marked differences between these categories in terms of the number of words learned during phase IV.

Factors Relating to the Characteristics of the Child and Population

As described in the procedure section, a fairly stringent selection criterion was used to identify appropriate subjects for this study. A review of the subject descriptions reveals that, indeed, a homogeneous group of subjects was selected. In addition to meeting the six selection criteria, each subject displayed a number of other similarities that bear noting here. In the records it was reported that each of the subjects displayed a normal development of language until approximately the age of 18-24 months, followed by a sudden dramatic disappearace of all signs of receptive and expressive communication. Similarly, a review of the records revealed that each of the subjects had a history of nonfunctional use of language, which was characterized by both immediate and delayed echolalia.

Although an analysis of the effect of early language development, and subsequent loss, is beyond the scope of this work, this similarity between subjects is worthy of note for the implications which it might have for later language development. An analysis of the effect of the historical pairing of spoken words and nonmeaning, however, provides us with some interesting insights.

Although it is impossible to determine with any precision the amount or degree of nonfunctional language used by the subjects prior to this study, both age and prior reports from relevant family members and professionals made it possible to obtain a rough measure of this nonfunctional linguistic history. From these indices it was determined

that subject 1-F. M. had the longest history of nonfunctional usage of language, and subject 2-P. B. had the shortest history. When the results of phase IV training were considered in light of this prior history, an interesting pattern emerged. It was noted in the results of both the percentage of correct spontaneous vocalizations and the percentage of correct spontaneous changes, that the child with the shortest history of nonfunctional language (P. B.) reached the highest levels of responding of all three subjects. Conversely it was also noted that the subject with the longest history of nonfunctional language (F. M.) responded at the lowest levels of the three subjects. It would appear then that a child's prior experience with nonfunctional language would be of particular importance since it might serve to inhibit the rate of later functional language development.

This type of informal analysis is of particular interest since it raises some important questions about the effect of prior history on the development of expressive language skills. However, it should be pointed out that these are only suggestive of a pattern which would require extensive and careful investigation before any firm theoretical conclusions could be made.

Special Issues

In order to assess whether a word had been learned during training, a criterion for acquisition was set. Although previous research in language acquisition with this population had used a criterion of as low as five consecutive correct responses it was felt that a more stringent

measure of acquisition was needed. For this reason acquisition criterion for this project was set at fifteen consecutive correct responses. In order to avoid "artificial" acquisition of a work by virtue of massed responding, a further requirement was made that the fifteen consecutive correct responses be intermixed with responding on at least two other words. Despite these attempts to assure for an accurate measure of learning, post acquisition responding with subjects 1 and 3 (F. M. and R. C.) occasionally fell below a level of 60% correct during a session. With subject 3-R. C. this post acquisition drop in responding was only found on the one word she acquired in the oral category, "radio." With subject 1, however, this drop in responding occurred on three different words trained in the total communication category (i.e., soap, cup and shoe). While this type of drop in performance would indicate that perhaps an even more stringent measure of acquisition is necessary in order to accurately assess learning, the criterion used in this study did provide a consistent measure for comparing responding across categories.

Summary

The results of this study demonstrate quite clearly that total communication training proved to be the most effective strategy for teaching expressive vocal communication skills to each of the three subjects. In addition, the repeated replication of these results both within and across subjects would suggest that total communication may be, in general, the most effective of these two treatment approaches for teaching expressive language skills to echolalic children.

A number of specific factors might account for the marked success of this model. Included in these are: an intrinsically more extensive cueing system which the child could use to process, code and recall information, the development of chains of vocal and gestural responding which may serve to interrupt echolalic behavior and thereby allow the child to focus attention on the accurate production of appropriate vocalizations, and the ionic quality of signs, in general, which may offer the child additional information which would assist in both processing and recalling words.

The results of the present study are in agreement with a wide body of previous research in which total communication training was found to be an effective strategy for teaching receptive and expressive gestures to mute retarded (Bricker, 1972; Topper, 1975), brain damaged (Snell, 1974) and both mute and echolalic autistic children (Bonvillian and Nelson, 1976; Fulwiler and Fouts, 1976; Salvin et al., 1977; Brady and Smouse, 1978; Casey, 1978; Barrera et al., 1980a; Barrera, 1980b). Although it has become a widely accepted practice to teach gestures to mute autistic children, sign language programs have generally not been viewed as a desirable treatment strategy for echolalic chlidren due to their existing vocal imitative abilities. This extension of the previous research is of particular importance since it draws from the findings of the total communication literature which have demonstrated the importance of the role of multiple cues in the learning of language. In addition, however, by emphasizing the development vocal responses during

training, this research sought to maintain and expand upon the existing vocal repetoires of the echolalic child.

Although the results of this project demonstrate that total communication training was substantially superior to oral training for teaching basic expressive vocal language skills to each of the three subjects, a number of questions remain unanswered. Since this research was not designed to evaluate the specific characteristics of the training models which may have contributed to the demonstrated effect, further systematic research is needed to empirically test each of these factors. Of particular importance would be a careful analysis of visual, auditory, tactile and kinesthetic cues in order to determine the relative importance of each of these factors in facilitating language acquisition in echolalic children. In addition, further research is needed to investigate the importance of (a) the levels of movement of gestures, (b) the intrinsic iconic characteristics of sign language gestures, and (c) the intrinsic tactile qualities of sign language gestures in attempting to isolate those characteristics which might assist in language acquisition. Furthermore, because of the relatively small number of subjects who participated in this comparison, repeated replication of these findings with other children is necessary before any firm theoretical or therapeutic conclusions can be made.

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APPENDICES

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DEPARTMENT OF PSYCHOLOGY

Dear Parent or Guardian

Over the course of the past few years, many different teaching approaches have been used to develop communication skills with children who have, for various reasons, experienced a delay in their ability to communicate. As a result of this, educators have found that certain children learn more quickly and more efficiently with certain types of training. Since communication is such an important skill and necessary for other academic skills, it is especially important to determine which teaching approach is most effective for each individual child.

For many years, the training of speech was carried out in a totally vocal manner. That is, the therapist would use only his/her voice to instruct the child. More recently, however, a number of researchers studying the development of speech with such children have shown significant success when training is carried out with the therapist using both words and sign language hand gestures during training.

During the next few months, I will be conducting a research project in cooperation with the May Institute. In this research, I will be studying which of these two teaching approaches is most effective with individual children. In other words, your child's learning performance with two different but widely accepted teaching approaches would be studied. The program will involve extensive language training (1½ hrs. per day, four days per week), and more specifically, a) teaching your child the names of 20 objects using only words during training, and b) teaching your child the names of 20 different objects using both words and sign language gestures during training. By determining if your child learns one of the two groups of words more quickly, we may be able to draw some conclusions about which learning model works best for your child. Once your child "selects" a particular approach, language training will continue with that approach, alone, and we will examine how quickly words continue to be learned. Both edible (food) reinforcers and praise will be used throughout training as rewards.

As part of the training program your child will be administered a number of standardized tests in order to obtain a measure of their pre and post training abilities. The tests which will be administered are: The Peabody Picture Vocabulary, The Vineland Social Maturity Scales, The Uzgiris-Hunt Ordinal Scales of Psychological Development, The McCarthy Scales, and the Meecham Scales of Expressive and Receptive Language.

In order to obtain a record of your child's progress throughout the project, each language training session will be recorded on audio cassette, and selected sessions will be videotaped. These tapes will also serve the function of providing a measure on the reliability of the data recording system. These tapes will be used only for the purposes of the language training project and will at no time be heard or viewed by anyone except the project staff and relevant May Institute personnel.

As part of the project, we will be regularly advising you of your child's progress though the program. In addition, as a final stage of the project, we will be conducting staff workshops so that the advances made during training may be carried into the child's regular program following the conclusion of this study. Should you be interested in attending these workshops, we would be most happy for you to attend.

As such, the training involved in this research should serve to significantly supplement the language training which your child is currently receiving. At no point during the study will your child be subjected to any discomfort or risk. This research has been approved by the University of Massachusetts, Department of Psychology, Human Subjects Committee and has the support of the administration and the Board of Trustees of the May Institute.

Although you agree to have your child participate, you are free to withdraw consent at any time and, thereby, discontinue participation in the project. Should you have any questions concerning any of the proceoures, etc., please feel free to contact me. Thank you for your attention and intrest.

Sincerely,

Richard D. Barrera M.S.
Department of Psychology,
University of Massachusetts, Amherst, MA.
Phone: - office (617) 945-1147
home (617) 945-3225

RDB/mw

The Commonwealth of Massachusetts
University of Massachusetts
Amherst 01003

DEPARTMENT OF PSYCHOLOGY

I grant permission to have my child _____ participate in the research project being conducted by members of the Department of Psychology of the University of Massachusetts at Amherst in cooperation with the administration and staff of the May Institute for Autistic Children.

I understand that the goal of this project is to attempt to identify the most effective and efficient language training program for my child. In addition, I have been assured that all identifying information concerning my child will be held strictly confidential, to be shared only with the project staff and relevant personnel at the May Institute.

I also grant permission for my child to be audio and videotaped for the puooses of this research, with the understanding that these tapes will be only used for the puposes of the language training and will be heard and viewed only by the project staff and relevant May Institute personnel.

I also retain my right to withdraw consent at any time and, thereby, discontinue participation in the study.

_____
Parent or Guardian

_____
Witness

_____
Date

ATTENDING TRAINING [illegible]

NAME _____ DATE _____ SESSION _____

LOO SIT NICELY

TRIAL	YES	NO	TIME	TRIAL	YES	NO	TIME	TRIAL	YES	NO	TIME	TRIAL	YES	NO	TIME	TRIAL	YES	NO	TIME
1				15				29				43				57			
2				16				30				44				58			
3				17				31				45				59			
4				18				32				46				60			
5				19				33				47				61			
6				20				34				48				62			
7				21				35				49				63			
8				22				36				50				64			
9				23				37				51				65			
10				24				38				52				66			
11				25				39				53				67			
12				26				40				54				68			
13				27				41				55				69			
14				28				42				56				70			

LOOK AT ME

TRIAL	YES	NO	TRIAL	YES	NO	TRIAL	YES	NO	TRIAL	YES	NO	TRIAL	YES	NO	TRIAL	YES	NO	TRIAL	YES	NO
1			15			29			43			57			71			85		
2			16			30			44			58			72			86		
3			17			31			45			59			73			87		
4			18			32			46			60			74			88		
5			19			33			47			61			75			89		
6			20			34			48			62			76			90		
7			21			35			49			63			77			91		
8			22			36			50			64			78			92		
9			23			37			51			65			79			93		
10			24			38			52			66			80			94		
11			25			39			53			67			81			95		
12			26			40			54			68			82			96		
13			27			41			55			69			83			97		
14			28			42			56			70			84			98		

Phase III Recording Checklist

page ____

Child's name ____________ Date ______ Session = ______ Time ______

Trial	Ther. vocal cue(s)	Ch's resp.	Volume L	M	H	Echo Yes	No	Clear Yes	No	Error Inc	Pronun

PHASE IV TREATMENT RECORDING SHEET

Name ______________________ Date ____________ Treatment ____________ Session ________ Time ________

Trial	Word	Therapist's Question	T's Prompt FV	PV	FG	PG	Vocal Resp.	Sign Resp Corr	Incorr.	Rehearsal G	V	Voc Comp SP	Gest Comp SP	Spont Chang Vocal