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SUBMITTED TO THE GRADUATE FACULTY

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BY

DOUGLAS O. BRADY

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THE EFFECTS OF SIMULTANEOUS TREATMENTS FOR LANGUAGE ACQUISITION IN AN AUTISTIC CHILD

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Abstract

The total communication method using a single-subject, intensive design proved more effective when compared to two other methods of training in a single-subject, intensive design. A theoretical formulation compatible with current research and neurological theory was offered that provided a rationale for the effectiveness of the total communication approach to teaching communication skills to an autistic child. Implications of the results were discussed and compared with recent studies examining the use of sign-based treatments in language training for autistic children.

THE EFFECTS OF SIMULTANEOUS TREATMENTS FOR LANGUAGE ACQUISITION IN AN AUTISTIC CHILD

Douglas O. Brady
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One of the most common presenting symptoms of infantile autism is the profound lack of spoken language or retarded language development (Rimland, 1964; Rutter, 1966; DeMyer, Churchill, Pontius, Gilkey, 1971; Ornitz, 1973; Rutter, 1974). The typical autistic child is often first seen in speech and hearing clinics before the diagnostic investigation of autism is considered (Ornitz, 1973). The observed frequency of language dsyfunction in autistic children has formed the basis for hypothesizing that the main behavioral defect in an autistic child is the inability to develop and use language (Hausserman, 1962; Rutter, 1965; Wing, 1966; Rimland, 1973; Rutter, 1974). Moreover, the absence of a spoken or communicating language is correlated with the prognosis for an autistic child's later adjustment (Rutter, 1966; Rimland, 1973). An autistic child who does not speak normally or develop the use of speech like a normal child, may improve behaviorally in other ways, but is unlikely to achieve any normal social adjustment. It is this observation that has led many researchers and clinicians to

consider the defect of language to be the prime incapacitating factor in infantile autism, out of which the bizarre behavioral abnormalities and social deficiencies arise (Rutter, 1967; Rutter and Bartak, 1971; Colby, 1973; Webster, McPherson, Sloman, Evans, and Kuchar, 1973).

A few researchers have cited success in obtaining speech in mute or selectively mute autistic children by operant conditioning (Lovaas, 1966; Colby, 1973; Lovaas, Koegel, Simmons and Long, 1973). However, most of the children given this type of training did not spontaneously generate new sentences outside the specific training conditions or environment and required reinforcement on a continual basis to maintain their very limited speech repertoire. Follow-up studies revealed no lasting effects of treatment nor generalization (DeVilliers and Naughton, 1974; Ornitz, 1973; Lovaas, Koegel, Simmons, and Long, 1973).

Recently, Bonvillion and Nelson (1974), Creedon (1973), Fouts and Fulwiler (1974), Miller and Miller (1973), and Webster, McPherson, Sloman, Evans, and Kuchar (1973) have reported very successful results when teaching mute autistic children sign language. These studies claim rapid acquisition, retention, and generalization outside of the teaching environment.

Bonvillion and Nelson (1974) reported in detail a process of sign language acquisition over a six month period in a mute autistic boy. In their discussion they speculated that American Sign Language, being predominantly a visual-

motor language, facilitated the acquisition of language and aided communication in an autistic child. They cited as a basis for their speculation the research results of Tubbs (1966) and O'Connor (1971) which indicated that there are normal visual responses in autistic children, and when compared to auditory stimuli responses, visual stimuli responses are dominant.

Results of some recent studies are encouraging and provide a tentative explanation and rationale for the efficacy and use of sign language training with autistic children. Bryson (1970) reports that autistic children performed poorer on visual-auditory and visual-vocal tasks in opposition to visual-visual tasks. A study by Davis (1970) revealed that autistic children performed better on tasks requiring visual integration in opposition to tasks requiring auditory integration. Fouts and Fulwiler (1974) reported in their review of the literature the results of studies that indicated autistic children experienced difficulties with auditory discrimination (Hingten and Coulter, 1967) and visual-auditory cross-modal associations (Gillies, 1965; Lovaas, 1966; Bryson, 1970, 1972). They speculated that language deficiency in autistic children is due to an inability to make specific auditory-visual cross-modal associations and not due to a defect in processing auditory or visual information. They concluded that a gestural or sign language is the most effective means of teaching autistic children to communicate since it is a

visual language and thus avoids the difficulty these children experience in making crossmodal associations.

Webster, McPherson, Sloman, Evans, and Kuchar (1973), in reporting successful results in training a mute autistic child to follow simple instructions by gestural commands, commented on the findings of Hermelin and O'Connor (1970) and incorporated them into a theoretical interpretation as a rationale for the effectiveness of their approach. They reported that the results of the Hermelin and O'Connor (1970) studies may suggest that "autistic children suffer impairment in ability to encode stimuli meaningfully in various sensory and perceptual channels." And they also speculated in agreement with Hermelin and O'Connor (1970) that "the deficit is to some extent modality dependent, and affects the auditory-vocal channels more than visual and particularly motor activity."

Both Rutter (1974) and Ward (1970) concluded in their reviews of research on Infantile Autism that there are several conflicting theories, unsubstantiated hypotheses regarding etiology, no generalized diagnostic procedure, and an absence of established and effective treatment procedures for any behavioral changes in autistic children. Rutter's (1974) review of treatment prognoses with autistic children cited some clinicians who claim there is little treatment potential (Kanner and Eisenberg, 1956; and Ornitz, 1973) and some behavior psychologists (Lovaas, 1965, 1966, 1973) who suggest that there is considerable potential for response acquisition. The recent successful reports of sign language training for language

acquisition, both communication receptive and expressive, and decreased bizarre behavioral manifestations suggest an empirical justification for further research and study. However, the reports of effectiveness of treatment programs with autistic children are varied. Bonvillion and Nelson (1974) report significant results in sign language acquisition in a six month period and Creedon (1973) reported successful acquisition of complex signing ability and vocalization. Fouts and Fulwiler (1974) reported that after only 20 hours of training in 1/2 hour sessions per week, the use of the child of several appropriate signs, concomitant increase in vocal speech, and the spontaneous generalization of American Sign Language outside of the training environment. Miller and Miller (1973) reported receptive communication was enhanced by signing and suggested that the acquisition of receptivity decreased bizarre behavior. Webster, et al. (1973) reported improved communication and a reduction in the bizarre behavior after introduction of a gestural language. They also reported a difficulty in establishing the behavioral cues, e.g. signs and vocalizations, that influenced the behavior of the subject. There is no way to compare the relative effectiveness of treatment procedures across studies, given the disagreement as to the efficacy of any treatment, the variation in reports of outcome, as well as unknown degree of similarity among the autistic children studied. The successful results of sign language training reported in the literature must be replicated, extended, and compared with other treatments to substantiate any claim of success.

The purpose of the present study was to assess the effects of three types of language training reported in the literature as being effective in teaching autistic children to communicate. The study employed an intensive, (N-1) design that assessed the effects of three types of language training administered simultaneously to alleviate the language deficiency in an autistic child. The types of treatment were: sign language, operant conditioning of vocalization, and the total communication approach. It was hypothesized that an autistic child would acquire a sign or gestural language if it was compared with reinforcement of vocalization, and that a total communication approach would be the most effective means of teaching communication to a mute autistic child.

METHOD

Subject

The autistic child was a 6-year, 4-month old caucasion boy. He is an only child and lives at home with his mother. There is no father in the home. The mother reported a history of bizarre behavior and extreme hyperactivity. Mother also reported that her son scratches others and himself, has uncontrollable seizures of laughter and crying, bites himself and others, bangs his head on sharp metal objects, hits himself on the ears, runs away frequently, and engages in unintelligible verbalization. During the initial baseline sessions with the child, he engaged in climbing, crawling, darting, turning his hands over and over, spinning, and exhibited overall constant disorganized and unoriented movements.

The child has been seen by a family physician, a private neurologist, a pediatric neurologist at a university medical center, a medical center psychiatrist, and a clinical psychologist at a private child treatment facility. He has attended a nursery school since the age of three, a private school for learning disordered and emotional children, and has attended a private Montessori school. All of the schools have discontinued his placement since their programs were not able to meet the specific needs or furnish the treatment necessary for this child. Examination by a school psychologist resulted in denial of eligibility for any classroom placement in public school. The present treatment was undertaken at a Child Guidance Center prior to placement in a state funded special education program designed to serve multiple handicapped children not otherwise served in the community. On the basis of the psychiatric examination, the child's diagnosis was 295.8 (DSM-II) Schizophrenia, Childhood type and, in his case, Infantile Autism. The clinical psychologist's diagnosis of the child was Infantile Autism.

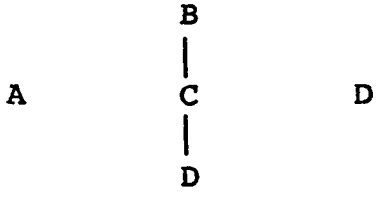
Apparatus

The study utilized a nine-word, nine-object experimental language reported by Churchill (1972). The nine-objects of the experimental language were simple wooden shapes, i.e. a ring, a block, and a stick. There were three groups of the objects, a group consisted of one block, one ring, and one stick. Each of the groups was painted the same color and there were three colors used: red, blue, and yellow. The wooden

objects were purchased at a local toy shop and came painted with the required safe, nontoxic colors.

Design and Analysis

Following Browning (1967, 1973) and Browning and Stover (1971) a simultaneous treatment design was used to examine the effects of three treatment approaches in language training. The baseline "A" was followed by the three treatments (symbolized as B, C, D) administered by three different persons at the same time. A counterbalanced order for treatments was used to control for ordering effects of treatment and persons. The design with three treatments is symbolized as follows:



The column of B, C, and D indicates that the treatments were administered at the same time by three different experimenters. This vertical sequence was repeated three times in counterbalanced order. The D represents the use of the treatment found to be most effective (in this study the total communication approach) across three experimenters. The data was analyzed using Benjamin's (1965) Latin square procedure as reported in Kirk (1968) in which the subject serves as his own control. This simultaneous design involved, (1) baseline assessment, (2) three treatments administered simultaneously in counterbalanced order following baseline, and (3) the

implementation of the most effective treatment in the final phase. No return to baseline was employed. The simultaneous treatment design was used because it allowed a comparison of three "effective" treatments on one individual, and it avoided the ethical and treatment problems of removing a treatment procedure and attempting to reinstate problem behavior or allow learned responses to extinguish.

Procedure

A baseline was undertaken to determine the number of productive actions that the child would perform in response to a given verbal statement by the experimenters. This assessment served as a measure of the child's capacity for productive communication and language. During this phase of the study, the experimenters uttered and performed a series of 27 statements based upon an experimental nine-word language reported by Churchill (1971). It is composed of nine words, three objects, three colors, and three actions. It forms the following matrix:

ring	block	stick
blue	red	yellow
give	tap	slide

As an example, the child was instructed to "give blue ring" and if he responded correctly would have given the experimenter a blue ring; this proceeded on until "slide yellow stick" was instructed. The total number of correct responses served as the measure of language production and capacity. Each experimenter used a check sheet and routinely recorded each response

in an unobtrusive manner to avoid the social reinforcement effect or attending to "correct" behavior. The baseline measure was determined by an assessment of each of the three experimenters over two sessions, and an average of the sessions across experimenters served as a quantified measure of baseline language capacity and productive communication. The simultaneous treatment phase of the study consisted of 21 sessions, each session consisting of a particular ordering of presentations of the three treatments. Each of the three treatments were of 1/2 hour duration and were separated by a 5-minute play break. The 21 sessions were divided into 3 blocks, each block consisting of 7 sessions with a particular ordering of treatments. The order in which the experimenters administered the treatments for each successive block of 7 sessions was counterbalanced for sequential order of treatment conditions in order to meet with the requirement for a 3 x 3 special Latin square design. Experimenter 1 administered treatment B on block one, treatment C on block two, and treatment D on block three. The order of treatments by blocks for (7 sessions) Experimenter 2 was C, D, and B; the order for Experimenter 3 was D, B, and C. Three treatments were available to the subject in the course of three equal time intervals from all three experimenters. The final phase of the study consisted of 14 treatment sessions, symbolized as D in the design, using the most effective treatment (total communication approach) on a continued basis. At the completion of the final treatment phase in the study, the child's

home caretakers were instructed in the total communication approach to language training, and are now teaching him the simple signs necessary for daily living. The total communication approach in language training is utilized by the special education program he will attend in the upcoming school year. At that time, he will be well acquainted with the procedures.

Treatments

The vocalization treatment utilized no signing and no gestures. Appropriate association to objects by words and responses to statements were based on a Lovaas-type procedure using favorite foods (potato chips, marshmellows) and social reinforcement (Lovaas, Schreibman, and Koegel, 1974). The training was based on the nine word-nine object experimental language previously mentioned.

The signing treatment was based on a procedure developed by Gardner and Gardner (1969) for teaching chimpanzees sign language. Briefly it involved the experimenter showing the child the object, shaping the child's hand into the correct position for the word, object, or color, and then immediately rewarding the child for the correct shaping of the sign. This procedure was repeated until the child made the sign without the experimenter's aid. This molding and fading technique is similar to the techniques developed and modified by Lovaas in teaching autistic children to produce consonant sounds.

The total communication treatment involved the experimenters speaking the correct words while simultaneously

demonstrating molding or prompting the sign and followed by immediate reinforcement. It also utilized verbal prompting and verbal reinforcement.

At the end of each session an assessment of the child was undertaken to obtain the measurement of correct responses to the statements comprising the experimental language.

RESULTS

Table 1 indicates the mean number of responses obtained on the nine-word, nine-object experimental language for each block of the 7 sessions in the simultaneous treatment phase of the study. Benjamin's (1965) Latin square analysis which uses a subject as his own control was utilized to test for differential effects among the three treatments. Table 2 shows there was a significant difference among treatment conditions ($df = 2, 36$; $p<.001$) when compared on the number of responses to the experimental language assessment. Duncan's new multiple range test (Kirk, 1968) was used to test for mean differences of responses on the test under the three treatment conditions. It was found that the child responded significantly more under the total communication treatment than under either the signing treatment or the reinforcement of vocalization treatment ($p=.01$). The difference between signing and vocalization treatments was not significant.

Since the total communication approach was the most effective treatment for obtaining responses on the experimental language assessment, it was continued for 2 additional

blocks of 7 sessions. White's (1972) method for obtaining a median trend line was employed to establish a trend line for the significant treatment condition. Following Ripstra (1973) the trend line for the total communication approach was extended into the final treatment phase. Using a binomial test (Siegel, 1956) it was revealed that there was a significant difference ($p=.005$) between the simultaneous treatment phase and the final treatment approach phase for the total communication approach.

Although the treatment effect between blocks of sessions was significant it was not examined further except to note that it indicated a significant difference among the blocks in effecting responses in the child. This would have been necessary given any change in the number of responses across treatments and was expected. The significant experimenter effects indicate a differential responding by this child for an experimenter. The significant treatment x experimenter interaction refers to a significant square uniqueness which is a result of the special Latin square design and analysis. It reflects in part an experimenter x treatment interaction that was differentially effective across the 3 blocks of sessions during the simultaneous treatment phase. The design employed enables a researcher to identify in a given case the most effective treatment and experimenter combination.

DISCUSSION

The results of this study offer substantial support for the use of a sign based, total communication method in the teaching of communication skills to an autistic child. The total communication approach when compared to two other methods of training (sign language only, and reinforcement of vocalization) was clearly more effective in this single subject intensive study. Recent experimental evidence points to a rationale for the effectiveness of the total communication approach.

Ornitz (1974) has suggested that autistic children have a dysfunctioning vestibular system. He has hypothesized a neurological mechanism composed of vestibulor nuclei that regulates the very complex, reciprocal, feedback relationships between general sensory input, auto-vestibulor input and output, and the kinesthetic movements of the normal child. In a normal child vestibulor input serves as a controlling mechanism which regulates other forms of input and motor activity at the spinal, subcortical, and cortical levels. If a dsyfunction exists in the vestibulor system, then all sensory input, auto-vestibulor input and output, and kinesthetic movement of an autistic child is disordered at the spinal, subcortical, and cortical levels. This theory offers an explanation for the bizarre, hyperactive, motor movements of the autistic child.

Some researchers have concluded that this bizarre, motor behavior of autistic children is due to a physiological state of overarousal (Hutt, et al., 1965), and a theory has been offered to explain the effectiveness of sign language training with autistic children (Fouts and Fulwiler, 1974). However, research evidence exists that casts doubt on this theory and indicates the hyperactive motor behavior of autistic children is not caused by, nor results from, a chronic state of physiological arousal (Sorosky, 1968; Ornitz, et al., 1970; Hermelin and O'Connor, 1970; Ornitz, 1970). Instead, the bizarre repetitive motor behavior could represent compensatory attempts to obtain feedback that is precluded by a dsyfunctioning vestibulor system. Normal children order the world into a meaningful system by information obtained from their sensory processes. It has been suggested (Ornitz, 1973) that autistic children are attempting to do the same but are prevented from normal functioning by a dysfunctioning vestibulor system. Thus, the kinesthetic movements of autistic children could be compensatory attempts to order the world, and would serve the same function as the perceptual processes of normal children.

Research evidence supports this position and indicates that the motor component of the compensatory, hyperactive behavior of autistic children plays a major role in their learning processes. Hermelin and O'Connor (1970), and Frith and Hermelin (1969) have reported research results that autistic children,

when learning, make a major use of cues from stimuli that are primarily manipulative or involve motor feedback. A motor response, as for example, a signing movement could serve as a learning cue or source of feedback, in whose presence the likelihood of a previous motor response would increase. A motor movement of signing could serve as a cue for learning in autistic children, and could very easily (by molding) be incorporated into the behavioral repertoire of the child. The kinesthetic movement of signing in an autistic child would serve the same function as speech in a normal child. Signing can be understood by another person who signs, and who in turn could respond back to the autistic child with a meaningful visualized kinesthetic movement of signing. This movement would provide the child with a visual motor movement that would in turn serve as a cue for further learning. In an autistic child kinesthetic movements would serve to implement meaningful associations. The autistic child who signs would "learn" or make associations among his motor movements in the kinesthetic modality rather than from his other sensory modalities.

It has been reported by many studies that there is a preference in autistic children for the visual sensory modality when it is compared to the auditory modality (Hingen and Coulten, 1967; Bryson, 1970; Davis, 1970). These results have been offered to explain the effectiveness of a visual-based (sensory modality) sign language. However, Lovaas (1971) has found no such evidence or preference for the visual sensory

modality. He has argued that while this preference is apparent, it is misleading. It is a result of the autistic child's inability to respond to two or more sensory stimulus modalities, when presented in a complex (two or more) stimulus situation. In such a situation an autistic child selectively responds to only one sensory modality. It can be argued based from this research evidence that when an autistic child is presented with a complex stimulus situation, the first stimuli providing input would have the greatest probability of being selected, and all other stimuli would be ignored. In a simultaneous presentation of auditory and visual stimuli, the visual modality would most likely provide the initial input. If a visual stimulus is the initial input in a complex stimuli situation, then the visualized motor movements of a sign language would provide the cues for learning. It would also follow that autistic children would use these motor movements as cues for further learning in a chaining process.

In the total communication approach the autistic child is presented the optimal conditions for learning. Both visual and auditory stimuli are presented simultaneously but they comprise one contiguous association of two motor movements, the gesture of signing, and the facial gestures of the mouth when speaking. The contiguous presentation becomes one motor movement cue for further learning. It has been reported often in clinical studies that autistic children are acutely aware of facial gestures and that they have a unique ability to recognize form discrimination (Ornitz, 1973). Further, it is

possible that this simultaneous presentation is more effective because it becomes a learning cue that is not often encountered by the autistic child in the environment, and can be selected preferentially from among the complex stimulus situations continually presented to him in the normal world.

The superior effectiveness of the total communication approach is explainable on the basis of its being compatible with the learning processes of the autistic child which are altered by a dsyfunctioning vestibulor system. In a sequential analysis of the learning process involved in total communication acquisition the following most likely occur: (1) a simultaneous presentation of signing gestures and movements of the face when speaking, this becomes one visualized motor movement that serves as a cue for learning; (2) another person shapes or molds the hands of the child into the correct sign, thus making a motor response in the child that can be used by him for feedback.

This process is analogous to the manner in which a normal child uses sensory processes for feedback in learning, and explains the ready acquisition of the total communication system by the autistic child.

Guthrie (1959) has offered a learning theory that accounts for the success of the total communication approach. His theory, briefly stated, contends that if two responses occur simultaneously in time or are contiguous then the likelihood increases that they will occur in that sequence again. The effectiveness of the total communication approach is based

upon it fitting into the compensatory kinesthetic movements that serve as feedback for the autistic child. In a naturally occuring repetition of movements the likelihood of correct associations between a unique association of signing-facial movements, and a self-gesture is dramatically increased if they are presented contiguously as in total communication training.

In summary, then, several recent studies have suggested the effectiveness of a sign-based treatment approach for language acquisition and communication with autistic children. This study reports the superior effectiveness of the total communication approach in communicating with an autistic child when compared with two other treatment approaches. A rationale for the effectiveness of the approach has been offered that is compatible with recent research evidence, and is based upon recent neurological theory and research. The encouraging results of this study are based on one intensive examination of a single case. Further research is indicated to establish the possible effectiveness of this treatment approach across other autistic children, and to investigate the variable involved in the treatment-experimenter interaction.

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TABLE 1

MEAN NUMBER OF RESPONSES FOR EACH TREATMENT FOR EACH BLOCK OF SESSIONS IN THE SIMULTANEOUS TREATMENT PHASE

	Blocks During Treatment Phase			All Blocks
Treatment Approach	Block 1 $\bar{X}$	Block 2 $\bar{X}$	Block 3 $\bar{X}$	Combined $\bar{X}$
B. Signing	0.57	4.85	5.00	3.47
C. Vocalization	3.28	1.00	1.00	1.76
D. Total Communication	3.71	8.28	8.28	6.76
B, C, D Combined	2.52	4.71	4.76	3.99

TABLE 2

LATIN SQUARE ANALYSIS FOR RESPONSES AMONG THREE TREATMENTS FOR LANGUAGE ACQUISITION

Source	SS	df	MS	F
Between Blocks and Replications	221.33	20	---	---
Blocks (B)	68.67	2	34.34	4.05*
Replications within Blocks	152.66	18	8.48	---
Within Blocks and Replications	578.67	42	---	---
Treatments (T)	271.14	2	135.57	29.47**
Experimenters (E)	73.23	2	36.62	7.96**
T x E within Blocks	68.67	2	34.34	7.47**
T x E x Replications within Blocks	165.56	36	4.60	---

*p .05

**p .01

APPENDIX A

PROSPECTUS

PROSPECTUS

The behavior of the autistic child is one of the most distrubing of the many types of unusual behavior seen in young children and one of the most difficult to understand. The variability of the bizzare behavior, the changes with maturation of the child, the wide differences in degree of severity in individual cases, the confusing and inconsistent terminology which has been used to describe these children, and the lack of any definite physical signs have made diagnosis and treatment a difficult and unreliable process (Ornitz, 1973).

As a diagnostic term, Infantile Autism commonly refers to a collection of behavior that begins shortly after birth and includes the following distinct manifestations: extreme emotional and social withdrawal from people; a profound lack of speech for communication; compulsive ritualized behavior and repetitive nonfunctional use of objects; and failure to engage in role play alone or with other children. Researchers and clinicians in the fields of child psychology and psychiatry have observed these forms of behavior in children and only recently has there been consensual agreement among some to group them under the diagnostic category of Infantile

Autism (Rimland, 1964; Creak, 1964; Fish, 1971; Ornitz, 1973; Rutter, 1974).

One of the most common presenting symptoms of autism is the profound lack of spoken language or retarded language development (Rimland, 1964; Rutter, 1966; DeMyer, Churchill, Pontius, Gilkey, 1971; Ornitz, 1973; Rutter, 1974). The typical antistic child is often first seen in speech and hearing clinics before the diagnostic investigation of autism is considered (Ornitz, 1973). The observed frequency of language dsyfunction in autistic children has formed the basis for hypothesizing that the main behavioral defect in an autistic child is the inability to develop and use language (Hausserman, 1962; Rutter, 1965; Wing, 1966; Rimland, 1974; Rutter, 1974). The absence of a spoken or communicating language is correlated with the prognosis for an autistic child's later adjustment (Rutter, 1966; Rimland, 1973). An autistic child who does not speak normally or develop the use of speech like a normal child, may improve behaviorally in other ways, but is unlikely to achieve any normal social adjustment. It is this observation that has led many researchers and clinicians to consider the defect of language to be the prime incapacitating factor in autism, out of which the bizzare behavioral abnormalities and social deficiencies arise (Rutter, 1967; Rutter and Bartak, 1971; Colby, 1973; Webster, McPherson, Sloman, Evans, and Kucher, 1973).

A few researchers have cited success in obtaining speech in mute or selectively mute autistic children by

operant conditioning (Lovaas, 1966; Colby, 1973; Lovaas, Koegel, Simmons and Long, 1973). Most of the children given this type of training did not spontaneously generate new sentences outside the specific training conditions or environment and required reinforcement on a continual basis to maintain their very limited speech repertoire. Follow-up studies reveal no lasting effects of treatment or generalization (DeVilliers and Naughton, 1974; Ornitz, 1973; Lovaas, Koegel, Simmons, and Long, 1973).

Recently, Miller and Miller (1973), Creedon (1973), Fouts and Fulwiler (1974), and Bonvillion and Nelson (1974) have reported very successful results (claiming both retention and generalization) when teaching mute autistic children sign language. Bonvillion and Nelson (1974) report a process of sign language acquisition over a six month period in a mute autistic boy and reveal their technique in detail, while performing "detailed analyses" on sign, sign combinations, and underlying semantic structures of the child's acquired sign language. In their discussion they speculate that American Sign Language, being a predominantly visual-motor language, might facilitate the acquisition of language and aid communication in an autistic child. The basis for this speculation is the research by Tubbs (1966) and O'Connor (1971) which revealed that in autistic children there are normal visual responses, and that in comparison to auditory stimuli responses, visual stimuli responses are the most dominant.

Fouts and Fulwiler (1974), while reporting a less detailed account of technique, offer a rationale for their approach that echoes the Bonvillion and Nelson (1974) study, but is more extensive and speculative. They report the results of studies that indicate autistic children have difficulties with auditory discrimination (Hingten and Coulter, 1967) and in particular have problems with visual-auditory crossmodal association (Gillies, 1965; Lovaas, 1966; Bryson, 1970, 1972). Bryson's (1970) study which reports autistic children perform poorer on visual-auditory and visual-vocal tasks as opposed to visual-visual tasks, and Davis' (1970) study which reveals autistic children perform better on tasks requiring visual integration as opposed to tasks involving auditory integration are both utilized to speculate that the language deficiency of autistic children may be due to an inability to make specific crossmodal associations and is not due to an inability to process auditory or visual information.

A key study cited by Fouts and Fulwiler (1974) is reported by Jakab (1972) in which he reported that autistic children use meaningful nonverbal, not vocal, communication. Also discussed were the studies by Ruttenberg and Gordon (1967) which suggested that gestures and facial expressions are necessary when communicating with an autistic child, and the study by Pronovost, Wakstein, and Wakstein (1966) which reported autistic children would not respond to language training if gestures were omitted. These studies provide for

the conclusion offered by Fouts and Fulwiler (1974): a gestural language is the most effective means of teaching autistic children to communicate, and it is most effective because it is a visual language and avoids the hypothesized crossmodal association difficulties. The results of Fouts and Fulwiler (1974) are remarkable: after only 20 hours of training (training sessions were 1/2 hour periods twice a week) the autistic child was using several signs appropriately, the use of vocal speech increased concomitantly, and the use of ASL generalized spontaneously from the therapy environment to the outside. The results of this study, if replicated and extended, could provide empirical support for a theory of autism that views language deficiency and the resulting bizarre behavior as the manifestation of perceptual dysfunction due to a neurological defect which prevents crossmodal associations.

Fouts and Fulwiler (1974) have formulated a theory that accounts for the pervasive language deficiency in autistic children as due to a neurological defect in the autistic child's cerebral cortex that prevents crossmodal association of sensory input. Following Rimland (1964), they postulated a Reticular Activating System (RAS) that incorporates incoming stimuli to maintain an adequate level of organismic arousal but, due to a hypothesized neurological defect, the autistic child's RAS is incapable of utilizing sensory input in a normal, dual manner, i.e., as stimulation of the RAS, and as feedback to deactivate the RAS and begin crossmodal associations of sensory input. As a result, the autistic child is

in a superaroused aversive state and all sensory input results in increased stimulation of the RAS. Association of sensory input across modalities cannot take place in this aroused state, and without association the utilization and production of language is impossible. In light of this theory the repetitive behavior of the autistic child may be viewed as compensatory self-feedback aimed at shutting down the very aversive state of constant arousal of the RAS.

If the theory is correct and there is a defect in autistic children that prevents crossmodal associations, then most sensory input results in stimulation of the RAS. In particular, auditory stimuli being all pervasive (we do not have earlids) provides a constant flow of incoming stimulation for the RAS. Spoken language is thus aversive since it is arousing to the RAS. Secondary reinforcement is usually quickly attained as a result of aversive conditioning, and as a result all encounters with noise making objects or humans would be avoided by autistic children. This theoretical framework provides an explanation for the failure of attempts to teach vocal or auditory communication to autistic children, i.e., auditory sensory input is arousing to the RAS and is aversive. Sign language avoids crossmodal difficulties, allows for the RAS to shut down, and visual-visual associations can occur. Sign language is thus both a positive reinforcer and a response that serves as feedback to the RAS to shut down. The acquisition of sign language could be

viewed as aversive conditioning: a response (signing) terminates the aversive state of arousal. Given this dual analysis of the acquisition of sign language, we must expect a very rapid rate of learning and the Fouts and Fulwiler (1974) study indicates this is the case.

Rutter (1974) and Ward (1970) concluded in their reviews of research on Infantile Autism that there are several unsubstantiated hypotheses regarding etiology, no generalized diagnostic procedure, conflicting theories, and an absence of established effective (empirically based) treatment procedures for any behavioral change in autistic children. Rutter's (1974) review of treatment prognoses with autistic children cited some clinicians who claim there is little treatment potential (Kanner and Eisenberg, 1956; and Ornitz, 1973) and some behavior psychologists (Lovaas, 1965, 1966, 1973) who suggest in their single-subject, single-response studies that there is considerable potential for response acquisition. The reports of effectiveness of treatment programs with autistic children are varied; Bettelheim (1967) claims a "good outcome" with 42 per cent of autistic children, Eisenberg (1956) claims "good outcome" for only 5 per cent of cases treated, Ornitz (1973) reports "poor outcome" on all treatment approaches, Fouts and Fulwiler (1974) report "successful acquisition" of a sign language for communication, and Bonvillion and Nelson (1974) report "significant results" in sign language acquisition. Given such variation in treatment reports, most of them based on very simplistic reporting

systems, as well as unknown degree of similarity among the autistic children studied, there is no way to compare the relative effectiveness of treatment procedures across the studies.

Therefore, it is proposed that a very detailed and intensive study of language training in one autistic child be undertaken. This study will employ an intensive (N-1) design that will assess the effects of three types of language training reported in the literature as being effective in treating autistic children. The three types of language training administered simultaneously to alleviate the language deficiency in an autistic child will be: sign language, operant conditioning of vocalization, and the total communication approach (a simultaneous combination of signing and vocalization). It is hypothesized that an autistic child will differentially acquire a sign or gestural language if it is contrasted with reinforcement of vocalization, and that a combination approach will lead to significant language acquisition and productive vocal communication. Quantification of results and analysis of the data will form the basis for anticipated significance in treatment approaches.

RATIONALE FOR INTENSIVE (N-1) STUDIES

Traditionally group designs and inferential statistics have been the preferred approach in most psychological research; however, several researchers have questioned the relevance of group designs and inferential statistics for the improvement of applied psychology (Chasson, 1967; Shontz,

1965; Strupp & Bergin, 1969; Yates, 1970; Lazarus & Davison, 1971; Thosresen, 1969). The problems encountered in group designs and the use of inferential statistics as reported by the preceding authors include (1) the very limiting value of group designs when assessing the antecedent factors responsible in the change and modification of individual behavior; (2) in group design there is a philosophy of science that is assumed which results in an excessive reliance upon statistical significance rather than replication of results over time, conditions and with different researchers, and (3) experimental control is achieved by complex research designs and inferential statistical procedures, rather than control of extraneous variables by using a subject as his or her own control.

Campbell and Stanley (1966) have stated that the interrupted time-series design is an excellent quasi-experimental design. Chassan (1967) has discussed the advantage of time-series designs with single subjects (he referred to them as "intensive" designs) in the assessment of psychotherapy. Browning and Stover (1971) reported the use of "same-subject" designs to evaluate the impact of behavior-modification techniques with emotionally disturbed children. Thoresen (1974) has presented a comprehensive and cogent argument for the use of intensive designs and consequent analysis in counseling. A review of the literature provides ample justification for the utilization of intensive, time-series, single-subject studies in applied psychology. Basic

to the approach of intensive analysis is the necessity of studying one subject in extensive detail.

The main factor underlying the use and value of intensive designs for applied psychology is that excellent experimental control is provided by having the same subject serve as his or her own control. It is argued that no kind of group design exercises control of all past events prior to the study and only intensive designs provide this type of vital experimental control (Chassan & Bellak, 1966). Campbell and Stanley (1966) argue that intensive designs (multiple time-series) control for all of the major extraneous variables that might influence the experimental results during the actual investigation e.g. maturation, regression effects, and instrumentation factors. Intensive designs provide the very careful experimental control that group experiments attempt to provide by statistical procedures and complex research design.

Thoresen (1974) summarizes the rationale for the use of intensive designs in studying the effects of applied psychology on a single subject:

> (1) Specific actions of individual subjects are the unit of focus rather than "average" comparisons between groups of individuals.
>
> (2) The frequency, magnitude, and variability of an individual's actions can be examined continuously during each phase and between phases of an experimental study. Only with an intensive-design is the examination possible because of the descriptive data orientation of intensive-design studies.

(3) The individual subject serves as his or her own control (the magnitude and duration of change is compared to a baseline of their own actions). By this type of control past experiences and individual differences are fully controlled.

(4) Experimental control of variables is greatly facilitated thus reducing the need for statistical control through complex design and inferential procedures.

(5) The effects of treatments administered simultaneously on one or more subject's behavior (dependent variables) can be examined over time for a particular individual by using multiple baseline and other procedures.

(6) Causal relationships can be established by replication of specific results by means of certain intervention techniques across individuals.

(7) Clinicians can determine the extent of relevant changes in client actions continuously during treatment and alter treatment if necessary based on the data provided.

This discussion and the examination of pertinent literature has provided a general argument for the utilization of intensive designs or N-1 studies in applied psychology. However, the necessity of comparing treatments that effect language production in autistic children is the main rationale for the utilization of the "simultaneous treatment design."

METHOD

Subject

The subject will be an autistic child selected for treatment to increase language productivity and interpersonal communication, and decrease bizzare behavior. The behavioral characteristics which will warrant the diagnosis of Infantile Autism are: absence of spontaneous communicative speech;

failure to attend to verbal commands or to tasks; absence of play behavior; stereotyped behavior; and extreme desire for sameness or routine. In addition a detailed family history will be taken and it will be determined that the child has received the proper diagnosis of Infantile Autism by a clinical psychologist or psychiatrist.

Design and Analysis

Browning (1968, 1973) and Browning and Stover (1971) have offered an intensive design that is referred to as a "simultaneous treatment design." The baseline "A" is followed by two or more treatments (B, C, D) administered by different persons at the same time. A counterbalanced order for treatments is used to control for ordering effects of treatments and persons. The design with three treatments could be symbolized as follows:

$$\begin{matrix} & B & \\ A & C & B \text{ or } C \text{ or } D \\ & D & \end{matrix}$$

The column of B, C, and D indicates that the treatments are administered at the same time by different experimenters. This vertical sequence is repeated three times in counterbalanced order. The B or C or D represents the use of the treatment found to be most effective across three experimenters. The analysis of the data utilizes Benjamin's (1965) Latin square procedure in which the subject serves as his or her own control. This simultaneous design involves (1) three treatments following baseline, and (2) the implementation of the most effective treatment in the final phase. No return

to baseline will be employed. The simultaneous design is used because it allows us to compare "effective" treatments on one individual, and it avoids the ethical and treatment problems of removing a treatment procedure and attempting to reinstate problem behavior.

Procedure

A baseline will be undertaken to determine the number of productive actions that can be undertaken in response to a verbal statement by the experimenters. This is to be understood as an assessment of the subject's capacity for productive communication and language (Hackett, 1959, 1960; and Premack, 1970, 1971). To determine the baseline capability of the subject for language and communication, the experimenters will utter and perform a series of 27 statements based upon an experimental nine-word language reported by Churchill (1971). It is composed of nine words representing objects, actions, and colors and forms the following matrix:

ring	block	stick
blue	red	yellow
give	tap	slide.

As an example, the subject will be instructed to "give blue ring" and would respond correctly by giving the experimenter a blue ring; this proceeds on until "slide yellow stick" is instructed. The total number of correct responses will serve as the measure of productive language capacity. To communicate a child must know and understand the meanings of words and statements; this can only be ascertained by using words

correctly and responding correctly to statements. Each experimenter will use a wrist counter to obtain an unobtrusive measure and avoid the social reinforcement effect of attending to "correct" behavior. The baseline will be determined by assessment of each of the three experimenters during two sessions, and an average of the sessions will constitute a quantified measure of baseline language capacity and productive communication. Treatment sessions will be of ½ hour duration. During a period of 21 sessions three treatments will be conducted simultaneously and successively by the three experimenters. The order in which the experimenters will administer the treatments for each successive week will be counterbalanced for sequential order of treatment conditions in accordance with the requirements for a 3 x 3 Latin square design. Experimenter 1 will administer treatment B on week one, treatment C on week two, and treatment D on week three. The order of treatments by week for experimenter 2 will be C, D, and B; the order for experimenter 3 will be D, B, and C. Three treatments will be available to the subject in the course of three equal time intervals from all three experimenters. The final time period of 14 treatments symbolized as B, or C, or D, indicates the most effective treatment, i.e., the treatment offering the greatest number of correct actions based upon the instructions given in the specific treatment approaches, will be continuously used with the subject. After the experiment, if the treatment is effective, the parents (or staff if the subject is an in-patient) will

be trained in the treatment approach so that it may be continued with the subject.

Treatments

Three treatments will be simultaneously utilized and systematically compared for efficacy in treating a language deficient autistic child.

The vocalization treatment will utilize no signing and if possible no gestures. Appropriate associations to objects by words and later responses to statements will be based on Lovaas-type principles using social reinforcement and favorite reinforcers. The training will be based on the nine word-nine object experimental language previously mentioned.

The signing treatment will again be based on a reinforcement model except no vocalization will be employed by the experimenters. The use of appropriate signs and appropriate responses to statements will be reinforced.

The total communication approach will use signing and vocalization by the experimenter to associate words and objects, and reinforcement will be administered to correct responses to the statement.

All treatments will follow the sequence of (1) reinforcing associations between the nine words and nine objects of the experimental language, and (2) reinforcing correct responses to statements composed of the previously acquired associations between words and objects.

Vocalization and bizarre behavioral manifestations will be charted outside the treatment situation to determine

if there is any concomitant variation with treatment or treatments.

Summary

A review of the literature revealed conflicting information regarding the efficacy of treatment, diagnostic procedures and theories of autism. The results of recent studies employing sign language with autistic children have indicated that it is both quickly acquired, and effective in teaching communication. The basis for utilizing sign language as a preferred treatment is provided by evidence from several studies that indicate autistic children have crossmodal association difficulties, auditory sensory input is not normal and visual-visual association can occur in autistic children with the visual modality being preferred for environmental contact. A theory is offered to explain the empirical data and offers a rationale for success when employing sign language in teaching autistic children to communicate. The single-subject intensive "simultaneous" treatment design is offered as a procedure for assessing effectiveness of three treatments for teaching an autistic child to communicate. Analysis of the results by a Latin square procedure will ascertain the effectiveness of the treatments. It is hypothesized that an autistic child will differentially acquire a sign language when contrasted with attempts to reinforce vocal communication and that the total communication approach will lead to both the acquisition of a sign based communication and increased productive vocal language.

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APPENDIX B

DEVELOPMENTAL HISTORY OF THE AUTISTIC CHILD STUDIED

DEVELOPMENTAL HISTORY OF THE AUTISTIC CHILD STUDIED

Birth - Infancy

The child is a six year, four month old caucasian boy. He is the first and only child in his family. His mother was 32 years old at the time of his birth. His mother and father were divorced after two and one half months of marriage. During this time the husband administered severe beatings to his wife, and threatened her with constant and severe physical violence.

The child was a full term six pound, four ounce baby, who was jaundiced at birth from unknown etiology. During the first month, he had severe colds, numerous throat infections, and experienced great difficulty adjusting to a formula. His sleep patterns as an infant were characterized by frequent awakenings and constant crying during the waking periods. He did not sleep during the day and averaged about one to one and one half hours of sleep at night. He would not mold to his mother's body, and when picked up would stiffen his own body.

Ages 1-2

Between the ages of 1-2, he developed severe behavior problems such as: hyperactivity, self-biting, biting others, and beating his head against the wall. During this time he became obsessed with vacuum cleaners, keys, motors, twisting

his hair, and pulling the hair of others. If left unattended, he would engage in this engrossing examination and repetitive behavior for hours. He began nursery school at age two at a private church nursery. He exhibited separation anxiety from his mother and was frequently upset. His reaction was characterized by high pitched crying and whining, self-inflicted biting, and he would not respond to verbal commands or touch during this behavior reaction. He never participated in directed activites. For very short periods of time, he would play with wooden blocks and snap beads together. He was totally unaware of his surroundings or other children, often wandered around the room aimlessly and would not allow his teachers to touch him. He had no language and made bizarre, repetitious sounds during the 1-2 year period.

Agest 3-4

Since the age of two the child has had an intense obsession with lawnmowers and keys of any kind. He is now able to pick the appropriate key out of a ring of keys that starts his grandfather's riding lawnmower, and will run to any moving mower he sees. During the later part of the 3-4 period he became aware of water faucets, and would turn them on and off again for long periods of time. He never engaged in play with other children, nor developed a spoken intelligible language during this age period.

Age 4 to present

Occasionally the child will respond to verbal commands and whisper single words. He makes many garbled sounds but

they are not contingent on any situation, person or object. He has no conception of danger and must be restrained from running into the streets or jumping out of the car. If he is presented with a frustrating situation he will initially try to bite or slap himself, and if other people are present, he will bite and scratch them. At the present time he shows little affection to his mother, or grandparents, but he does prefer riding with his grandfather on the riding lawnmower. His sleep pattern is still abnormal. He will sleep from 9:30 or 10:00 until 1:00 and then awakens crying, hitting himself, kicking or butting his head. This routinely happens every night and lasts 30 to 45 minutes. He has these attacks several times during each night. Medication has been tried but does not stop the attacks unless it totally sedates him. He does not dress himself, and must have close supervision when eating. Presently, he is not toilet trained and wears diapers at night. Effort is now beng made to toilet train the child.

Present Evaluation of Behavior

The child is a physically beautiful, brown-eyed six year old boy. He exhibits bizarre and erratic behavior with severe developmental lags in language, sensory motor development, perceptual development, cognitive development, and in social and emotional relationships.

Language Development

His language is below the two year level, and echolaliac. He utters garbled sounds, and makes unusual motor-like

noises. He will presently (after treatment) respond to verbal statements such as: "come here," "sit down and pick up the bag," "remove the toys," and "shut the door." He will also occasionally respond to inquiries about his need to urinate by going to the bathroom door and waiting for it to be opened. His sounds are rich in inflections and variety, but they are produced at random, making speech unintelligible. He has been receiving private speech therapy for nine months and at present speaks three words, "bye-bye," "shush up", and "quiet."

Sensory Motor Development

He has very good gross motor development. He will not hold a pencil, crayon or chalk, and will not scribble or make marks when directed. Eye-hand motor development seems average. It was not possible to establish right or left dominance. He is not interested in puzzles, beads, or block games, and refuses to play with them.

Cognitive Development

No assessment of cognitive development was attempted, but it is apparent it does not follow normal development and lags severely. The treatment situation revealed he has the capacity for language and is able to respond to a simple language involving basic nouns, adjectives, and verbs. In addition, he could respond appropriately to color inquiries on the test. He does not seem to be aware of himself as a person, and cannot point to parts of his body. He responds more to the tone of voice than his name.

Social and Emotional Development

He is far below normal in development. He does not relate to people, does not play with other children, has no fear of danger, poor feeding habits, poor sleeping habits, bizarre behavior patterns, obsessions with objects, is not interested in toys and does not communicate openly with others.

The distinct behaviors and symptoms indicating infantile autism are: present since birth, normal E.E.G., unresponsive to mother's body, absence of speech, repetitive bizarre behavior, perseveration for sameness in environment, normal gross and fine motor development, and detached and disoriented behavior (Ornitz, 1973; Rimland, 1974).

APPENDIX C

RESPONSES IN SIMULTANEOUS AND FINAL TREATMENT PHASES

RESPONSES IN SIMULTANEOUS TREATMENT PHASE

BLOCK 1

Experimenters		1	2	3
Treatment Order		D	B	C
Sessions	1.	3	0	9
	2.	6	0	3
	3.	6	1	3
	4.	5	3	6
	5.	6	0	2
	6.	0	0	0
	7.	0	0	0

BLOCK 2

Experimenters		1	2	3
Treatment Order		B	C	D
Sessions	1.	2	0	4
	2.	3	1	6
	3.	3	0	5
	4.	6	3	6
	5.	9	0	10
	6.	6	0	15
	7.	5	3	12

BLOCK 3

Experimenters		1	2	3
Treatment Order		C	D	B
Sessions	1.	0	9	3
	2.	0	9	4
	3.	3	7	7
	4.	1	6	7
	5.	0	6	5
	6.	1	12	6
	7.	2	9	3

RESPONSES IN FINAL TREATMENT PHASE

BLOCK 4		BLOCK 5	
Sessions	1. 12		8. 9
	2. 12		9. 9
	3. 21		10. 7
	4. 15		11. 10
	5. 11		12. 13
	6. 6		13. 12
	7. 5		14. 12

APPENDIX D

MEANS AND STANDARD DEVIATIONS AMONG RESPONSE IN SIMULTANEOUS AND FINAL TREATMENT PHASES

MEANS AND STANDARD DEVIATIONS FOR TREATMENTS

DURING SIMULTANEOUS TREATMENT PHASE

	Mean	Standard Deviation
VOCALIZATION	1.76	2.3217
SIGNING	3.47	2.7316
TOTAL COMMUNICATION	6.76	3.6865

MEANS AND STANDARD DEVIATIONS FOR EXPERIMENTERS

DURING SIMULTANEOUS TREATMENT PHASE

	Mean	Standard Deviation
Experimenter 1	2.52	2.6761
Experimenter 2	4.71	3.9388
Experimenter 3	4.76	3.6962

MEANS AND STANDARD DEVIATIONS FOR BLOCKS

DURING SIMULTANEOUS TREATMENT PHASE

	Mean	Standard Deviation
BLOCK 1	2.5238	2.8039
BLOCK 2	4.7142	4.0883
BLOCK 3	4.7619	3.4627

MEANS AND STANDARD DEVIATIONS FOR BLOCKS OF TOTAL COMMUNICATION TREATMENTS IN FINAL PHASE

	Means	Standard Deviations
BLOCK 4	11.714	5.407
BLOCK 5	10.285	2.138

APPENDIX E

RESULTS OF DUNCAN'S NEW MULTIPLE RANGE TEST FOR MAIN TREATMENT EFFECT

RESULTS OF DUNCAN'S NEW MULTIPLE RANGE

TEST FOR THE MAIN TREATMENT EFFECT

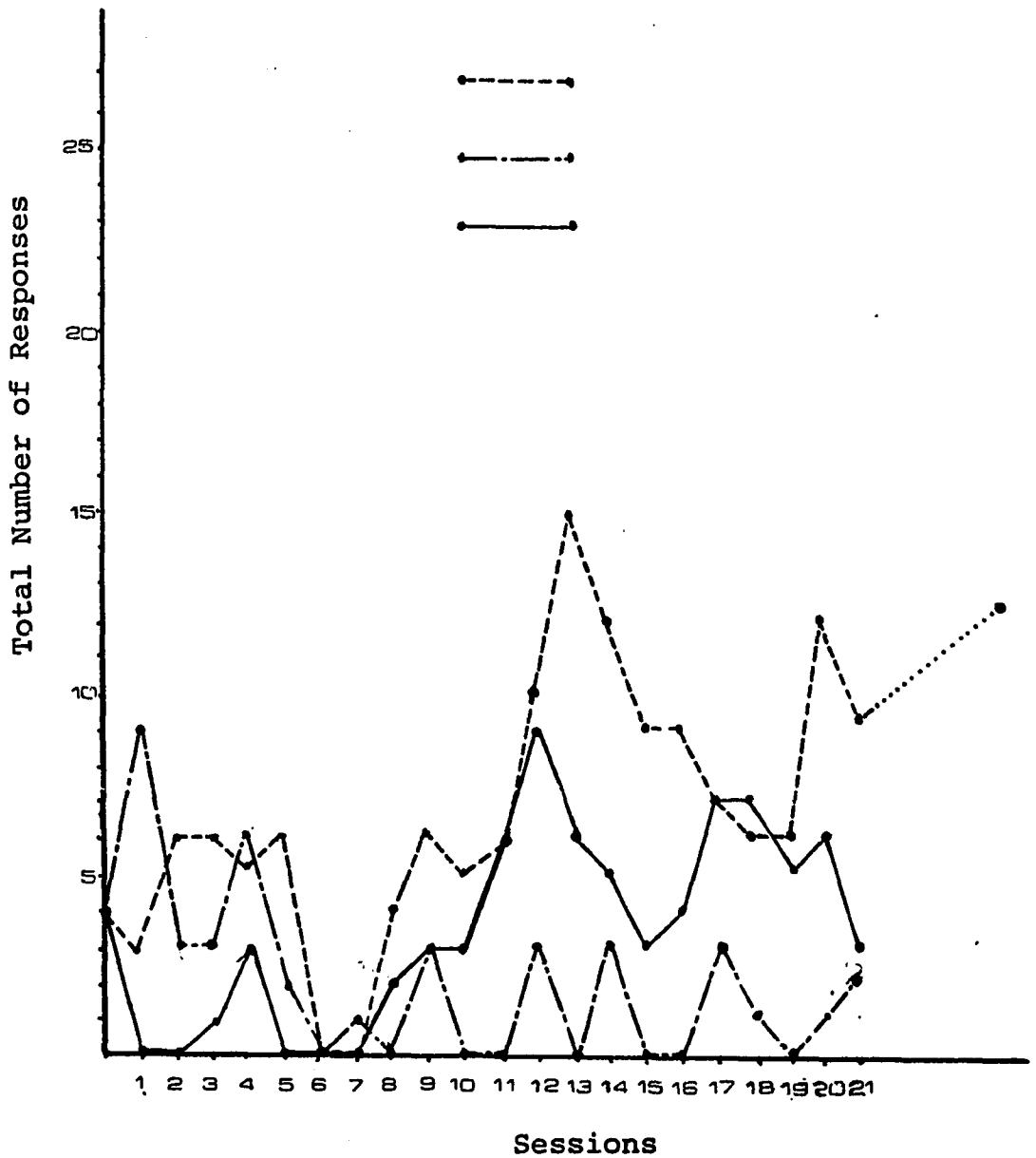
		$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_3$
Treatments Means		1.76	3.47	6.76
Vocalizations $\bar{X}_1$	1.76	----	1.71	5.00*
Signing $\bar{X}_2$	3.47	----	----	3.29*
Total Communication $\bar{X}_3$	6.76	----	----	----

*significant at the .05 level

APPENDIX F

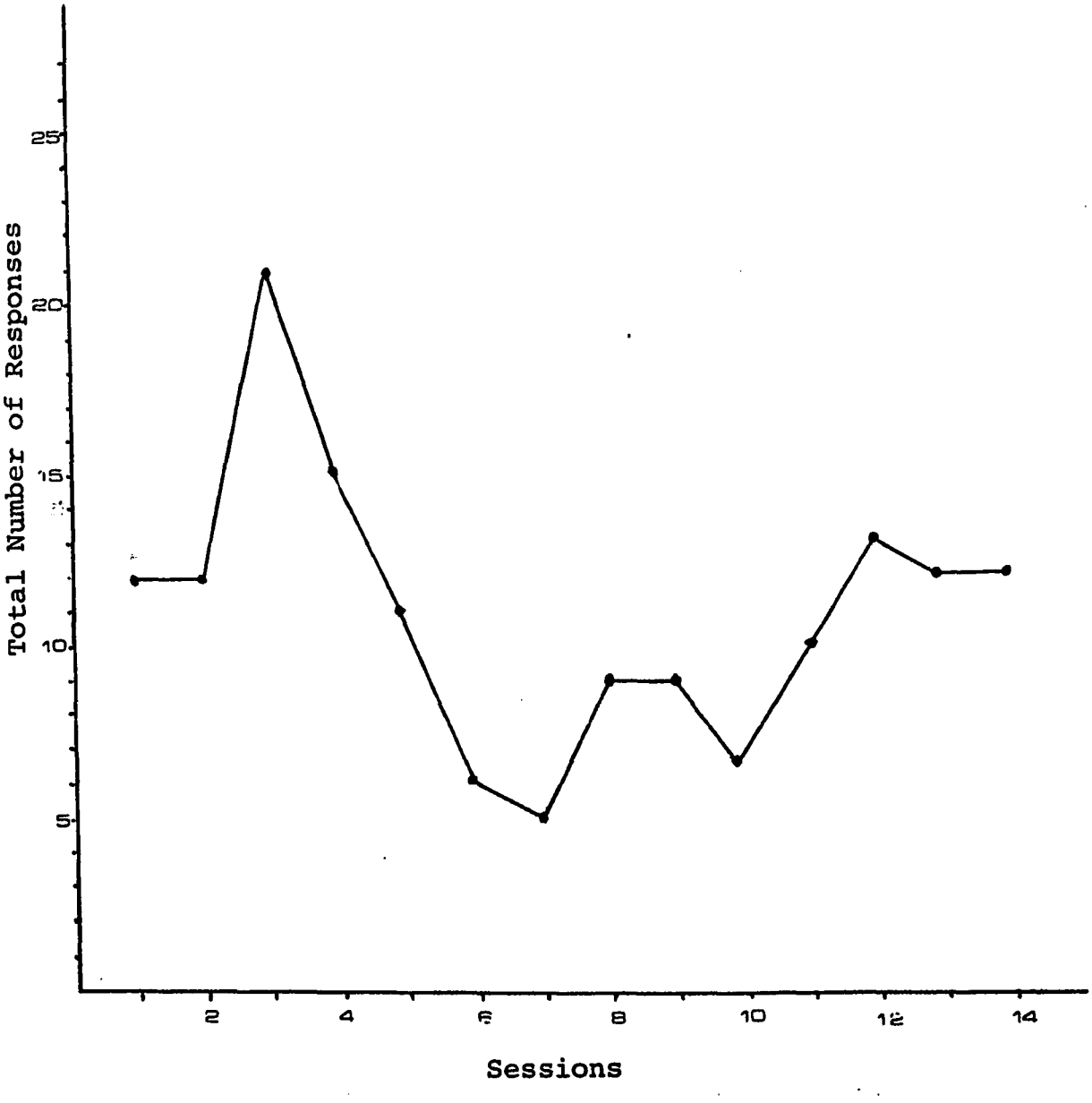
GRAPHS OF SIMULTANEOUS AND FINAL TREATMENT PHASES

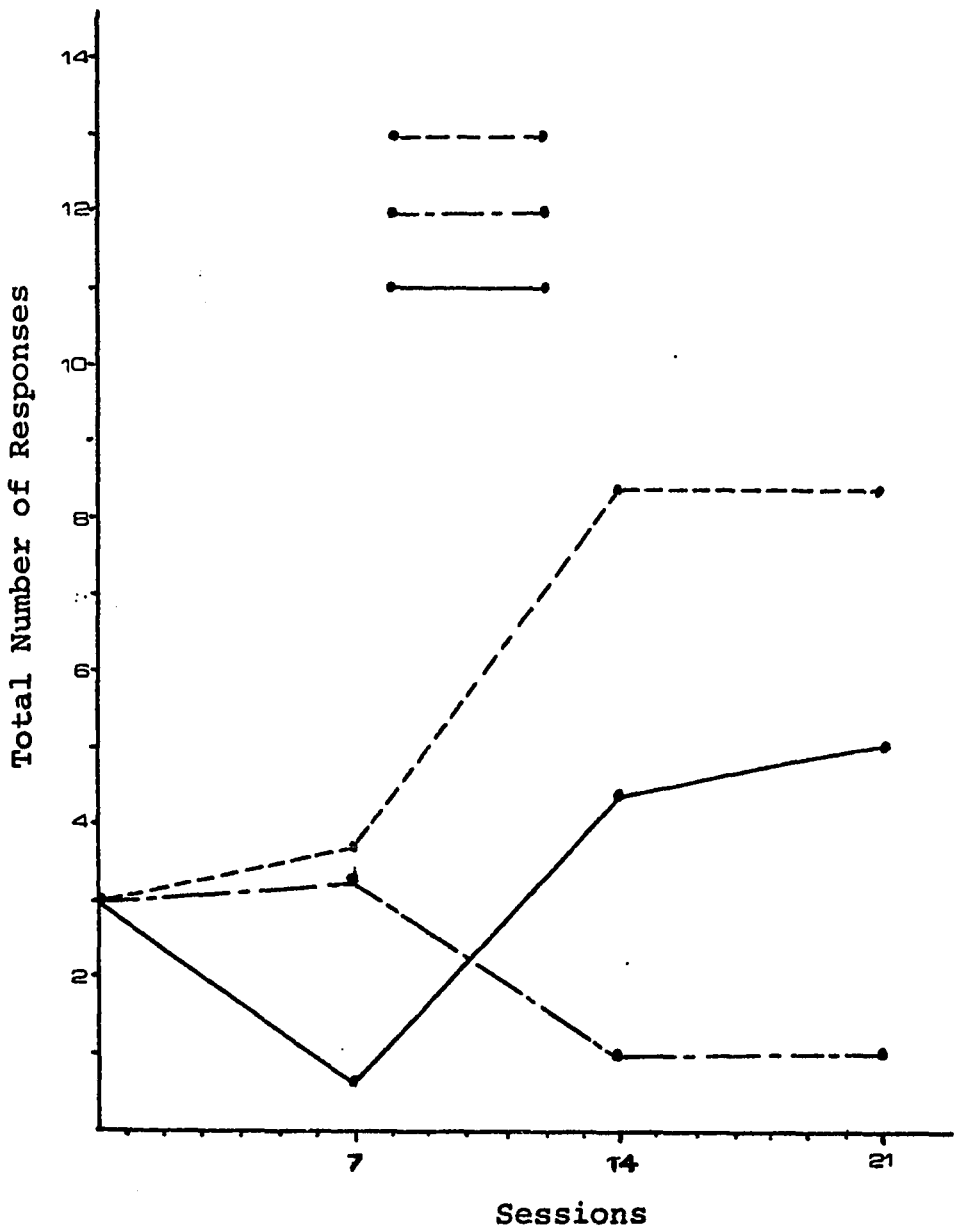
RESPONSES AMONG TREATMENTS IN SIMULTANEOUS TREATMENT PHASE



RESPONSE IN FINAL TREATMENT PHASE

TOTAL COMMUNICATION ONLY




Total Number of Responses
14
12
10
8
6
4
2
7
14
21
Sessions