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The Effect of Gesturing Behavior on Verbalization in Pre-School Deaf Children

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THE EFFECT OF GESTURING BEHAVIOR ON VERBALIZATION IN PRE-SCHOOL DEAF CHILDREN

(TITLE)

BY

PAMELA S. BLAIR

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INTRODUCTION

A statement often made by teachers of the deaf and hard of hearing child, as well as by speech clinicians, is: "We have to get that child to stop using gesturing or he will never learn to talk!" Such a statement assumes a specific interrelationship between gesturing and verbal behavior that remains an unanswered question. Perhaps too much emphasis is put upon the extinction of gesturing behavior.

"Pre-school three and four year olds have a view of the world that is strongly presymbolic. Their thinking is not always tied to the objects themselves," stated Dr. David P. Weikart (1971) in his study on cognitively oriented curriculums for normally hearing pre-schoolers. The thinking of the pre-school deaf child does not center about the symbolic labeling of a specific object alone, but rather the child attempts to relate his conception of this object in a highly emotional and often non-verbal manner. Deficiencies in vocabulary and language abilities, resulting from hearing loss, force deaf children to seek any means of communication available to them. Thus, they use a variety of gesturing, touching, and physical expression to accompany and make meaningful their vocalizations. Gesturing serves as a means for the child to express

his emotions and brings some relief for his communicative needs (Di-Carlo, 1964).

Controlled studies concerning the effects of gesturing on verbal behavior are minimal. Some researchers have stated, in related studies, that certain cues accompanying speech serve as aids, rather than determents to the learning of speech and language skills. For example, Cornett and Miles (1967) sought a method of combining lip reading and signing and developed a technique called "Cued Speech" in which specific gestures accompanied distinct phonemes in teaching speech and language skills to deaf children. The progress of only one child was reported and the results were impressive in that the child made observable progress as measured by a comparison of the size of vocabulary at the onset of therapy and at termination of the study. The child's vocabulary almost tripled and the parents reported greater language usage in the home as well.

There is, as mentioned above, a great lack of information to support any statement of the effects of gesturing upon the use of meaningful verbalization. One of the greatest problems faced by a deaf person in a hearing, as well as a deaf world, is the need to communicate. For clinicians and teachers of the deaf, there exists a responsibility to guide the deaf child toward the best level of communication possible for that particular child. Who is to say, without proof, that gestures must not be allowed in the classroom or at home, especially if gesturing is a

meaningful and basic form of communication for the child. Better ways of teaching verbal language skills must be sought. One should begin to question current methods and beliefs and to take a closer look at both verbal and gesturing behavior and the effects they have on one another before definite conclusions are drawn.

Why study the effects of gesturing on verbal behavior? There are several strong reasons, but the most important is the need on the part of the deaf child to communicate in a world where he is often an oddity. Impairment of the auditory sense deprives the deaf child of his most valuable means of survival within the hearing environment: verbal communication. It is up to those who are responsible for the education of these children to find the most productive way to help the child develop this all-important mode of communication. If language can be learned faster and retained longer through a combination of the use of gestural communication and verbalization, then this is what should be done.

Another reason for a study such as this is to generate evidence for or against the use of gesturing in the classroom and its effect on verbal behavior. The inter-relationship between gesturing and verbalization is still an unanswered question. The purpose of this study is to supply some answers concerning this relationship.

Finally, no one really knows to what extent gesturing does influence the amount of verbalization. If one believes that gesturing helps the deaf child to understand his environment, then perhaps it should be

hypothesized that the use of gesturing will enhance verbal performance. Research must be done to assess the effects of gesturing on verbal performance. If it is discovered that reinforcement of gesturing does cause a decrease in the amount of verbalization, deaf educators and speech clincians will have to take a critical look at their therapy programs. If, on the other hand, it is discovered that reinforcement of gesturing causes an increase in verbal behavior, a new concept of the use of gesturing as a supplement to the development of oral language may be what is needed. Oralists and Manualists may have to join hands and combine methods to provide the best possible education in language for the deaf child. This is, in fact, what the new movement toward "total communication" is all about.

More emphasis may need to be placed upon the reinforcement of verbalization behavior. If, on the other hand, this research hypothesis concerning the ill effect of gestures upon verbalization is disproved, old ideas concerning the suppression of gesturing may have to be thrown aside.

Statement of Problem

It was the purpose of this study to investigate the effects of gesturing behavior on the development of verbal language skills in the pre-school deaf child. Stated as a null hypothesis:

> Reinforcement of gesturing behavior in the deaf and hard-of-hearing pre-school age child does not result in a statistically significant decrease in the amount of verbalization.

Statistical significance of the following questions will be explored:

1. If gesturing behavior is reinforced, will verbal behavior decrease from established baselines?

2. If verbal behavior is reinforced, will gesturing behavior decrease?

3. If verbalization increases with the reinforcement of gesturing, will verbal behavior return to baseline levels when the gesturing is no longer reinforced?

CHAPTER II

REVIEW OF RELATED LITERATURE

Definition of Terms

Several terms must be operationally defined in order that the reader be aware of the specific ideas that the author is relating. In communicating, the deaf child uses those avenues most available to him. The language of the deaf has often been broken down into four areas: oral language, natural sign or gesturing, signing, and fingerspelling. Oral language refers to the spoken, verbal communication of the deaf accompanied by natural gesture. The Committee for Education and Science in Great Britain defines an oral communication as "a communication by word of mouth. It involves the dual ability to speak and to comprehend spoken utterances (1964)." Much is involved in learning oral communication since the ability to communicate effectively by verbalization cannot exist without some command of language.

There are many different kinds of signs and varieties of signing. Some distinguish between Natural Sign or Gesturing, a movement nearly always understood by a hearing person as well as by a deaf person, and sign language as described below. "In an analysis in the booklet "Con-

versation with the Deaf," the Reverend Canon T. H. Sutcliffe identified the following elements in signing: gesture, used either naturally or in conventional form; facial expression; mime; and the identification of objects by reference to an outstanding characteristic and of qualities by reference to objects possessing them." (Great Britain Committee, 1964)

Signing, says the Committee (1964), is a generic term referring to the use of signs and gestures of various kinds. This is in contrast to what they define as formalized sign language, which is a system of signs, universally used by the deaf, that form a language. Sign language is a system of communication that must be learned, like another language.

Fingerspelling, as its name implies, consists of the spelling out of individual words of the written language, letter by letter, on the fingers. Each letter of the alphabet is represented by a particular sign (Great Britain Committee, 1964).

Definitions of Basic Gestures

Hirsch (1963) discussed various types of gestures which people use in communication in conjunction with verbal symbols. Included are gestures of the hands, movements of the head, facial mimicry, and general body movements and positions (Quigley, 1966). Quigley further states, in discussing the work of Hirsch:

"A deaf person can only communicate freely when he has

> learned, in addition to a regular form of communication, to use appropriately the generally accepted gestures of normally hearing people."

Gesturing is, therefore, a part of all communication whether the person is considered deaf or hearing, and Quigley believes that gestures or natural signing have a definite place in the teaching of language to the deaf child.

Russian Research on Gesturing Behavior

Quigley reported on the quantity of literature concerning the relationship of gesturing and signing to oral language that has been written in the Soviet Union. While most of the research is written in Russian, Quigley discussed the major points of the most significant of the Russian studies. He mentioned several prominent Russian researchers who have dealt with gesture as a useful tool in language acquisition of the deaf child (Quigley, 1966). One study (Simonov, 1960) discussed the lack of desire on the part of today's researchers and educators to understand the part of "mime and gesture in the education of deaf persons in the development of their speech" (Quigley, 1966). Simonov also reported poor results in studies done in the Soviet Union concerned with the use of traditional methods in educating the deaf. He stated that after years of schooling, deaf persons soon forgot or failed to use oral speech, preferring to use an interpreter. He felt that "it should be possible to create some unity of grammar and syntax between the language of signs and oral speech" (Quigley, 1966; Simonov, 1960).

Quigley further reported on a Russian study done by Tevoort (1961). This study was concerned with observing the development of traditional communication forms. Tevoort filmed out-of-class conversation of deaf children in both Europe and the United States and did a linguistic analysis of the data. Results indicated that "deaf children tend to develop a relatively primitive system of gestural communication on a purely visual basis and with a relatively small vocabulary" (Quigley, 1966). Says Tevoort:

> "The young deaf child usually develops a system of communication that deviates from the acoustical language of his environment in that it follows the structuring principles of a visual system and grows out to a completely different system of communication." (Quigley, 1966; Tevoort, 1961)

Gesturing and Signing In and Out of the Classroom

Out-of-class communication used among deaf children in which spontaneous gesture often appears, often predominates, regardless of what method the teacher may be stressing in the learning situation. Children tend to fall back on this familiar form of communication when conversing with each other, even if they still use some oral language to accompany it.

Among deaf educators and researchers, the trend has been against the use of signing or gesturing in the classroom. Some educators fear that if signing is used in the classroom, even in conjunction with speechreading and speech, the signing might tend to become the dominant element, and might interfere with oral progress and linguistic development.

Quigley (1966) believes that although such risks may exist, this type of statement can only be made after detailed investigation over a long period of time. He feels the hypothesis that identifies gesturing as an adverse influence upon the development of language in deaf children must be tested and proven through research with deaf children (Great Britain Committee, 1964). The actual linguistic behavior of deaf children needs to be observed, recorded, and analyzed in terms of types of communication used, frequency of usage of oral language as compared to that of natural gesturing, and the effect of one type of communication upon the other. This study has been conducted in the hope of proving that the use of natural gesturing in the teaching of language to the deaf child will not retard or prevent the acquisition of oral language.

Presently, there is not universal agreement on how deaf children should be instructed in language development skills. Deaf educators have often split into two camps: Manualists and Oralists. However, there does not appear to be as clean a break between these two metoods that stress (1) a purely manual approach utilizing signing and fingerspelling only (Long, 1963), and (2) a purely oral approach that emphasizes verbalization only, (Bolesta, 1967) as the advocators of each group would prefer to believe. The deaf child must grow up and live in both a hearing and a deaf world, and he needs to learn to communicate as best he can by any means available to him. The answer does not seem to lie in promoting one method over another. If this occurs, the deaf child will

ultimately be the one to suffer. The deaf educator must recognize the native signing that the child has already available to him as a useful basis for the development of oral language.

Language Development

"A language is a system of symbols. A symbol is a sign made by a person which directs the behavior of others or of the person himself to a situation, which may be that in which the sign occurs, or not actually present when the sign appears" (Great Britain Committee, 1964). This statement can be made concerning any verbal form of language, but it also can be made in reference to the conventional signing of the deaf. Natural signing develops in much the same way as oral language begins to develop in a hearing infant. What the baby sees on the lips is a modification of his picture of a certain person who establishes her importance by satisfying specific needs, such as the need for food and drink, shelter, and affection. Upon the appearance of the "comfort bringer", her face changes in a rather definite relation to the comfort that she is furnishing. A hearing child will soon begin to associate the facial expression of the mother to specific words that she says in conjunction with specific activities she performs. Later, the child will begin to imitate these words that he hears and sees. Similarly, a deaf child will soon begin to associate the facial expressions and lip movements to specific activities perfromed by the mother. The child may begin to imitate certain body motions and facial expressions made by the mother. The gesture

of facial expression begins to take on more meaning for the child than the movements of the lips forming the words (Meyer, 1934). The child begins to learn to associate certain feelings and actions with specific facial movements as they form words. The development of oral language can later spring from this early beginning lipreading skill. Alice Streng (1967) says that the "deaf are endowed with an innate capacity for learning language." Strickland (1967) agrees, and points out that even normally hearing children bring to school a langauge. She emphasizes that little opportunity is afforded children in most schools to use the skills in language that they have developed in the pre-school years. Deaf children, similarly, bring a language to school with them. It may consist of some isolated words picked up from association with parents and siblings and certainly contains several examples of natural gesture and "home" gesture, (i.e., those gestures adapted by the family and used exclusively within the family group). Should teachers utilize this important avenue of communication that the deaf child has begun to develop? In the school situation, the child will have the opportunity to begin to expand his mastery of linguistic skills. The development of communication skills is foremost in importance in the education of the deaf child. The child must be taught the value of language; the power of communication by means of experiences in which he has the opportunity to utilize language skills. He comes to school with the desire to communicate. Educators must foster in him the desire to use and under-

stand oral language. Why not start with a language form the child is already familiar with and let it serve as an asset in teaching oral language? Begin with natural gesturing and build a second language system upon it—verbal language. "Unless a deaf child is allowed to acquire and then expand his knowledge of sign language, he will be deprived of a natural basis for the acquisition of communicative competence in the deaf community, and find himself a pathological curiosity in the hearing world." (Cicourel, Boese, 1972) Cicourel and Boese make another very realistic and significant statement concerning the language of the deaf:

> "Whereas it may be true that every person must at some time in life come to grips with the hearing world, it is just as true that the deaf child will probably never be at home in a hearing world, but can be just as comfortable in a deaf world." (Cicourel, Boese, 1972)

We can emphasize the acquisition of oral language for the deaf, but we cannot suppress this native signing. Native signing refers to learning to sign or use gesture as a first language where the signs do not necessarily correspond with signs linked to oral language (formalized sign language) unless the parents use these latter signs systematically with the child. (Cicourel, Boese, 1972) A big problem with stressing the oral method is that educators are usually unaware that the native signs are important for the child's perception and interpretation of his environment (Cicourel, Boese, 1972). Therefore, the education of the deaf must incorporate the realization of the importance of the system of

natural gesture both to the security of the child and to the linguistic development that he obtains.

Cicourel and Boese acknowledge the importance of learning an oral method to enable the deaf person to communicate with a hearing world that he must live in, but they stress that if this deaf person is to make maximum use of an oral method, the teacher must realize that the child can learn an oral method only through a natively acquired sign system as a first language (Cicourel, Boese, 1972). In a study currently being researched by Cicourel, he investigates the assumption that hearing children acquire primitive signs and use them even after the acquisition of oral language. Gesturing is very important as a part of communication for the hearing in conjunction with the oral language used. Educators do not suppress a hearing child from natural gesturing as he speaks or from using body posturing and facial expression when he speaks, which is also a form of gesture; so educators of the deaf child should not do so either!

Gesturing and Body Language

Gesturing is a method of communication utilized either consciously or unconsciously by all people. When a person attempts to relay a specific message to another person, movements of the hands and eyes, as well as facial expression and body posture serve to enhance and perhaps even strengthen the impact of what the speaker is saying. It is very difficult to carry on a conversation without in some way using body

movements to accompany our message. For those who would not accept such an idea, try to put across an important idea to another person while clasping the hands tightly in the lap. The result is that communication, even though verbal language is being transmitted, is hindered. Words alone do not supply the emphasis one may wish to impart in his communicative message. The receiver, in turn, may misinterpret the sender's ideas, and certainly, without gestures, the entire conversation may lose some of its vividness and interest.

Recently, an awareness of a form of nonverbal communication known as body language or kinesics, which is the scientific study of body language, has developed. It is hypothesized (Fast, 1970) that all human beings, regardless of their oral language, culture, or physiologic status (i.e., deaf, emotionally disturbed, retarded, blind) communicate emotions, ideas, attitudes and often specific messages to other persons through the use of this non-verbal channel. Body language may include any movement, conscious or unconscious, of all or a part of the body used by a person to communicate an emotional message to his environment (Julius Fast, 1970). Facial expression can play a large part in interpreting the message a person may be sending out to his immediate environment. Sometimes, these facial gestures and expressions may convey a meaning without any verbalization at all, as when one is driving in a car and someone cuts him off as they pass. Although no words may be spoken, the offender need only to look at the face of the driver he has

cut off to get a clear message of what the person feels!

Facial expression can also be used effectively to reinforce verbal messages. Deaf persons are especially receptive to the facial expressions of the people with whom they communicate. It is of little use to discipline a deaf child verbally if your eyes or your mouth do not also relay your disapproval. Even though the child may understand what is being said to him and that he is being reprimanded, he will either not take the person seriously or will be confused regarding what the actual message is.

Fast (1970) explains that to understand nonverbal body language we must understand that it is partly instinctive, partly taught, such as the tendency to draw the body away from unpleasant objects or situations, and partly imitative. This is especially true of the deaf child. He will learn to imitate facial expressions as they closely relate to the visual world for their information about the environment. Later, deaf children learn to relate objects and ideas to other people through imitative gestural movements that they associate with some characteristic of an object or action.

Actually, one cannot separate body language from spoken language any more than one should separate natural gesture from oral language. One is essentially speaking of the same idea in both of these statements. Says Dr. Ray L. Birdwhistell in Fast's book on body language (1970): "Spoken language alone will not give us the full meaning

of what a person is saying," nor will body language alone give us the entire message. If one can make such a statement concerning the hearing, certainly one must apply that concept to the communication of the deaf. Verbal communication alone is especially lacking in meaning for the deaf child. Gesturing provides a concrete basis for understanding of verbal language. Gesturing alone, however, will not provide the necessary means of communication for the deaf unless it is developed into a system of formalized signing. If this becomes the deaf person's only means of communication, he is at a great loss in a hearing environment. Therefore, it appears that educators must observe and encourage a combination of gestures or body language and verbalizations when teaching the deaf child a system of communication.

Deafness as a Second Culture

Communication involves a highly integrated interaction with one's environment. Hall (1959) says: "To interact with the environment is to be alive, and to fail to do so is to be dead." Speech is one form of interaction with one's environment, but Hall (1959) stresses that speech is enriched and reinforced by gestures. Language is a system of symbols for objects and concepts that the individual perceives in his environment. When people talk they are using vocal symbols (Hall, 1959). When deaf persons use a gesture, they are communicating through a primitive, but basic use of symbols for the world as they perceive it.

In The Silent Language (1959) and The Hidden Dimension (1966),

Hall deals with cross-cultural communication. He emphasizes that the mode of body language communication may vary according to cultural standards and expectations, and if man is to communicate successfully with people of other cultures, he must respect and be aware of these variations. Members of a specific culture share strong, meaningful experiences and communicate these experiences to one another, although it may be at an unconscious level. The people of a given culture use these common experiences with which to judge and evaluate the world as they perceive it. One must avoid projecting the rules of his culture on to the culture he is for any reason interacting with.

The deaf could perhaps be said to make up a "mini-culture" of their own. Hearing persons too often tend to project their own standards and expectations upon the world of the deaf person. One must try to understand that a deaf person perceives his environment visually, kinesthetically, and emotionally, but NOT auditorily, as the hearing person does, and this makes a big difference. A deaf child will attempt, like a hearing child, to relate to others the world he perceives. All people have the need to communicate. However, a deaf child symbolizes his environment into gestural, rather than verbal symbols. True, verbal symbolization, or language, can be taught, but one must understand the symbols; they must have meaning for that child. Allowing the child to use gestures to accompany verbal language could aid in giving meaning to the verbal symbols.

Griffith (1969) quotes Myklebust when he refers to gesturing as a form of symbolic behavior: "Only those children who have internalized their world symbolically can use gesture as a language." Myklebust reinforces the idea that children cannot use any form of expressive language if they have not first utilized some means of receiving sensory information in a meaningful manner.

One cannot refute the importance of the visual sense. Much more information is fed into the nervous system visually than through either touch or hearing (Hall, 1966). Gestures are visual symbols readily learned and understood by deaf and hearing alike, and are very important to the quality of communication.

Other Research: Summary

While research dealing directly with gesturing behavior and it's relationship to verbal language is scarce, one study should be noted at this point. In Persons With Hearing Loss, (1969), Griffith discussed research done at the University of Illinois using the Motor Encoding portion of the Illinois Test of Psycholinguistic Abilities (ITPA) by Kirk and McCarthy (1961). This portion of the test determines how well a child uses gestures to expres's himself without the use of verbalization. Griffith (1969) indicates a study by James Olsen (1960) that compared the ITPA test scores of hearing and deaf children. Results indicated a significant difference between scores of both groups on every subtest of the ITPA except the Motor Encoding portion. While the mean test score

for hearing children was 22.72 on this subtest, the norm for deaf children was 21.88, not a significant difference in mean scores. This was an expected result as deaf children rely more heavily on the gestural mode of communication than does a hearing child. However, it also shows the high level of importance that the gesture acquires in the life of the deaf child.

At present, the literature dealing with the effects of gesturing behavior on verbalization in deaf children is minimal. Much more research dealing with the amount of gesturing behavior observed as a function of the type or amount of hearing loss and the frequency and type of gesture behavior in relation to the age of onset and degree of deafness is needed.

From the literature available, one can conclude the following:

(1) Communication exists on many levels. Gesturing, signing, fingerspelling, and body language, as well as verbal communication must be included.

(2) Gesturing, as defined by Hirsch (1963), Fast (1970), and others, is a part of all communication and serves as a basis for the deaf child's understanding of his environment. Gestures serve to supplement and add meaning to verbal communication for both the hearing and the deaf.

(3) Traditionally, the trend has been to discourage the use of gesturing in the classroom for fear that permitting gesturing would reduce the chances for the development of oral language. However, little research has been done to support this theory. Today, more and more educators are proposing the combined use of gestures and signing to complement oral education. More research is needed to provide a firm basis for this position, as well.

(4) There is little research to support the theory that gesturing is a determent to the development of verbal language, yet this idea lives on. However, there is also little, if any, research that directly supports the use of gestures to accompany verbalization in the teaching of language to deaf children. More studies must be undertaken to provide a basis for argument.

CHAPTER III

SUBJECTS, EQUIPMENT, AND PRODECURES

I. Selection of Subjects

The children who served as subjects were selected from the Pre-School deaf classroom at Mark Twain Elementary School where the investigator served as kindergarten teacher. Since all three children underwent the same reinforcement vs. non-reinforcement schedules, each child, in effect, served as his own control. The following criteria served as the basis for selection of subjects:

(1) Age: The children used had to be between the ages of three and seven years to be elegible for the deaf education program. The specific children chosen for this study ranged from four years, one month to five years, eleven months. Two males and one female child participated in this study.

(2) Hearing Loss: All of the children in the deaf education class were classified in either the low hard-of-hearing or profoundly deaf range of hearing impairment. This range is defined as grades III and IV by Huizing (1953). A grade III impairment is equal to a severe loss ranging from 60-90 dB while grade IV refers to a loss of more than 90 dB. (These losses are average losses in the speech frequencies, 500, 1000, 2000 Hz.) All of the subjects were given a binaural puretone audiometric threshold test to assess actual thresholds.

The investigator administered these tests. Of the three participating children, one male and one female fell into the profoundly deaf range while the third child, a male, was classified as a grade III impairment (Huizing, 1953). Audiograms are included in the appendix of this paper.

(3) Educational Status: All participants were required to have been members of the Pre-School Deaf class for at least one year prior to the present school year.

The Pre-School Deaf Class consisted of nine students, five of whom satisfied all of the requirements to participate in this study. Three of the five eligible students were selected as subjects for the study on the basis of good attendance records. All of the participating students were full-day students in the class.

II. Pilot Study

A pilot study was necessary in order to establish an operational definition, as well as a range of gesturing behaviors.

(1) Procedure

Shibaden Videotaping equipment, Model #TU-23UL, was set up in the classroom within full view of the children for two days prior to the actual taping. On the third day, a video tape was made of the morning lessons and activities of the children in the Pre-School Deaf classroom. At a later time, this video tape was viewed by the investigator and three other observers; the Pre-School teacher, and two Ph.D. professors from the Department of Speech Pathology and Audiology at Eastern Illinois University. The observers were selected on the basis

of clinical experience and educational background with deaf children. Each observer was asked to write down, as he viewed the tape, a description of any action on the part of the children that he felt constituted a gesture. Examiner percentage of agreement was then determined.

Percentage of agreement among the four observers was determined for each individual gesture observed as follows: If four out of four observers recorded the same gesture, there was 100 per cent agreement; if three out of four observed it, there was 75 per cent agreement; two out of four constituted 50 per cent agreement and if only one observer described a particular gesture, it was indicated as 25 per cent agreement. An average percentage was computed for the entire list of gestures compiled by all four observers combined. This average percentage of agreement was only 58.33 per cent; however, the investigator feels that the real significance of this pilot study lies in the individual percentages of agreement for each gesture.

A total of 69 gestures were described by the four examiners. Of these, 12 gestures were observed by all four observers, or 100 per cent agreement; 75 per cent agreement was established for 18 gesturing behaviors, and 50 per cent agreement was established for 19 of the gestures described. This indicates that there was a fairly high level of agreement regarding the what the observers described as a gesture. This data can further be interpreted as shown in the following table, indicating percentage of agreement based on the total number of observed gestures (N = 69):

TABLE 1

PERCENTAGE OF EXAMINER AGREEMENT

Percentage of Agreement Among the Observers	Actual Number of Gestures Out of 69	% of Total Number of Recorded Gestures
75% and over agreement	28	43.48%
50% and over agreement	47	71.01%
50% and under agreement	38	55.07%

From the total described gestures observed by all of the examiners, a total list of gesturing behaviors was compiled. It included those gestures shown below. The percentage of agreement breakdown for each individual gesture is shown also.

TABLE 2

GESTURES OBSERVED BY FOUR EXAMINERS UPON VIEWING THE FIFTY MINUTE PILOT FILM

Gesture	Observer:	#1	#2	#3	#4
Child points to hearing aid	100%	+	+	+	+
Child moves hand to head and then to stomach	100%	+	+	+	+
Points to self	100%	+	+	+	+
Puts finger to lips	100%	+	+	+	+
Enlarges eyes as if glowering	100%	+	+	+	+
Pats table	100%	+	+	+	+
Raises two fingers	100%	+	+	+	+
Raises four fingers	100%	+	+	+	+
Places one hand horizontally above the other	100%	+	+	+	+
Points from picture to self	100%	+	+	+	+
Points to ear	75%	+	+	+	-

TABLE 2—Continued

Gesture	Observer:	#1	#2	#3	#4
Raises index finger in front of body and nods head	75%	+	+	-	+
Shrugs shoulders and raises hands, palms up	75%	+	-	+	+
Extends hand in front of body for attention	75%	+	-	+	+
Extends arms sideways and flexes wrist downward (HOME)	75%	+	+	+	-
Waves hand over object	75%	+	+	+	-
Uses manual alphabet "I"	75%	+	+	+	-
Swings arm in half circle movement with fist clenched	75%	+	-	+	+
Points to indicate "you" and "me"	75%	+	+	+	-
Moves arm across body rapidly	75%	+	-	+	+
Smiles and nods head	75%	+	+	+	-
Hand cupped and drawn away from head (indicating horns)	75%	+	-	+	+
Flexes fingers inwardly repeatedly	75%	+	-	+	+
Stands on chair	75%	+	+	-	+
Puts hand in front of the eye in a circle shape	75%	+	+	+	-
Points from picture card to self	75%	+	-	+	+
Makes an imaginary scribble movement with hand	50%	+	+	-	-
Cups hands in ball shape	50%	+	+	-	-
Points to chest	75%	+	+	+	-
Shakes head	100%	+	+	+	+
Shakes hand and points finger	50%	+	-	+	-
Cradles arms and rocks them side to side	100%	+	+	+	+
Shakes hand right and left	50%	+	-	-	+
Snaps fingers	50%	+	+	-	-
Waves hand	50%	+	+	-	-
Moves hand slightly up and down in a rapid motion	50%	-	+	-	+
Points finger to chest vigorously	75%	+	+	-	+
Spreads both arms out in large circular movement	50%	+	-	+	-
Raises finger in circular movement from head	50%	+	+	-	-
Points with finger toward blackboard	50%	-	-	+	+

TABLE 2—Continued

Gesture	Observer:	#1	#2	#3	#4
Points finger to camera	50%	-	+	-	+
Points from ears to temples on both sides	50%	+	+	-	-
Shrugs shoulders	25%	+	-	-	-
Nods head	25%	+	-	-	-
Small arm swing using wrist only	25%	+	-	-	-
Throwing motion with fingers extended	25%	+	-	-	-
Puts hand to face	25%	+	-	-	-
Jerks body backward with arms extended frontward	50%	+	+	-	-
Points index finger downward	25%	+	-	-	-
Sticks out tongue and shakes head	25%	+	-	-	-
Both hands cupped and moving upward and outward from either side of the head	25%	+	-	-	-
Pats another person's arm	25%	+	-	-	-
Facial grimace with lower and upper teeth approximated to indicate "scary"	25%	+	-	-	-
Throws arms upwards beside head	25%	+	-	-	-
Both hands make fists with palms downward and body bouncing up and down (horse)	25%	+	-	-	-
Slaps both hands on table	25%	+	-	-	-
Opens and closes mouth with no sound	25%	+	-	-	-
Raises hand up with palm out	25%	-	-	+	-
Hand on head with head down as if sleeping	50%	+	-	-	+
Rubs lip with finger	25%	-	+	-	-
Rocks back on legs of chair	50%	+	+	-	-
Strokes object (look at this)	50%	+	+	-	-
Raises hand to answer question	50%	+	+	-	-
Sequential pointing	50%	+	+	-	-
Points to arm, then shoulder	25%	-	-	+	-
Pointing and nods	50%	+	-	+	-
Yells and gestures hands downward	50%	+	-	+	-
Moves hands over hair	25%	-	-	+	-

+ indicates that the observer noted the behavior
- indicates that the behavior was not observed by the observer

III. Method for Evoking Samples

The present investigation of the interrelationship between gesturing behavior and verbalization was completed during a five month period. Gestural and verbal behaviors were observed and recorded by the clinician during the usual morning sessions. The Pre-School teacher conducted the normal group lessons and activities while the investigator kept a tally of the behaviors of the three study participants.

(1) Radio Telemetry

Verbal language samples were recorded by means of the Hoshiko method of sampling language using radio telemetry, as used in a language study by Webb (1971). Equipment included: (a) a Piezo wireless FM microphone, Model WX-127-B; (b) a Rheem Califone tape recorder, Model 70-TCP; and (c) an Electro-Phonic AM-FM Multiflex radio.

The children were fitted with a chest-type harness, worn on the outside of the body over, or adjacent to the child's body-worn hearing aid to secure the transmitter. For two days prior to the study, each child wore this harness with a dummy microphone for twenty minute intervals, as this was the time allotted for each child to be observed each day (see section IV (2)). In this way, the child adjusted to the presence of the microphone on his body, and was not overly conscious of the harness when the actual data-collecting began. On the third day, the actual observation began and the real microphone was inserted into the harness.

To insure the intelligibility of recordings, the equipment was set up within 12 feet of the children's work area. In this way, the receiver was kept within a range of the transmitter at all times and a clear signal was recorded. The recording equipment was set up in view of the children, three days prior to the beginning of the study to familiarize them with it. A schematic diagram of the radio telemetry instrumentation is included in the appendix of this paper.

As a cross check for the recorded samples, the examiner kept a running tally of the number of verbalizations by using a digital counter. These tallies were checked against recorded samples at the end of each day.

(2) Tallying of Frequency of Gesturing Behavior

Frequency of occurrence of the gesturing behaviors was recorded through the use of a Three Channeled Mini-Counte r, Model 58004. This instrument consisted of a box containing three digital counters which were connected to three corresponding buttons in a small hand-held box. When the examiner observed a gesturing behavior, the button for channel one was depressed and the gesture recorded on the first digital counter. Likewise, when a verbal behavior was observed, the examiner depressed button number two, which recorded the verbalization on the second digital counter. At the same time, verbalizations were being recorded on the radio telemetry device. At the end of a twenty minute session, the total number of gestures and verbalizations respectively,

was recorded for each child. At this point, the Mini-Counter was reset for the next twenty-minute observation period with the next child. Channel three of the counter was not used.

IV. Reinforcement of Behaviors

(1) Equipment

A Lafayette electric M & M Dispenser, Model 58800, was used as the reinforcement device. The children were seated in a group with the Dispenser placed beside the particular child that was being observed. When the behavior being reinforced was observed the examiner would immediately reinforce the child by pressing a button which released a piece of sugared cereal, Cocoa Puffs, into the magazine of the dispenser. The children received rewards only during their twenty minute periods of observation. The examiner controlled the reinforcement dispenser button with one hand and the digital counter with the other.

(2) Reinforcement Schedule

Gesturing and verbalization behavior was charted (see section IV) and observed for a particular child to determine the frequency of occurrence and variability as each behavior was manipulated through reinforcement. The observation schedule for each child was as follows: based on the table of random numbers found in Tables for Statisticians (Arkin and Colton, 1950):

TABLE 3

REINFORCEMENT SCHEDULE

	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9
10:00-10:20 A.M.	2	1	2	3	1	3	1	2	1
10:20-10:40 A.M.	1	3	1	1	3	1	3	3	3
10:40-11:00 A.M.	3	2	3	2	2	2	2	1	2

(Note: The children are numbered as follows: Child #1, #2, #3)

The procedure for collecting data was determined on a basis of nine day periods of reinforcement vs. non-reinforcement. The following breakdown of time periods explains the reinforcement schedule:

Phase I: Establishment of Baseline Behaviors

1. Baseline behaviors were established for verbal behavior and for gesturing behavior. During the twenty-minute sessions previously described, each child wore the cordless microphone to transmit verbalizations through the radio telemetry device. The clinician transcribed and charted the number of verbalizations after each day of observation.

2. The clinician kept a running tally of the gesturing behavior that was observed during each twenty-minute session each day.

3. Each child had an individual graph upon which behaviors were charted and compared daily (see section VI).

4. NO behaviors were reinforced at this time.

Observations to determine baselines continued for nine days, until each child had been observed for a total of three hours.

Phase II: Reinforcement of Gesturing Behaviors

1. After baselines had been established, the reinforcement of gesturing began. All gesturing behavior was reinforced during the entire twenty-minute session for each child. No verbalization behavior was reinforced during this time. Reinforcement was given using the M & M Dispenser previously described. Because of its potency, edible reinforcement was used as a reinforcer, in the form of sugared cereal (McReynolds, 1969). Girardeau and Spradlin (1969) further assert that reinforcement increases the probability of the future occurrence of the response.

2. All three children continued to wear the microphone during their respective twenty-minute sessions.

3. The clinician continued to keep tally of each child's gesturing and verbalization behavior during their twenty-minute time block.

This procedure continued for nine days, until each child had been observed for three hours. Gesturing behaviors and verbalization behaviors were charted and baselines observed.

Phase III: Termination of Reinforcement for Gesturing Behavior

1. Immediately following the previous nine days of reinforcement, the clinician discontinued reinforcing gestures. NO behavior was reinforced during the morning sessions.

2. Verbalizations and gesturing behaviors continued to be recorded and graphed daily. Baseline changes were observed.

This procedure continued for nine consecutive days, or until all children had been observed for three hours.

Phase IV: Resumption of Gesturing Reinforcement

Immediately following the previous nine day period of non-reinforcement:

1. The children were reinforced for ALL gesturing behavior in the same manner as in Phase II. Verbalizations were not reinforced.

2. This manner of reinforcement continued for nine consecutive days. At the end of this time, all behaviors were charted on graphs and results noted.

Phase V: Reinforcement of Verbalization

At this time, the clinician reversed procedures to study the effects of verbalization upon gesturing behavior.

1. The same procedure, including radio telemetry and the tally-type record keeping were employed.

2. ALL verbalizations of the type that suggest the attempt at language usage for communication were reinforced by the clinician. Both gesturing behaviors and verbalizations were charted and graphed.

3. Gestures were not reinforced at this time.

This procedure continued for nine consecutive days, until each child had been observed for three hours.

Phase VI: Termination of Reinforcement for Verbalization

1. The clinician discontinued reinforcing verbalization. NO behavior was reinforced in the morning sessions.

2. The clinician continued to keep a daily record of the number of verbalizations and gesturing behaviors for each child.

The results were charted and graphed for each child daily. Baselines were observed and changes and variations noted. This procedure was continued for nine days.

Phase VII: Resumption of Verbalization Reinforcement

At this time, the children were again reinforced for ALL verbalization behavior as described in Phase V.

V. Examiner

In order to minimize examiner bias as much as possible, the

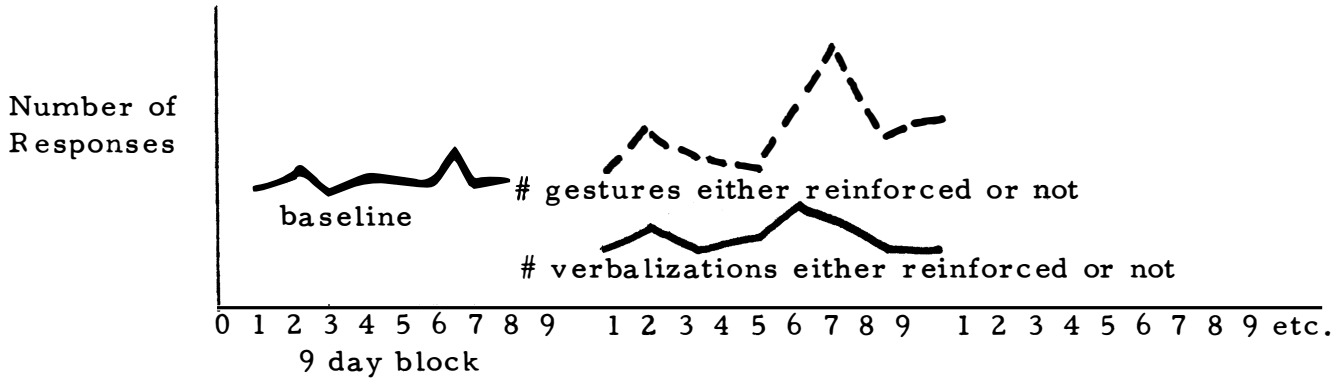
investigator controlled the reinforcement schedule and personally tallied all responses. In addition, only the Pre-School Deaf Education teacher conducted morning lessons and activities.

Examiner reliability in recording the number of verbalizations was insured by the use of the tallying system which was utilized to check the results transcribed from the play-back of the daily recordings.

VI. Graphing of Data

The data obtained from this study was charted continuously for each child, as follows:

EXAMPLE: CHILD #1



TIME

These behaviors were charted on one continuous graph, over time, for each child. Responses were charted daily for gesturing behavior as well as for verbalization behavior regardless of which one was being reinforced. In this way, frequency data could be accurately accumulated for later use in data analysis. Individual graphs for each child are included in Chapter IV of this paper.

VII. Data Analysis

The questions posed at the beginning of this study were answered using nonparametric frequency data, since the nature of the data was nominal. The χ^2 test for independent samples (variables) was used to determine statistical significance of baseline changes as they related to the effects of reinforcement upon two types of behavior: verbal and gesturing (motor). A table of the type below was employed with behavior and reinforcement as the two variables.

TABLE 4
EXAMPLE OF χ^2 TABLE

	Behavior: Verbal	Behavior: Motor (Gesture)	
x	a	b	Sum of row #1 (k)
-	c	d	Sum or row #2 (l)
	Sum of Column #1	Sum of Column #2	N = Sum of the observed frequencies: k + l; m + n.

x = is reinforced
- = is not reinforced

A table, such as the above 2 x 2 table, was used to give information in the form of frequency scores such as the number of times a behavior occurred when it was reinforced and the number of time it occurred

when it was not being reinforced. The behavior under observation was either verbal or motor (gesturing). The null hypothesis (H_o) that asserts that there is no difference between the variables was tested using the χ^2 formula:

$$\chi^2 = \frac{N/(ad) - (bc)/^2}{(k)(l)(m)(n)}$$

CHAPTER IV

RESULTS AND DISCUSSION

Frequency distributions were obtained on two behaviors: gestures and verbalizations. The responses were systematically charted and analyzed by means of the χ^2 test for independent samples (Siegel, 1956). This chapter presents the statistical computations and resulting interpretations to answer the questions posed at the beginning of this investigation. Obtained results are presented both graphically and by means of statistical comparisons for each subject and then for all of the subjects combined.

Initially three questions were asked concerning the relationship between gesturing and verbal behavior in pre-school deaf children. They were:

1. If gesturing behavior is reinforced, will verbal behavior increase?

2. If verbal behavior is reinforced, will gesturing behavior decrease?

3. If verbalization increases with the reinforcement of gesturing, will verbal behavior return to baseline levels when the gesturing is no longer reinforced?

In the following sections, these questions will be answered and discussed in terms of the data obtained.

RESULTS

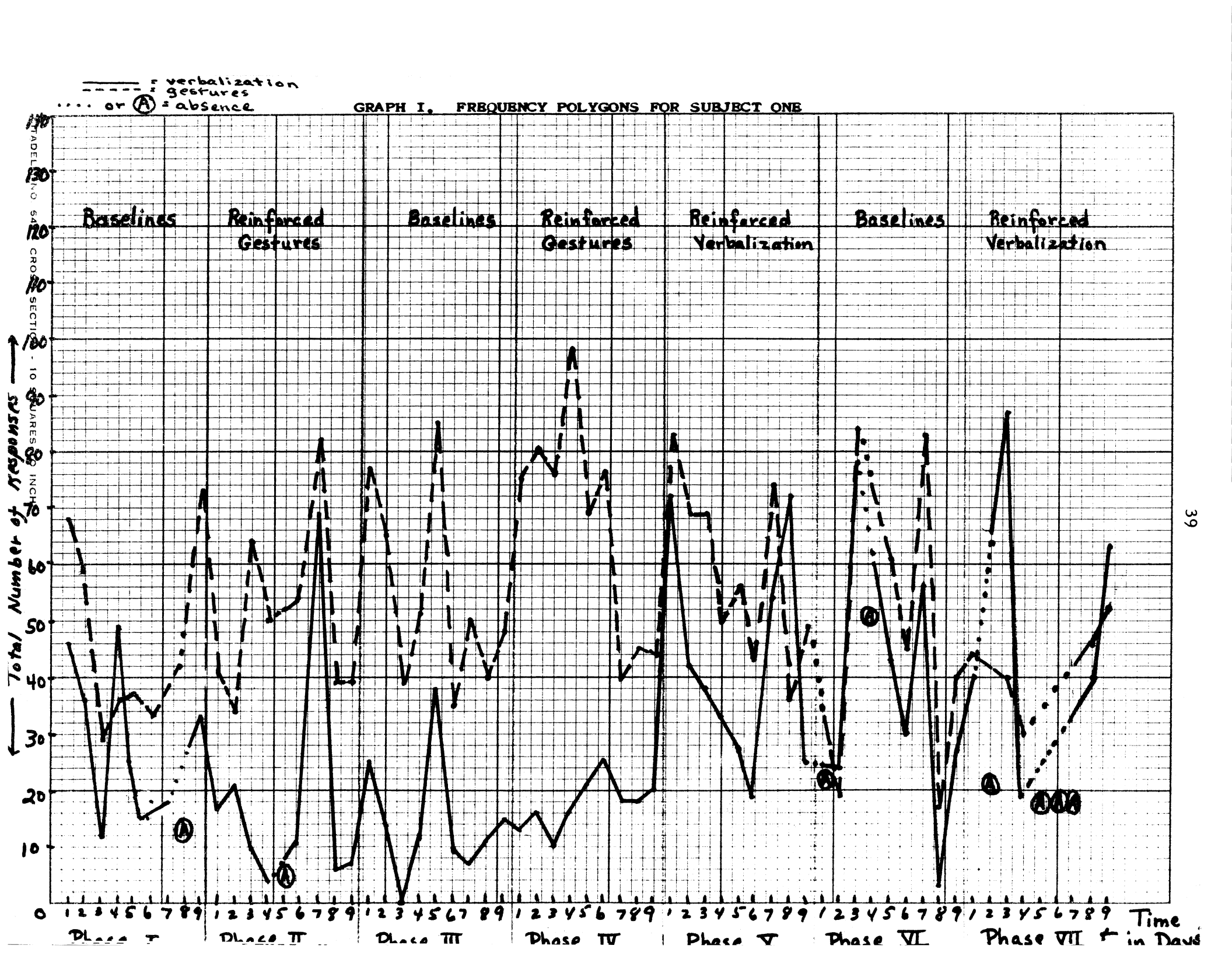
Subject One

Subject number one was a four year old male with a grade III hearing impairment as classified by Huizing (1953); that is, his loss, according to this classification, was in the range of 60-90 dB. Subject One was classified as a hard-of-hearing child. The teacher described the subject as a vocal, energetic child who learns quickly and eagerly. He was an excellent imitator, often mimicking new words. Reinforcement served as a powerful motivator for this subject. He would discover what was being reinforced at a particular time and would repeatedly give that response in order to obtain reinforcement.

Between Behavior Comparisons

Clinical Impressions.—Graph I shows the frequency response curves for this subject. The ordinate represents the frequency of occurrence of the behavior, either verbal or gestural, and the abscissa represents time, divided into nine-day phases of reinforcement vs. non-reinforcement. The responses, verbal (solid line) and gestural (broken line), were recorded over the entire five month period on a day to day basis. Interpretation of Graph I warrants the following observational statements:

1. Generally, for the first three nine-day segments, (Phases I, II, and III) the curves are mirror images of each other. As one behavior increases, the other behavior increases and visa versa. The one exception occurred during the first nine-day segment (Phase I) when baselines were being observed. There is a dramatic increase in verbal


——— : verbalization
– – – – : gestures
.... or Ⓐ = absence
GRAPH I. FREQUENCY POLYGONS FOR SUBJECT ONE
Baselines
Reinforced Gestures
Baselines
Reinforced Gestures
Reinforced Verbalization
Baselines
Reinforced Verbalization
Total Number of Responses
Time in Days
Phase I
Phase II
Phase III
Phase IV
Phase V
Phase VI
Phase VII
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

behavior on the fourth day. Antecdotal records indicate, however, that this is due to the nature of the classroom situation and that the verbal behavior recorded here is more imitative in nature than spontaneous. More specifically, the type of activity within which Subject One participated on that particular morning was a language drill where he was presented with new words. As he saw the word on the lips of the instructor, he would imitate the word; thus his verbal responses that morning were almost entirely imitative in nature, rather than spontaneous.

2. For all three baseline periods (Phases I, III, and VI), the frequency of gesturing behavior was greater than the frequency of verbalizations.

3. Baseline variability increased throughout the study as a function of reinforcement.

4. In nearly all instances, the level of gesturing behavior was higher than the level of verbal behavior with three exceptions:

   On three different occasions, the level of verbalization exceeded the level of gesturing behavior. That situation appears attributable to situations occurring in the classroom, as explained in #1 above.

5. The level of gesturing behavior increased when reinforced as compared with baselines.

6. The levels of verbal behavior increased when reinforced as compared with baselines.

7. When gestures were reinforced, verbalization decreased in Phase IV and increased in Phase II.

8. When verbalizations were reinforced, gestures decreased in Phase VII and increased in Phase V.

χ^2 Data. —The χ^2 test was applied to the numerical frequency data for Subject One in order to assess the significance of the difference of the observed behaviors. The following results were obtained:

In all instances, the frequency of gesturing behavior was significantly higher than the frequency of verbal behavior. (At one degree of freedom, a significant χ^2 is 3.84 at the .05 level of confidence.) Subject One obtained a significant χ^2 value for every nine-day period that he was observed; c.f. Appendix E for all χ^2 values for all subjects.

Within Behavior Comparisons

Analysis was done in terms of changes in frequency of a given behavior across time to assess any significant variation in behavior as reinforcement was introduced or withdrawn. A Mann-Whitney U was computed for each subject comparing the phases of reinforcement vs. non-reinforcement as shown in Table 5 below:

TABLE 5

SIGNIFICANCE OF WITHIN BEHAVIOR COMPARISONS FOR SUBJECT ONE

Comparison	U	Interpretation
Baseline (I) vs. Reinforced Gestures (II)	26.00	NS*
Reinforced Gestures (II) vs. Baseline (III)	30.50	NS
Baseline (III) vs. Reinforced Gestures (IV)	27.50	NS
Baseline (I) vs. Reinforced Verbalization (V)	21.00	NS
Reinforced Verbalization (V) vs. Baseline (VI)	28.50	NS
Baseline (VI) vs. Reinforced Verbalization (VII)	13.00	NS

*NS = not significant
S = significant

For Subject One, as for all subjects, there appeared to be a fixed ratio between gesturing and verbalization regardless of whether the behavior was reinforced or not. Inspection of Table 5 suggests the following conclusions:

1. There was no significant difference in the frequency of gesturing behavior between Phase I and Phase II.

2. There was no significant difference in the frequency of gesturing behavior when it was reinforced in Phase IV. Apparently the reinforcement did not have the effect of increasing gesturing behavior for this subject.

3. Reinforcement of verbalizations, Phase V, did not cause a significant increase in the frequency of this behavior over the previously established baseline (Phase I).

4. Again, in Phase VII, where verbalizations were reinforced for the second time, there was no significant increase in the behavior over baseline VI.

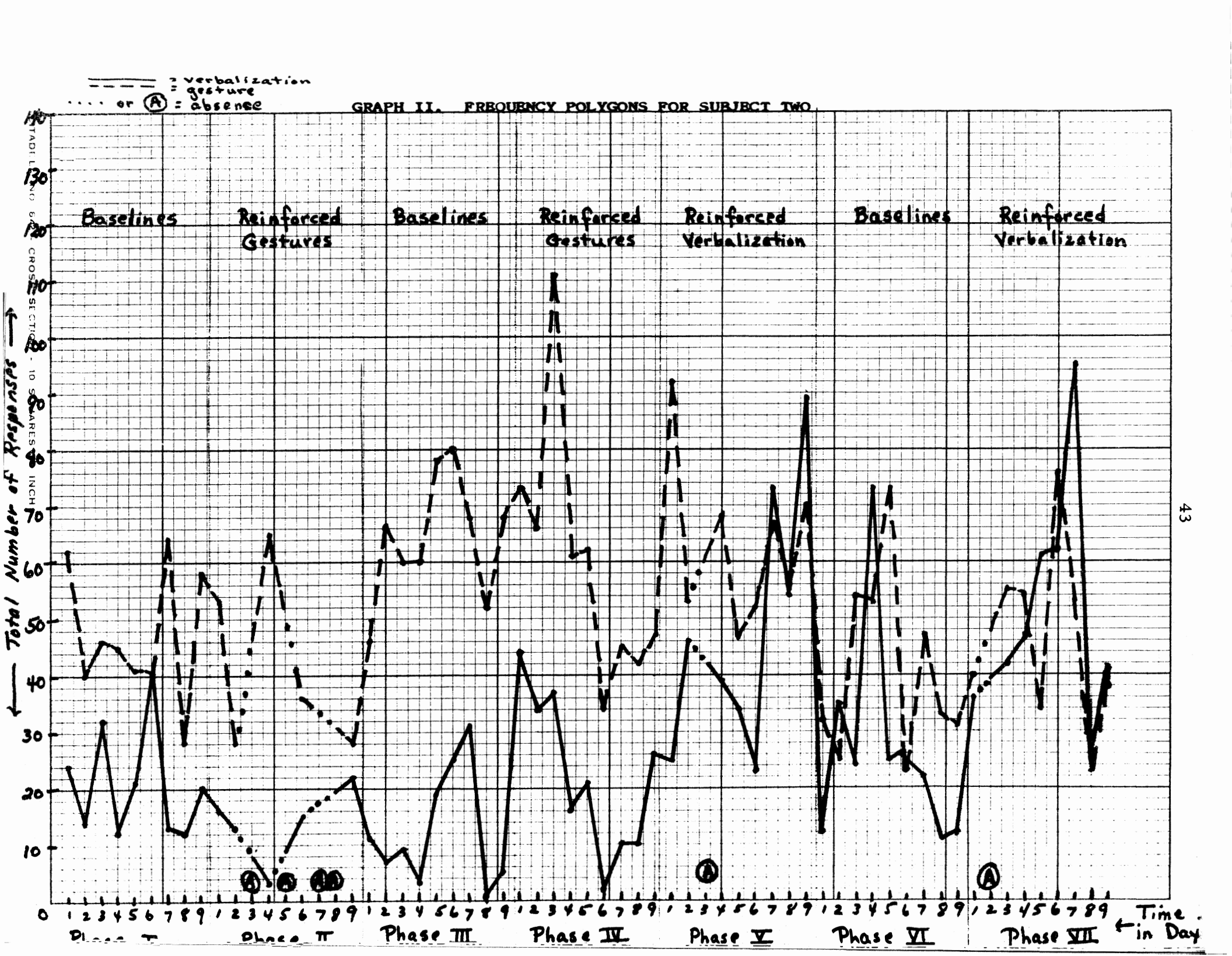
In summary, for Subject One, it must be assumed that reinforcement showed no significant increase in either behavior.

Subject Two

Subject Two was a five year old male with the most severe hearing loss of the three subjects in this study. His impairment was classified as a grade IV impairment by Huizing (1953); that is, his range of impairment exceeded 90 dB in the speech frequencies, 500, 1000, and 2000 Hz. Subject Two was described by the teacher as being a healthy, well-adjusted little boy who was very interested in communicating his ideas to others. He was very descriptive, gesturally, and used this medium of communication predominately. He was a poor lip reader and his verbal attempts were generally minimally intelligible.

Between Behavior Comparisons

Clinical Impressions.—Graph II shows the frequency response


GRAPH II. FREQUENCY POLYGONS FOR SUBJECT TWO
= verbalization
= gesture
.... or (A) = absence
Baselines
Reinforced Gestures
Baselines
Reinforced Gestures
Reinforced Verbalization
Baselines
Reinforced Verbalization
Total Number of Responses
Time in Days
Phase I
Phase II
Phase III
Phase IV
Phase V
Phase VI
Phase VII
STANDARD CROSS SECTION - 10 SQUARES INCH

curves for Subject Two. Interpretation of this graph indicates the following statements:

1. Baseline variability increased throughout the study.

2. In all instances, gesturing behavior was higher than verbal behavior with four exceptions which appear to be related to situational factors within the classroom, such as the type of activity going on, the attitude of the subject, etc., and have no bearing on this study.

3. When gesturing behavior was reinforced, there was no appreciable increase in the first nine-day period, (Phase II), but there was an increase in the second nine-day reinforcement period (Phase IV). The lack of increase in the first period was probably due to the subject's absence on four days out of nine.

4. In both Phases V and VII, verbalization increased when reinforced.

5. When gesturing was reinforced, the level of verbalization remained constant.

6. When verbalizations were reinforced, gesturing behaviors remained constant, but there was considerable variability in all instances.

χ^2 Data. —The same procedures were used for Subject Two as were used for Subject One. Resulting χ^2 values exceeded the .05 level of confidence. In all instances, the frequency of gesturing behaviors was significantly higher than the frequency of verbal behavior.. Consult Appendix E for information concerning χ^2 values for all subjects.

Within Behavior Comparisons

Analysis of frequency of behaviors across time in terms of reinforcement vs. non-reinforcement, using the Mann-Whitney U revealed

the following data:

TABLE 6

SIGNIFICANCE OF WITHIN BEHAVIOR COMPARISONS FOR SUBJECT TWO

Comparisons	U	Interpretation
Baseline (I) vs. Reinforced Gestures (II)	17.00	NS
Reinforced Gestures (II) vs. Baseline (III)	6.00	S
Baseline (III) vs. Reinforced Gestures (IV)	30.50	NS
Baseline (I) vs. Reinforced Verbalizations (V)	7.00	S
Reinforced Verbalizations (V) vs. Baseline (VI)	14.00	S
Baseline (VI) vs. Reinforced Verbalization (VII)	8.50	S

NS = not significant
S = significant

Observation of the data in Table 6 warrants the following conclusions concerning the effect of reinforcement upon the behaviors investigated:

1. The first phase of reinforcement of gestures (II) did not yield a significant increase or decrease in the behavior. However, reinforcement of gestures during Phase II did yield a significant increase in gesturing behavior during the second baseline (Phase III). That is, baseline scores for Phase III were significantly higher than the reinforced gestures (Phase II) at an alpha level of .05. However, this interpretation must be tempered by the fact that the child was absent four days during the first reinforcment period (Phase II). Thus, it seems while the difference is statistically significant, it would not appear to be a meaningful educationally significant difference.

2. Reinforcement of gestures the second time (Phase IV) did not result in a significant increase in frequency of gesturing behavior as compared with baselines in Phase III.

3. Reinforcement of verbalization significantly increased the

amount of verbal behavior. (See comparison between Phases I and V.)

4. The reinforcement value held when the reinforcement was withdrawn. Verbalizations remained high. (Phases V and VI)

5. When reinforcement was again applied, the frequency of verbal behavior increased. (Phases VI and VII) These results are especially interesting in view of the fact that Subject Two was typically the least verbal of all subjects.

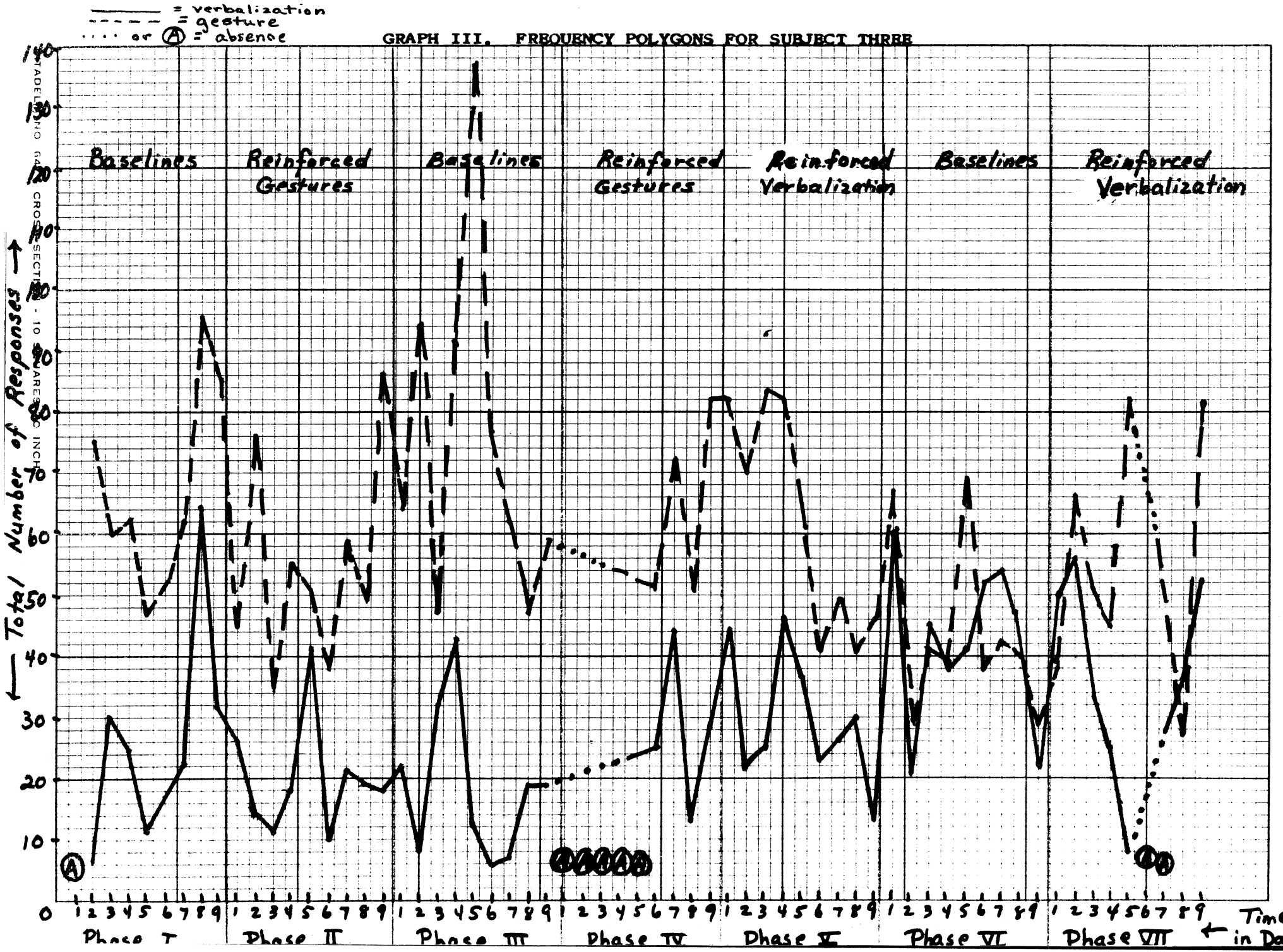
Subject Three

Subject Three was a five year old female with a hearing loss of greater than 90 dB in the speech frequencies in the better ear, placing her as a grade IV impairment (Huizing, 1953). This subject was described as an intelligent, animated little girl who used gesture and speech, when possible, vividly and descriptively. She tended to be a moody, obstinate child who was aware of her impairment and often appeared to resent it, especially when she felt she was not getting across her ideas. Subject Three lipread well and reproduced verbal units clearly and accurately. Her speech, although extremely limited, was intelligible.

Between Behavior Comparisons

Clinical Impressions.—Graph III shows the frequency response curves for Subject Three. Observation of curves and interpretation indicates the following statements:

1. As with the previous two subjects, baseline variability increased throughout the study.


——— = verbalization
- - - - = gesture
···· or Ⓐ = absence
GRAPH III. FREQUENCY POLYGONS FOR SUBJECT THREE
Baselines
Reinforced Gestures
Baselines
Reinforced Gestures
Reinforced Verbalization
Baselines
Reinforced Verbalization
← Total Number of Responses →
Time in Days →
Phase I
Phase II
Phase III
Phase IV
Phase V
Phase VI
Phase VII
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140

2. Gesturing behavior was higher than verbal behavior; that is, the frequency of gesturing behavior was always at a higher level than that of verbal behavior.

3. Verbalization increased during each nine-day period that it was reinforced.

4. When gesturing was reinforced, the level of verbalization remained constant and when verbalizations were reinforced, gesturing behaviors remained constant. However, considerable variability occurred in all instances.

χ^2 Data. In all instances, the frequency of gesturing behavior was significantly higher than the frequency of verbal behavior with one exception. During Phase VI (final observation of baselines) just after verbal behavior had been reinforced for nine days, over-all verbal behavior increased while over-all gesturing behavior decreased causing the differences between the frequency levels of the two behaviors to be non-significant. However, it should be noted that these changes may be due to classroom situations, scheduling problems (Easter vacation fell in the middle of this time segment), and the attitude of the subject. Subject Three was very moody during this period, and often less animated, which may account for the drop in gesturing baselines.

Within Behavior Comparisons

Analysis of frequency of behaviors across time in terms of reinforcement vs. withdrawal of reinforcement, using the Mann-Whitney U values revealed the following data for Subject Three:

TABLE 7

SIGNIFICANCE OF WITHIN BEHAVIOR COMPARISONS FOR SUBJECT THREE

Comparison	U	Interpretation
Baseline (I) vs. Reinforced Gestures (II)	19.00	NS
Reinforced Gestures (II) vs. Baseline (III)	19.50	S
Baseline (III) vs. Reinforced Gestures (IV)	15.00	NS
Baseline (I) vs. Reinforced Verbalization (V)	26.50	NS
Reinforced Verbalization (V) vs. Baseline (VI)	20.50	S
Baseline (VI) vs. Reinforced Verbalization (VII)	26.50	NS

NS = not significant
S = significant

Observation of the data in Table 7 warrants the following conclusions concerning the effect of reinforcement upon the behaviors investigated:

1. During the first period of reinforcement of gestures (Phase II) there was no significant change in frequency of gesturing behavior as compared to baselines (Phase I).

2. Comparison of baselines (Phase III) to reinforced gestures (Phase II), yielded a significant difference in the frequency of gestures. During the second baseline period (Phase III) the level of gesturing behavior was significantly higher than those during the first reinforcement period (Phase II). This appears to be the result of imposed variability. The subject was highly gestural, especially on one day in the middle of Phase III, when she achieved a total of 137 gestures during one twenty-minute session. The subject was highly involved in the redecorating of her bedroom at home and would continually act out the painting, carpeting, etc., that was being done.

3. Phase V, the initial reinforcement period for verbal behaviors, yielded no significant difference in the frequency of that behavior. (Compare with Phase I)

4. When reinforcement was withdrawn, verbalizations increased during the baseline period (Phase VI). This was due to imposed factors that caused the variability to occur. On the first day of Phase VI a new unit was introduced that was very stimulating for this particular subject. As a result, verbal behavior increased dramatically over this period regardless of the fact that the behavior was not being directly reinforced.

5. When verbalizations were again reinforced (Phase VII) there was no significant increase or decrease in verbal behavior as compared to Phase VI baselines.

Summary of Results

Intercomparisons of the three graphs would suggest the following statements concerning the relationships between gesturing and verbalizations in deaf children:

1. As gesturing behaviors are reinforced, the frequency of gesturing behaviors increases. (Moreover, as gestures are reinforced, the frequency of verbal behavior increases also.) For all three subjects, the curves depicting frequency of each behavior usually shadowed each other, regardless of which of the behaviors was being reinforced.

2. As verbalizations are reinforced, the frequency of verbal behavior increased. At the same time, as verbalizations were being reinforced, the gesturing behaviors increased.

3. When gestures were no longer being reinforced, gesturing behavior remained high, as did verbal behavior. The same applied when verbalization was no longer reinforced. Apparently, reinforcement had a strong effect upon these behaviors.

Basically, as stated above, the curves for the two behaviors shadowed each other. As one behavior increased, the other behavior correspondingly increased. When a decrease in a specific behavior

occurred, the other behavior decreased respectively.

In summary, the major issue in this study was the relationship between gesturing and verbalization. Future research should certainly focus on the selection of reinforcement as it did not appear to have a highly significant effect on the behavior in this study. Results indicated a high degree of imposed variability, due to situational factors, scheduling of activities in the classroom, and attitudes of the subjects on a given day.

DISCUSSION

The major finding of this study was that gesturing behavior and its reinforcement appears to have no inhibiting effect on verbal behavior. Throughout the study, the frequency of gesturing behavior remained higher than the frequency of verbal behavior. The two behaviors studied appear to be dependent, rather than competing behaviors. When one of the behaviors was reinforced, it would increase in frequency, as would the dependent behavior. For example, if gesturing behaviors were reinforced, the amount of gesturing increased, and verbalization, likewise, increased. Reinforcement of verbalizations caused an increase in that behavior, but also an increase in gesturing behavior. Consequently, this study does not provide evidence to warrant the conclusion that gesturning has a dilatorius effect on verbal behavior.

The children in this study utilized both verbal and gestural communication regardless of which behavior was reinforced. If deaf chil-

dren naturally use both means of communication, then teachers of the deaf should utilize both verbal and gestural communication in teaching linguistic skills. The hypothesis that gesturing is a determent to verbal behavior is not supported within the conditions and limitations of this study.

The results of this study question attempts to inhibit gesturing behavior in the deaf. The present data indicated that the use of one behavior will probably facilitate, rather than inhibit, the use of the other behavior.

As was indicated in the Results section of this chapter, there was a great deal of variability in both behaviors. Sources of variability in the behaviors may have included the following:

1. Type of lesson being taught—either highly verbal or highly non-verbal (language lesson vs. the viewing of a filmstrip).
2. Attitude of instructor or of the subject on a particular day.
3. Number of absences during a particular phase of the study.
4. Vacation periods falling within a particular time period such as Easter Vacation falling between the seventh and eighth day of Phase VI.

The graphs show in terms of within comparisons of behavior, gestural or verbal, that there is a great deal of variability. This variability can be interpreted as being either intrinsic or imposed. If one assumes that the variability observed is intrinsic, this would suggest that there were variations in both gestural and verbal behavior simply because that is the way that deaf children normally respond. Sidman

(1960) takes the position that variability is not intrinsic to behavior. He says that we impose variability upon behavior by means of our experimental design. It seems more appropriate to assume that these variations are due to imposed factors (Sidman, 1960) such as the classroom situation mentioned above, hunger and thirst cycles, and the fact that the use of a reinforcer interacts with the behavior which is being reinforced. When the behavior, gestural or verbal, interacts with the reinforcer, it results in a change in the nature of the behavior itself.

These variables were minimal even though they may have caused increases or decreases in behaviors for a particular child on a particular day. These variables, however, did not appear to have any effect on the final results of this study.

More research is needed to support the findings of this study. The present data shows how three children responded to reinforcement of two specific behaviors: gesturing and verbalization.

Systematic and/or direct replications of this study need to be done to reinforce the present data that indicates gesturing and verbalization are dependent, facilitating behaviors.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study was conducted to determine the relationship between two communicative behaviors in pre-school deaf children. The two behaviors studied, gesturing behavior and verbal behavior, were observed and the frequency of each behavior recorded over a five month period of reinforcement vs. non-reinforcement of each behavior.

It was hypothesized at the onset of this paper that the reinforcement of gesturing behavior would not have a negative effect on verbal behavior in pre-school deaf children (Chapter I). Specifically the questions posed at the onset of this investigation were:

1. If gesturing behavior is reinforced, will verbal behavior increase?

2. If verbal behavior is reinforced, will gesturing behavior decrease?

3. If verbalization increases with the reinforcement of gesturing, will verbal behavior return to baseline levels when the gesturing is no longer reinforced?

A review of related literature revealed the need for research concerning the relationship between gesturing and verbalization. Relatively few studies have been done to support the hypothesis that gestur-

ing behavior is a negative factor in teaching language skills to deaf children, yet that idea seems to dominate the minds of deaf educators and researchers. In the United States, especially, there appears to be a general trend against the use of gesturing in the classroom. Studies reported from the Soviet Union seemed to be more supportive of a combined method, utilizing oral communication, plus gesturing and signing to teach language to deaf children.

The experimental procedure utilized three children selected from the Pre-School Deaf class at Mark Twain Elementary School in Charleston, Illinois. All subjects were between the ages of four and six years of age, and were diagnosed as grade III to grade V hearing impairments (Huizing, 1953). For definitions of these hearing impairments, see Chapters III and IV. Gestural and verbal behaviors were observed and recorded for each child according to the following reinforcement schedule:

1. Phase I: Observations of baseline behaviors, both gestural and verbal, for nine days. No reinforcement.

2. Phase II: Reinforcement of gestures only, for a nine day period. Verbalizations were also observed and recorded, by radio telemetry, but were not reinforced.

3. Phase III: Observation of baselines for both behaviors. No reinforcement. (Nine days)

4. Phase IV: Reinforcement of gestures resumed for nine days. Verbalizations were again not reinforced, but were continually recorded.

5. Phase V: Reinforcement of verbalizations only for nine

days. At this time, gestures were not reinforced, but continued to be recorded.

6. Phase VI: Observation of baselines for nine days; no reinforcement of any behavior.

7. Phase VII: Resumption of verbalization reinforcement. Neither behavior was reinforced. Responses continued to be charted.

All responses were reinforced, tallied, and charted on individual graphs for each child by the examiner. Radio telemetry equipment was used to record all verbal responses and these responses were transcribed daily by the examiner and plotted on the continuing graphs. Gestural responses were observed and tallied using a Three Channeled Mini Counter described in detail in Chapter III.

Statistical computations were performed on the frequency polygons obtained to answer the previously listed questions. The χ^2 test for independent samples was used to analyze the significance of the difference between these behaviors for each child. Interpretations of these data were discussed.

CONCLUSIONS

The results of this study appear to warrant the following conclusions:

1. As one behavior is reinforced, the frequency of that behavior increases. However, the frequency of the second behavior also increases. For all three subjects in this study, the curves for gesturing and verbal behavior appeared to shadow each other regardless of which of the two behaviors was being reinforced.

2. When one behavior decreased in frequency, the frequency

of the other behavior tended to decrease also. Points number one and two here indicate that gesturing and verbalization are dependent, rather than competing behaviors.

3. When a behavior was no longer being reinforced, the frequency level for that behavior remained high, as did the frequency level for the second behavior. Apparently, reinforcement had a strong effect upon both gesturing and verbal behavior.

These results supply no evidence to warrant the hypothesis that gesturing has a dilatorius effect on verbal behavior. Results of this study lend partial support to the hypothesis that gesturing behavior has a facilitating effect upon verbalization. Direct or systematic replications of this study should be made. "The ultimate test of generality is replication" (Sidman, 1960). Using the same procedures as were used in the present study, it would be interesting to see if the same results were obtained when comparing verbalization and the use of signing in pre-school deaf children. Similar studies could be done using normally hearing four and five year olds in order to see how gesturing effects the verbalizations of the "normal" population. Information such as this, with normal children, would help us to better understand how to approach the deaf child: as a "normal child" except for the hearing impairment or as a totally different kind of being than the normal child.

Lastly, a study such as this could also be attempted using language delayed four and five year old children in order to see what part gesturing plays in their language development. More needs to be learned about the relationship between non-verbal and verbal communication and

their effects upon each other in order to help the deaf, as well as the hearing child in his development of linguistic skills.

APPENDIX

Appendix A

EASTERN ILLINOIS UNIVERSITY
SPEECH AND HEARING CLINIC
Clinical Services Building
Charleston, IL 61920

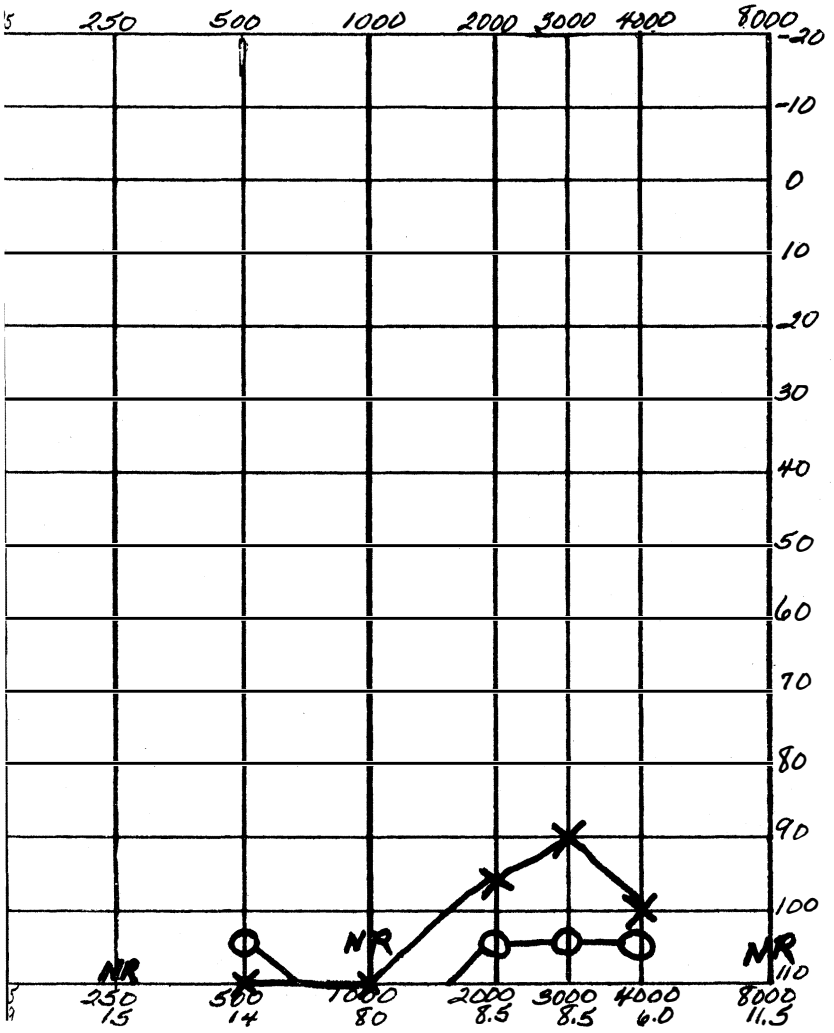
AUDIOMETRIC ANALYSIS

NAME Subject #1 AGE _____ TESTER _____ DATE _____

ADDRESS _____

TELEPHONE _____ AUDIOMETER (ISO 1964) _____

Frequency in cps



Average Hearing Threshold Level
500-2000 cps

AC: R_____dB L_____dB

BC: R_____dB L_____dB

Speech Reception Thresholds (SRT)

R_____dB L_____dB SF_____dB

Speech Discrimination Score

R_____% @_____dB

L_____% @_____dB

SF_____% @_____dB

	AC	BC
R (red)	O	]
L (blue)	X	[

Comments:

Appendix B

EASTERN ILLINOIS UNIVERSITY
SPEECH AND HEARING CLINIC
Clinical Services Building
Charleston, IL 61920

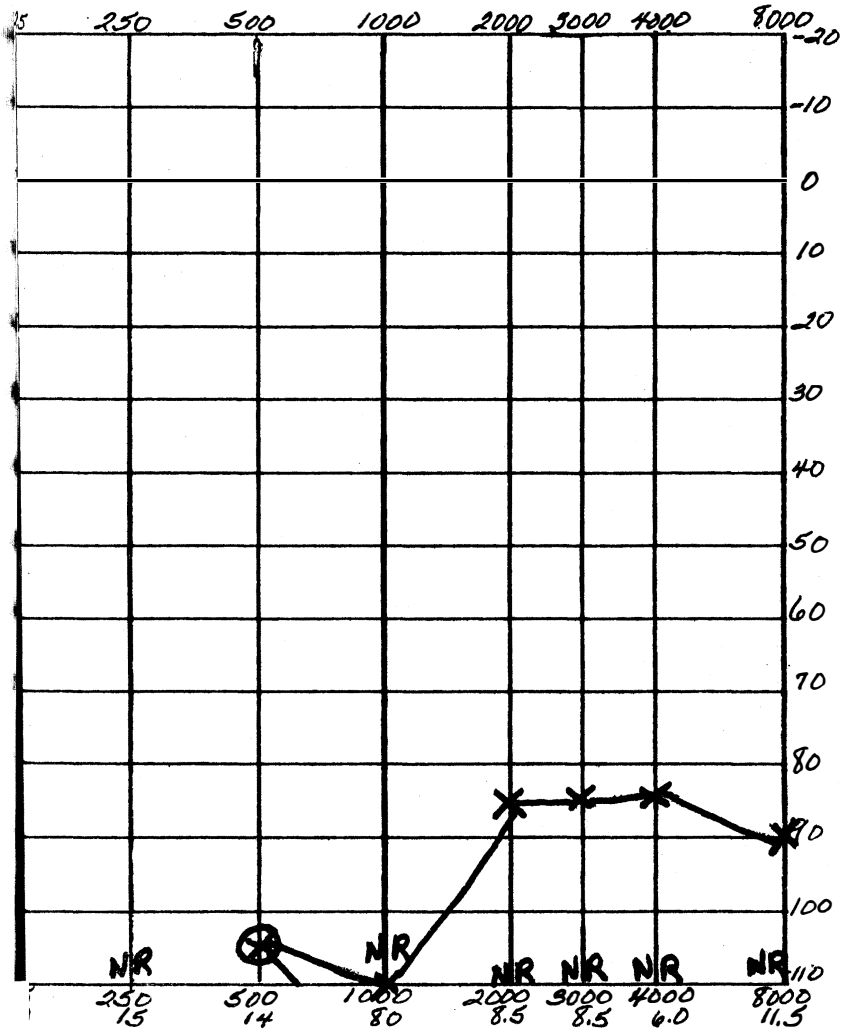
AUDIOMETRIC ANALYSIS

NAME Subject #2 AGE _____ TESTER _____ DATE _____

ADDRESS _____

TELEPHONE _____ AUDIOMETER (ISO 1964) _____

Frequency in cps



Average Hearing Threshold Level
500-2000 cps

AC: R_____dB L_____dB

BC: R_____dB L_____dB

Speech Reception Thresholds (SRT)

R_____dB L_____dB SF_____dB

Speech Discrimination Score

R_____% @_____dB

L_____% @_____dB

SF_____% @_____dB

	AC	BC
R (red)	O	]
L (blue)	X	[

Comments:

Appendix C

EASTERN ILLINOIS UNIVERSITY
SPEECH AND HEARING CLINIC
Clinical Services Building
Charleston, IL 61920

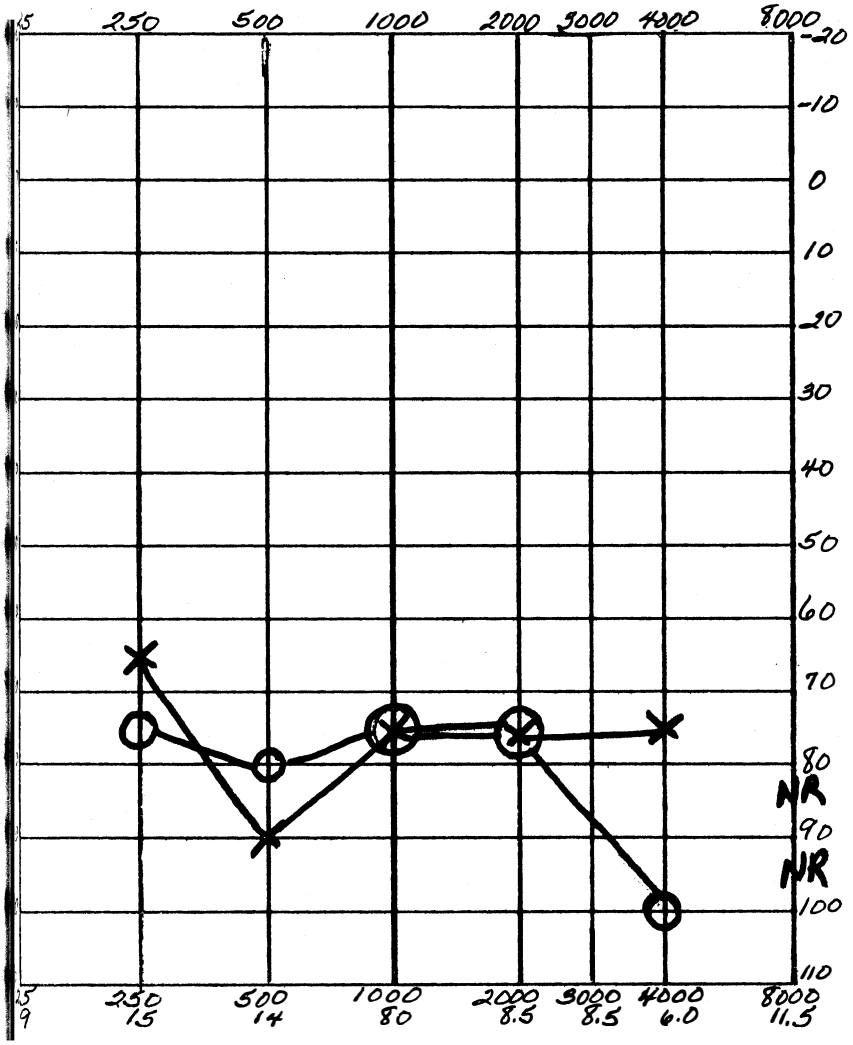
AUDIOMETRIC ANALYSIS

NAME Subject #3 AGE _____ TESTER _____ DATE _____

ADDRESS _____

TELEPHONE _____ AUDIOMETER (ISO 1964) _____

Frequency in cps



Average Hearing Threshold Level
500-2000 cps

AC: R_____dB L_____dB

BC: R_____dB L_____dB

Speech Reception Thresholds (SRT)

R_____dB L_____dB SF_____dB

Speech Discrimination Score

R_____% @_____dB

L_____% @_____dB

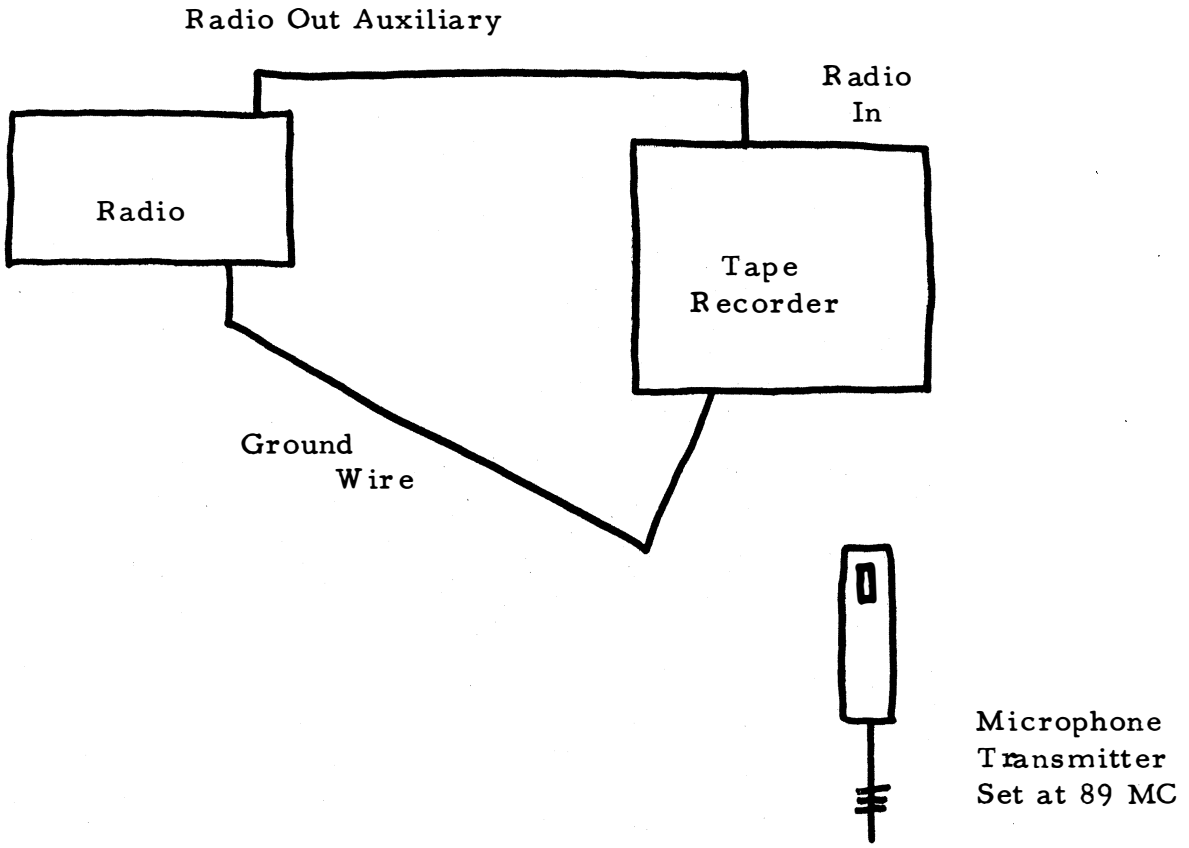
SF_____% @_____dB

	AC	BC
R (red)	O	]
L (blue)	X	[

Comments:

Appendix D

SCHEMATIC DIAGRAM OF RADIO TELEMETRY INSTRUMENTATION



Appendix E

FIRST NINE DAYS — BASELINES

Child	Observed		Expected	χ^2
1	V	234	305.50	
	M	377	305.50	33.46
2	V	188	306.00	
	M	424	306.00	91.00
3	V	207	372.50	
	M	538	372.50	147.06

SECOND NINE DAYS — GESTURES REINFORCED

Child	Observed			Expected		χ^2
		+	-	+	-	
1	V	0	145	106.63	38.37	
	M	403	0	296.37	106.63	575.87
2	V	0	69	51.94	17.06	
	M	210	0	158.06	51.94	279.08
3	V	0	178	130.85	47.15	
	M	494	0	363.15	130.85	671.98

THIRD NINE DAYS —BASELINES

Child	Observed	Expected	χ^2
1	131	310.50	
	490	310.50	207.54
2	111	344.50	
	578	344.50	316.52
3	168	423.00	
	678	423.00	307.44

Appendix E (Continued)

FOURTH NINE DAYS —GESTURES REINFORCED

Child	Observed +	Observed -	Expected +	Expected -	χ^2
1	0	157	124.57	32.43	
	603	0	478.43	124.57	760.07
2	0	541	146.02	53.98	
	200	0	394.98	146.02	741.02
3	0	111	77.43	33.57	
	256	0	178.57	77.43	367.02

FIFTH NINE DAYS — VERBALIZATION REINFORCED

Child	Observed +	Observed -	Expected +	Expected -	χ^2
1	382	0	160.18	221.82	
	0	529	221.82	307.18	764.00
2	383	0	165.19	217.81	
	0	505	217.81	287.19	888.00
3	266	0	85.76	180.24	
	0	559	180.24	378.76	825.06

SIXTH NINE DAYS —BASELINES

Child	Observed	Expected	χ^2
1	261	305	
	349	305	12.70
2	240	305.50	
	371	305.50	38.08
3	380	387	
	394	387	0.26

SEVENTH NINE DAYS —VERBALIZATION REINFORCED

Child	Observed +	Observed -	Expected +	Expected -	χ^2
1	249	0	133.05	115.95	
	0	217	115.95	101.05	466.00
2	410	0	213.87	196.13	
	0	376	196.13	179.87	785.98
3	210	0	103.68	156.32	
	0	392	156.32	235.68	652.01

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