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Preverbal communication: an experiment teaching sign language to a hearing infant

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Preverbal Communication: An Experiment Teaching
Sign Language to a Hearing Infant

by

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Language acquisition for hearing and deaf infants is influenced by physical development, cognitive capacity, and social interactional factors. Assuming the development of articulatory muscles as a limiting factor for speech development, this study involves supplementing a hearing infant’s use of speech (an oral mode of language) with sign language (a manual mode).

Using conversation, interactional routines (imitation and repetition), and picture books, a hearing infant, E., of hearing parents was taught sign language and speech simultaneously during the period between thirteen and twenty months of age, in the natural setting of his home. Sign use was observed daily and recorded on the basis of three criteria, comprehension, use and spontaneous production.

Infants have the cognitive capacity to learn one language in two modalities such that use of sign does not interfere with acquisition of speech. All infants, deaf or hearing, have the motor control necessary to produce signs. Deaf infants or hearing infants of deaf parents are motivated to learn and use sign language just as hearing infants are motivated to learn and use speech. The fact that development of motor control necessary to produce sign precedes that necessary for articulation of speech has been assumed to be a primary factor in early emergence of sign. A hearing infant of hearing parents in this study learns sign at a comparable rate as a hearing infant of deaf parents. It is the conclusion of this paper that the high degree of physical contact and social interaction involved in teaching sign language to an infant is the primary motivating factor which contributes to not only the early emergence of sign but the early advancement from the one-sign to the two-sign stage. Deaf and hearing infants who receive bilingual or bi-modal linguistic input seem to be language sensitive rather than language handicapped.
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CHAPTER I
DISCUSSION OF RESEARCH PROBLEM

Research Rationale and Objectives

Child development studies identify three factors influencing the language acquisition process: a) innate ability, b) cognitive development, c) parental interaction. The underlying assumption is that it is "virtually impossible to speed up the language-learning process" (Moskowitz 1978: 94D).

Assuming for the moment that development of speech apparatus is a limiting factor in language development, this study posits the question: what can be learned about an infant's communication potential by supplementing a hearing infant's use of the oral mode of language with a manual mode (i.e. sign language)? If infants have the cognitive capacity and a need to communicate but lack the vocal dexterity, my expectation is that by increasing the amount of linguistic interaction between parents and infant through the use of sign language, the infant's rate of language development will increase.

Data from language acquisition studies of deaf children with deaf parents provide evidence that deaf infants begin language learning (use of signs) earlier than hearing infants use words. The "earlier emergence and growth of signs is attributable to greater control of hand muscles as compared to oral muscles" (Hoffmeister and Wilbur 1980: 65). I suggest that manual dexterity is only part of the
reason. The second factor that possibly explains why deaf children are capable of using 85-sign vocabularies at a time when most hearing infants are just beginning to use words was articulated best by Blanton and Brooks:

This suggests that all children may develop cognitive and semantic skills farther in advance of their competence to produce spoken language than we had supposed (1978:255, emphasis mine).

In considering the interface between early language learning and language acquisition of the deaf, it is necessary to accept the underlying premise that the language learning process is the same for the deaf infant as it is for the hearing infant (McIntire 1974; 1977; Bellugi and Klima 1972; Grosjean 1980).

One objective of this study is to focus on the prephonetic stage of language development for more information about the comprehension aspect and production capabilities of infants. Thus, the theoretical approach of this study centers on the communicative need or social interaction between infant and parents as the third factor contributing to earlier emergence of signs. A hearing infant of hearing parents learning sign language is in no way motivated by deafness, but is motivated by the need and feedback of communicating.

In light of the oralist premise, which states that part of the message is lost when speech and sign are used together in early instruction (Benderley 1980), one of
the research aims was to gather data on whether or not the use of signs would affect the acquisition of speech. Because of the difficulty in recording complete data as E.'s (the subject) use of speech increased, there is not sufficient information to determine how acquisition of speech was affected (for example, the rate at which the mean length of utterance increased as E. began to use oral combinations.) However, there is evidence to report that use of sign did not inhibit or interfere with E.'s acquisition of speech. Rather, sign use enhanced our ability to understand his needs and perceptions as well as his ability to participate in socializing routines.

It is important to state that this sign language experiment with a hearing infant of hearing parents is not equivalent to a study involving a deaf infant. As parents, the researchers developed verbal and non-verbal communication patterns prior to using sign with the infant. Sign was initiated when the needs and interests of the infant began to exceed these patterns. The infant's interest in objects increased; he started walking and exploring more of his environment. It is also important to note that the experiment may have begun sooner had the infant not been hospitalized during his tenth month. The evidence from deaf studies suggests that a hearing infant could learn sign; we asked the question, would he?
**Introduction: Language Development Theories**

Fowler (1983) presented a description and analysis of four theoretical approaches to language acquisition. He outlined each theory and the subsequent data used to support or dispute the approach.

The first, the behaviorist approach proposed by Skinner in 1957, has been generally criticized as too limited because it does not explain the data which demonstrate the child's ability to produce words and to use grammatical rules not used or reinforced by adults. The other three approaches provide the foundation for most current research.

Chomsky's nativist theory, though undergoing slight revisions over the last 20 years, maintained in part, that language learning is innate, and that a certain level of maturation is necessary before a child learns language (Lenneberg 1967). Subsequent to Chomsky's hypothesis of innate principles, or "universals of language", came his work on generative devices for grammar (Leiber 1975; Dale 1972). Although many critics accept elements of the innateness principles, they dismiss the approach because it does not adequately answer questions raised by variation in linguistic competence (Fowler 1983). Also, there is conflicting evidence concerning the maturation development and the first emergence of speech, and the influence of parental speech on a child's speech.

The cognitive approach, which emerged during the 1960's
and 1970's, integrates language acquisition into the process of cognitive development. Piaget proposed four stages of cognitive development: sensorimotor, preoperational, concrete operational, and formal operational, placing speech in the final stage of the sensorimotor stage, or at 18 months. Followers of Piaget, referred to as neo-Piagetians, revised the theory to place the emergence of speech earlier, somewhere between 10 and 18 months. The cognitivists outlined a variety of pre-requisites for speech use which include mutual control of the focus of attention, object identity, object permanence, imitative behavior, and comprehension of means-end relationship. Critics of the cognitive theory complained that the theory disregards the role that language development plays in the formation of concepts. Similarly, they urged more attention be given to the role of the environment on linguistic progress (Fowler 1983).

A fourth approach, referred to as social theory or social interactionist theory, focuses on the variables of the social situation and effects these variables have on language development (Nelson 1978). One of the most significant of these is the parent-infant relationship. Until now most of the research has focused on the role of the mother (Ramey, Farrah, Campbell, and Finkelstein 1978; Snow and Ferguson 1977). Social pre-requisites to language identified by social interactionists include aspects
of dialogue, turn-taking (Bruner 1978), and interactional routines through which children learn to participate in their cultural environment (Boggs and Peters 1982). Pre-linguistic communication is becoming a new area of research (Bullowa 1979). This study follows the social interactionist approach, recognizing the infant's ability and need to communicate, the "communicative context" (Nelson 1978), during the pre-phonetic stage of language as a precursor to speech.

Fowler (1983) designed a study to determine the effect of developmental stimulation on early language learning potentials. His objective was to clarify the pre-requisites of language experiences that are necessary for children to learn to speak. Fowler seemed to be asking a question similar to ours. Since there is evidence that infants understand language before they produce it, is it possible that they can communicate earlier (with language) if given the means to do so? Fowler chose to instruct hearing children by means of verbal developmental stimulation as early as three months of age. In this study, we chose sign language, a manual/visual mode of early instruction. The infants in Fowler's study produced vocalizations between five and eight months of age, with word combinations appearing at 14 months of age. "Parent-child verbal interaction appeared to be related to variation in vocabulary size" (Fowler 1983:151).
With his study, Fowler began the search for a new theoretical approach, an ecological approach to the complex process of language development. In his approach he attempted to integrate all the existing contributions:

influences of language addressed to children, humans' innate capacity for the acquisition of language, recognition that children structure the environment differently depending on their point of cognitive development, and the application of the significance of the social setting upon the communicative skills (Fowler 1983:174).

Sign Language

Although the controversy over whether or not sign language is a language is fading, the question is inherent in much of the research pertaining to language acquisition by the deaf. The theoretical approach to the study of language acquisition of the deaf takes one of two perspectives. The first considers the deaf as language handicapped and focuses on the cognitive abilities of the deaf. Although findings have been mixed, some studies have implied deaf children are deficient in areas of reasoning, abstract thinking, and memory, either as the result of cognitive deficiencies or, more likely, as the result of "defective training" in language (i.e. their lack of oral skills):

The message that comes through is that language must support cognitive development at all periods if a deaf person...is to function more fully as a thinking human being. (Streng 1978: 32).

Proponents of this perspective believe sign language is inadequate and that only through oral speech training will
deaf children learn language and the satisfaction of cultural and social experiences.

The second approach focuses on dispelling misconceptions concerning sign language, in particular the attitude that sign language is iconic, agrammatical and can only express concrete concepts. Schlesinger and Namir offered this definition:

Sign language is a form of manual communication which is used in every community of deaf persons... It consists of stable, conventional hand movements and postures each of which conveys concepts, reminiscent of pantomime but far from being simply this...sign language is on the whole independent of spoken language (1978:1).

This independence from spoken language seems to be the crux of the issue. The acceptance of sign language as language depends first on the investigator's definition of language, and the evaluation of sign in those terms or in comparison with a spoken language (Schlesinger and Namir 1978). Subsequent studies outlined similarities and differences between manual and oral communication. Wilbur (1980) discussed semantic and grammatical features of sign language. Markowicz (1980) argued against misconceptions concerning linguistic features of sign. Other works by Stokoe (1966) and Battison (1974) investigated the parameters of sign: handshape, location, movement and orientation. Boyes-Braem (1973) and McIntire (1974) proposed a developmental sequence for learning handshape and devised techniques to transcribe these features. The work by Klima and Bellugi (1979)
recognized both the iconic and arbitrary faces of sign, the internal structural properties of sign, and the morphological processes in American Sign Language.

Grojean (1977, 1979) and other psycholinguists designed tasks to study performance structures of sign (production), perception, and memorization. They concluded that, although characterized by "peripheral traits" based on differences due to modality (manual or oral), "at a deeper level of analysis the two languages have much in common" (Grosjean 1980:55).

The last decade has seen a dramatic increase of research into aspects of gestural-visual language for a "new perspective on the human capacity for language and the form that language takes" (Klima and Bellugi 1979:1).

The study of gestural communication among the deaf is complicated by what Woodward (1980) and Cicourel (1978) described as sociolinguistic aspects. There are various sub-groups which make up the deaf community, including deaf children of deaf parents, deaf children of hearing parents who learn sign before age 6, or after age 6, hearing adults deafened after age 18. Each group learns sign in a unique environment, and uses sign in multiple situations, formal and informal (home, school, peer group, work). Cicourel (1978) identified the variations of sign used in these different circumstances as High and Low Signs. Woodward (1980) placed the existing variations of gestural systems
on a Sign to English continuum: ASL, Signed English, Pidgin Sign, and Manual English. ASL is the language used by deaf parents to deaf children and between peer groups of deaf adults and/or deaf children, with the least similarity to English syntax. Pidgin Sign combines syntax of English with a sign vocabulary. Manual English is used by hearing parents to deaf children and it is the most direct translation to English syntax.

Fischer's (1978) comparison of sign language to creole offered the following explanation of how the variations of sign language developed. Based on the fact that 10 percent of the deaf population have deaf parents, Fischer observed that the other 90 percent of deaf children learn language in an environment with hearing parents who attach a strong positive value to English. Those parents generally use a form of Pidgin Sign English with their children rather than learning ASL, essentially a second language for them. Deaf children who use Pidgin Sign with parents also use ASL with other deaf children. Most teachers of the deaf use some form of Signed or Manual English in classroom situations, if sign is used at all (Fischer 1978:329).

Even though the research that recognizes ASL as a language has increased, only within the last five years has this evidence begun to alter the social reality of those using sign language, more specifically those deaf children learning language.
The dichotomy between the oralists and manualists is very much a part of that social reality. To understand the oralist position, one needs to examine an attitude which took hold in the 1800's; it states:

that thinking took place in speech, and that to deprive a deaf child of speech by teaching him sign would deprive him of (or interfere with) the ability to think (Heinicke cited in Wilbur and Jones 1974:743).

This stigma has kept alive the feeling, even among the deaf, that ASL is somehow inferior to spoken English, and therefore not acceptable for use outside the deaf community or, in many cases, not acceptable as a first language for deaf children. The deaf community has divided itself into two camps; on one side are the oralists who call themselves "hearing impaired", and who speech read (lip-read) and speak. On the other side are the "deaf" who use sign language (Benderley 1980).

Because of the predominance of the oralist position in research, the emphasis in residential schools for the deaf has been on turning deaf children into speakers. Schlesinger reported the techniques used were not successful. As a result, educational achievement among the deaf was marked by a 3 to 4 year language gap; the average deaf adult read at a fifth grade level; and only 4 percent became proficient speech readers or speakers (Schlesinger 1978:58). Streng, an oralist, made the claim that "the ability to acquire language is very slow in a deaf child (1979:81) and "deaf
children don't reach competence with even simple syntactic structure until age 4" (1978:30). Data from studies of deaf children under the age of 3 whose parents use sign or speech dispute those claims. Streng criticized teaching strategies for the deaf which did not recognize that language development for the deaf child follows normal child development patterns, even though those patterns may occur later chronologically. In particular, Streng stressed the importance of deaf children being allowed to develop semantic categories first and then to move on toward syntax as do normal children. Also she noted the importance of situational or contextual cues.

Bateman (1985) noted that, because deafness is being detected earlier through advances in auditory testing techniques and increased awareness on the part of medical professionals and parents, deaf children are now able to participate in language-learning experiences during the first three years of their lives. He contrasted this to the circumstances for deaf children ten years ago whose hearing impairments were often neither detected nor accepted until they were three and four years old.

Some educational institutions emphasize "total communication" and advocate the use of a variety of language tools: amplification, ASL, and Manual English. The goal is to have children understand spoken and written English, so they are encouraged to speak and sign simultaneously.
Parents participate in the child's language development as soon as possible by learning to sign with speech (Bateman 1985, pers. comm.). There has been a shift to "bimodal input" (Schlesinger 1978) as hearing parents learn to sign in order to enhance the language development of their deaf infants.

Sign language is generally considered to be helpful in the development of deaf children when it is used with positive affect, without conflict, is accompanied by speech and auditory training, and is used early before a feeling of communicative impotence occurs between parent and child (Schlesinger 1978: 68).
CHAPTER II
REVIEW OF OTHER RELEVANT LITERATURE

Before sign language can be considered as significant linguistic input in the pre-phonetic and one-word stage, some explanation of the normal linguistic input and expression is necessary. Various aspects of the interaction between mother and infant as a primary source of linguistic information are discussed in the literature. The language a mother uses with her infant, or "motherese", serves several functions:

1) makes language learning task easier because mothers use short, well-formed sentences, and repetition.
2) allows for interpretation (of intent) and maintenance of the communication exchange.
3) gets the infant's attention.
4) provides additional opportunities for processing (Nelson 1978).

Most adults, as well as older children (siblings) modify their speech to infants. In their analysis of "baby talk", researchers have considered the questions how and why speech is modified (Berko-Gleason 1977; Nelson 1978; Sachs 1977). Berko-Gleason suggested "that children help shape the language behavior of those who speak to them by the kind of feedback they produce" (1977:204). Sachs contributed the hypothesis that infants have "perceptual sensitivity" to characteristics in adult speech; these characteristics include intonation, rhythm, higher pitch, and use of particular sounds. Sachs maintained that if infants have perceptual sensitivity, then the early input may...
function in:

1) gaining and holding the infant's attention
2) establishing affectional bonds
3) allowing the earliest communication (1977: 59-60).

Ramey et al (1978) focused on the "bidirectional effects" of the mother-infant interaction. One of the implications of the fact that the infant shapes the mother's behavior towards him is that there is a correlation between maternal behavior and infant competence. Berko-Gleason reiterated this:

The mother who decides that her pre-linguistic infant is asking for the name of an object has made a cognitive decision based on her estimate of the child's needs and state of linguistic and cognitive development...adults appear to be sensitive to even small changes in childrens capacities as they develop, a sensitivity that is reflected in the adult's speech (1977:204-5).

Infants are cued in to speech addressed to them by the special intonation, high-pitch and sounds. The fact that infants use these characteristics in their earliest productions or in "mutual babbling" (Sachs 1977) provides some evidence for the bidirectional effects in the mother-infant interaction.

The use of intonation and rhythm patterns which becomes "babbling and jargon babbling" (reproduction of sentence-like intonation) was identified as an early stage of communicating during the prelinguistic period, birth to approximately 2 years (Ferguson and Slobin 1973). The age babbling begins corresponds with the age an infant becomes preoccu-
pied with objects and object interaction through repetitive behavior. It may also be related neurophysiologically to other rhythmic actions such as waving and shaking. The appearance of each of these forms of repetitive behavior (including babbling) may reflect development of the motor cortex of the brain (Bond and Start 1984).

Moore and Meltzoff (1978) also discussed the significance of object interaction as a prerequisite for language development. Simply put, infants do not learn "words" referring to objects until they have the ability to associate labels with objects. This capacity for representing objects and/or events by symbols requires the ability to hold the object in memory and to believe it exists when it is no longer in view. An infant in the prelinguistic period discovers that utterances (either oral or gestural) produced by his caretakers communicate a message (meaning). He discovers that objects in his environment are often part of the message, either in terms of identification or of initiating actions in relationship to them.

Imitation continues to play a role beyond the infant's use of intonation. Imitation provides evidence of the infant's developing control of his speech production throughout the transition process from pre-phonetic to phonetic speech. Clark (1976) challenged the assumption that imitation presupposes comprehension. She observed that spontaneous imitations in natural settings such as feeding,
changing and bathing are often superior in structure to spontaneous productions recorded during structured observation sessions. Clark concluded that novel forms do enter a child's language through imitation and that the effects of imitation on children's speech are too pervasive not to be considered useful as a means of advancing a child's competence.

The recurrence of signal (oral and signed) which occurs during interactional routines (Boggs and Peters 1982) between parents and infants draws a child's attention to the importance of sounds and gestures. Some examples of such routines include summons-response, build and bust, point and name, and read and clap activities. The child learns the script so well that he can play either role (in some cases) and can eventually initiate and complete the routine by himself. These routines convey specific meanings through repetitive and predictable verbal and non-verbal behaviors, and help a child learn to comprehend two- and three-word instructions even before the child uses one-word sentences (Sachs and Truswell 1976). Because interactional routines structure socializing situation (e.g. turn-taking), Boggs and Peters concluded that they become part of the motivation process by which language-learning expands. As mentioned, interactional routines suggest some level of comprehension before speech production; moreover, they demonstrate the developing perception, attention and memory
capacities in infants. Researchers have begun to consider the data from language acquisition of the deaf for information regarding these capacities (perception, attention and memory), precursors to imitation, comprehension, and production (Brown 1972).

The language learning process for deaf infants involves the co-ordination of cognitive capacities and a variety of physical skills. Because a deaf infant (learning sign language) relies on visual rather than aural feedback, it is possible for him to see as well as feel what he is communicating (McIntire 1974). Furthermore, the muscles required for sign production depend on gross motor control rather than the fine motor control required for vocal articulation.

Imitation and interactional routines play a critical role in the language acquisition process of deaf infants as well as hearing infants, but rather than being cued to meanings conveyed by rhythm and intonation, they are cued by hand, body and facial gestures. Rather than "cooing" the infant's name, a mother of a deaf infant waves or stamps her foot on the floor to call to an infant across the room, or touches the infant's face to turn his attention to her.

A brief description of the basic components of sign language is necessary before a discussion of the data. The four components of sign phonology are: the shape of the hand(s) or "hand configuration"; the location of the hands
in relation to the body, or "place of formation"; the type and direction palm and fingers face. Each sign is made up of these components, and a change in only one may alter the meaning. Space and movement provide additional semantic markers:

1) Space can provide intonational cues. A pause in midair or move slightly forward may indicate a question.
2) Reversal of motion may turn sign into its opposite meaning.
3) Movement downward may mark negation.
4) Movement may signal tense, singular or plural. (Bellugi and Klima 1972:63).

The place of formation of the sign is acquired before the other features because it requires gross motor development. Finer control is necessary for proper hand configuration. Just as hearing infants in the babbling stage go through a sequence of approximations before they reproduce words and sounds correctly, infants learning sign language go through a sequence based on developing motor control of fingers and hands rather than articulatory muscles. For example, D., a hearing infant, with deaf parents went through the following sequence before correctly signing HORSE:

1) Roughly right place, wrong hand-shape, no motion.
2) Roughly right place, wrong hand-shape, wrong motion.
3) Right place, wrong hand-shape, right motion.

Clearly there are anatomical constraints affecting an infant's acquisition based on five features of hand config-
uration. This sequence is based on gradually increasing ability, both physical and cognitive, such that signs requiring handshapes beyond a baby's performance ability will result in a substitution (McIntire 1977). Factors influencing the infant's sign production (baby sign) and substitution of handshapes are outlined by McIntire:

1) Handshape beyond the physical and cognitive abilities.
2) Sign made with preferred finger tip contact instead of proper handshape.
3) Miming action instead of proper motion.
4) Nature of feedback (signs made within visual field offer potential feedback, influencing self-correction).

The data that are available for deaf infants with normal language acquisition are limited because much of the work done has focused on children with abnormal language patterns. Studies that are available confirm two assumptions of this research. First, the language-learning process for sign is the same as it is for speech, allowing differences based on modality. The second assumption is that infants learning sign, or sign and speech simultaneously, produce signed utterances earlier and use two-sign combinations before they use two-word combinations. The discussion of language acquisition is multifaceted, but in this paper I focus on two aspects; one is that the motor development required by a visual/gestural modality precedes that required by an aural/oral modality. The second is that the manual nature of sign requires both physical contact and a high degree of social
interaction, contributing to the advancement from the one- word to the two-word stage.

It is important to remember that the variability in the onset and rate of language acquisition is influenced by similar cognitive and social factors influencing language development in the hearing world. The data concerning whether language input was bimodal, oral or ASL are not always included in every study, so comparisons between studies are risky. The examples cited represent the few instances in which the language-learning process wasn't complicated by factors such as residual hearing increased by amplification, or negative feedback related to the combined use of sign with speech. Examples chosen here reflect only those cases of profound deafness either for the deaf parents or deaf children.

F.F., a deaf infant of deaf parents, the subject of McIntire's research (1974, 1977), started signing at 9 months, and by 10 months had a vocabulary of 20 items, including two-sign utterances. By 13 months, F.F. had acquired 85 signs, and by 21 months used more than 200 signs. Schlesinger and Meadow (1972) recorded a deaf infant of deaf parents who started to sign at 12 months and a hearing infant of deaf parents who started to sign at 10 months, each with similar increases in his/her vocabulary. (data on their multi-sign utterances are not available). M., a deaf child with hearing parents began to use sign at 12 months, two-
sign utterances at 18 months, at the same time he expanded his one-sign vocabulary (Hoffmeister and Wilbur 1980). Another hearing infant of deaf parents, D., started at 11 months, had acquired a vocabulary of 25 words by 18 months, and he began two-sign utterances at 17 months. D.'s spoken vocabulary was 35 words at 18 months, with no two-word sentences (Wilbur and Jones 1974). A hearing infant of deaf parents studies by Wilbur and Jones (1974) began "finger babbling" at 8 months, approximating finger spelling in the correct place of formation (near the shoulder).

Pola, a deaf child with deaf parents (Bellugi and Klima 1972) and D., a hearing infant of deaf parents (Wilbur and Jones 1974) both produced sign combinations paralleling the full range of semantic relationships expressed by hearing children, including an increase in length of utterance. Wilbur and Jones (1974), who observed three hearing infants with deaf parents, concluded that bimodal infants develop two separate language systems, at the one-word stage and at the two-word stage. Hearing infants who learn sign are not just translating from one language to another. Other studies confirmed that the child's use of speech does not appear to decrease when signs are learned but actually increases in frequency. Children use speech when no sign exists or when they haven't learned equivalent signs (Hoffmeister and Wilbur 1979).

Whether the deaf (or hearing) infant receives spoken
or signed English, ASL or some combination of all three is critical to any data analysis for two reasons, cognitive and social. The cognitive advantages of bilingualism and bimodalism have been recognized by Schlesinger and Meadow (1972), Lambert and Peal (1962), and Hoffmeister and Wilbur (1978). With respect to specific linguistic tasks, according to Ianco-Worrall (1972), bilingual children tend to be more advanced in recognizing the inherent arbitrariness of the relationship between a word and its referent. In light of the iconic (pictoral) feature of some signed words, an analysis of early vocabularies of bimodal and bilingual deaf children might shed light on whether the unique circumstance of learning two systems accounts for the earlier acquisition of multi-sign utterances.

Deaf children who learn sign early have an easier time learning English as a second language than do deaf children in oral programs trying to learn it as a first language (Moskowitz 1978). Historically, deaf children with deaf parents did better academically and psychologically than deaf children of hearing parents, due to the parents' acceptance of the deafness, realistic expectations of the child and the early social interaction made possible by use of sign language.

The cognitive, psychological and emotional advantages which resulted from the bilingual system available to deaf children of deaf parents have encouraged hearing parents to
begin communicating with their deaf infants earlier, through a bimodal system.

Early, reciprocal, meaningful, and joyful communication between parents and deaf infants could alleviate linguistic retardation and provide more access to successful communication... (Schlesinger 1978:67).
CHAPTER III
METHODOLOGY

Techniques for Teaching

A sign language study conducted with a normal hearing child, E., of hearing parents began in the pre-phonetic stage of language acquisition (11-13 months of age). The study continued through the single utterance stage (14-16 months of age), one-sign and one-word, until the beginning of the multi-utterance stage (16-20 months of age), two- and three-signs combined, and two-words combined. In the following text, these stages are identified as Stage 1, Stage 2, and Stage 3, respectively. The terms "word" and "vocalization" are used to indicate spoken (oral) productions; the term "sign" indicates signed (manual) productions. Because, at the beginning of the experiment there was no way to predict how or when E. would begin to use sign or speech, the techniques used to teach him sign language were modified for each of the three stages.

Stage 1 was a trial period, and a concerted effort was made to "teach" E. sign language, as well as speech. Throughout the period of study, E.'s environment provided the opportunity for him to observe the use of sign language between his parents, the researchers in this study, initially to encourage imitation and then to reinforce E.'s use of sign. A major portion of the linguistic interaction between E. and his parents involved simultaneous use of speech and

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It should be made clear that, unlike the language environment of a deaf child or a hearing child whose parents are deaf, E. heard more speech than he saw sign. However, in conversations directly involving him, sign language was nearly always used. Furthermore, unlike children with deaf parents, E. had the choice of using manual or oral language. Initially, we taught E. sign by molding his hand(s) to the correct handshape, and placing them in the proper location, and moving them in the correct manner; and we encouraged him to imitate signs. His use of sign during the first month was often touch prompted; that is if E. did not respond to my question, I repeated the question and touched E.'s hands or shoulder, saying "Can you show me the sign?" or "What is the sign?" If E. used "baby signs" (substitutions of baby handshapes for handshapes limited by motor development) consistently, we recorded them as acquired signs (baby sign is discussed in more detail in Chapter II).

The first signs taught to E. related directly to his immediate needs: EAT, DRINK, MORE, UP, DOWN, and a home sign of fingers holding the nose to indicate he needed a diaper change, POOP. Signed utterances are indicated in the following text by use of all capital letters (EAT, APPLE, etc.); spoken utterances are in all small case with quotation marks ("mama"); words signed and spoken together are indicated by capital letters in quotation marks ("IN", "DONKEY").
Imitation and repetition were used as positive techniques to reinforce learning. During meals, we used signs frequently in reference to E.'s or our own actions. Pointing to foods or glasses of milk, juice or water, we used the appropriate signs.

We also used picture books when demonstrating signs to E. The *Sesame Street Sign Language Fun* book provided us with signs for items relevant in a child's environment, along with colorful pictures which attracted E.'s attention. We sign-read a book about opposites, *Big-Little*. We molded these signs on E.'s hands, but he did not imitate or initiate their use as we sign-read. The turning point of the study was the day E., while sitting alone with this book, signed one of each of four contrasting pairs: *IN*, *TALL*, *BIG*, *OVER*, and *UP* and *DOWN*. Although this single spontaneous production was not an indication of comprehension, it did suggest E. was in fact, *perceiving* the sign input, paying attention to the signs, and remembering them. We decided E. was ready for an increase in sign input.

The techniques were modified during Stage 2 in that attention shifted from whether E. could sign to how much he would use sign language. The techniques used for introducing and teaching new sign vocabulary items during State 2 included conversation, picture books and games. Sign use became integrated into E.'s communication patterns, allowing him to learn language rather than just individual signs.
We continued to use signs in the natural context of mealtime, changing, play and in sessions with picture books. There was a decrease in the number of times the signs needed to be molded or repeated, E. acquired signs more readily. Sign language and speech were used to identify and discuss objects and people in E.'s surroundings: book, toothbrush, bed, dog, shoes, duck, dad, etc. In Stage 1, simplified syntax and routinized one- and two-sign/word phrases were used. As E. acquired single sign utterances, we increased the number of signs in an utterance. For example, during Stage 1, E. was asked "Do you want a DRINK?", "DRINK?" or DRINK? (Sign with no vocalization). During Stages 2 and 3 the same question was "Do YOU (POINT) want a DRINK?", MORE DRINK? or WANT MORE DRINK? Other conversational settings involved statements, rather than questions: "Daddy is EATing MORE APPLE", "Let's READ the BOOK", "SEE the dog."

Picture books were used during Stages 2 and 3 to expand E.'s vocabulary as well as to satisfy his interest in naming. Because many picture books for young children center on the baby animal theme, they provided us with the opportunity to use one book as a teaching tool to identify the animals and the others to check E.'s comprehension of the sign.

The routine of reading (signing) the same books set up a repetitive situation in which the child knew what phrases we would use. The situation created the opportunity for parents' phrases to recur in the child's speech (Nova 1985).
Observing us sign-read a variety of books was a language learning experience for E.

Picture books served as an object of much linguistic interaction between parent and child. E. requested us to read books to him. Books were a technique for using sign beyond the recurrence of parents' sign and speech. For example, E. knew the sign for elephant; while looking at a book *Goodnight Moon* with me, he signed ELEPHANT, ELEPHANT, even though there were no elephants apparent in the picture. I asked "Where's the ELEPHANT?" and E. pointed to a small elephant in the background of the picture. The incident is significant in that it gave us insight into what level of detail E. was perceiving while looking at a picture book. Being able to sign elephant expanded E.'s ability to be an initiating participant in a conversation, which is certainly an essential part of language development.

**Collecting and Recording Data**

The child's sign use was observed and recorded daily on the basis of specific criteria in an effort to distinguish between imitation, comprehension and spontaneous production. During the first month, we recorded whether a sign used had to be touch prompted, molded on E.'s hands or if he imitated the sign. These aspects gave clues about the child's manual dexterity and his willingness and/or readiness to watch for manual cues. If E. only imitated a sign but never initiated its use, the sign was not recorded as
part of his vocabulary.

Initially, both parents recorded signs E. used in separate notebooks. No formal time was set aside for "sign language", rather, observations were made in the context of everyday events. As the study proceeded, one person recorded observations of both parents; as one parent interacted with the child, the other observed and recorded.

The first criterion E. had to satisfy before a sign utterance was recorded was comprehension: E. demonstrated by his behavior/response that he understood the meaning of the sign (e.g., E. was asked to bring a book from the other room. He brings a book). The second criterion was use: E. used the sign correctly in response to a question, or in response to a question, or in the correct context (e.g., E. sees parent eating, signs EAT). The final criterion was spontaneous production, which required E. to initiate use of a sign (e.g., Riding in the car E. signs DRINK, DRINK, is offered a cup of milk, drinks it all).

I kept a daily journal with observations about the context and events involving sign use and vocal utterances. E.'s father recorded signs in list fashion with appropriate notations concerning whether a sign was touch prompted, molded, imitated and which of the criteria it met. Notes were compared and after mutual agreement that a sign was used, it was recorded on a wall calendar (Table 1). This wall calendar was kept for the first three months so the
### TABLE 1

#### A DAILY CALENDAR

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEPTEMBER:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>drink-m, i</td>
<td>drink-m</td>
<td>drink-S</td>
<td>drink-S</td>
<td>drink-S</td>
<td>eat-C</td>
<td>drink-U</td>
</tr>
<tr>
<td>eat-m, i</td>
<td>eat-m, i</td>
<td>up-S</td>
<td>down-i</td>
<td>up-S</td>
<td>eat-S</td>
<td>eat-U</td>
</tr>
<tr>
<td>up-C</td>
<td>down-i</td>
<td>down-i</td>
<td>up-S</td>
<td>down-i, m</td>
<td>down-i</td>
<td>poop-i</td>
</tr>
<tr>
<td>down-i</td>
<td>poop-c</td>
<td>poop-c</td>
<td>poop-c</td>
<td>poop-i</td>
<td>poop-S</td>
<td>poop-i</td>
</tr>
<tr>
<td><strong>OCTOBER:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eat-S</td>
<td>eat-S</td>
<td>eat-S</td>
<td>eat-S</td>
<td>eat-S</td>
<td>eat-S</td>
<td>eat-S</td>
</tr>
<tr>
<td>drink-U</td>
<td>drink-U</td>
<td>drink-S</td>
<td>drink-S</td>
<td>drink-S</td>
<td>poop-i</td>
<td>poop-i</td>
</tr>
</tbody>
</table>

**SYMBOL KEY:**
- C-Comprehension
- U-Uses correctly in response
- SP-Spontaneous Production (Imitates Use)
- tp-touch prompted
- m-molded
- i-imitation

**Blank Days:** no signs recorded

Signs underlined when they meet five-day consecutive initiated use and no longer are recorded.
### TABLE 1 -- A DAILY CALENDAR

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOVEMBER:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>over-C</td>
<td>over-C</td>
<td>over-C</td>
<td>over-C</td>
<td>cat-i</td>
<td>hat-i-C</td>
<td></td>
</tr>
<tr>
<td>hat-U</td>
<td>hat-U</td>
<td>hat-SP</td>
<td>hat-SP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>shoe-SP</td>
<td>shoe-SP</td>
<td>shoe-SP</td>
<td>fish-SP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oh my-1,C</td>
<td>oh my-SP</td>
<td>oh my-SP</td>
<td>oh my-SP</td>
<td>oh my-SP</td>
<td>oh my-SP</td>
<td>oh my-SP</td>
</tr>
<tr>
<td>hat-SP</td>
<td>hat-SP</td>
<td>hat-SP</td>
<td>fish-SP</td>
<td>hush-SP</td>
<td>more-SP</td>
<td></td>
</tr>
<tr>
<td>fish-SP</td>
<td>fish-SP</td>
<td>fish-SP</td>
<td>apple-SP</td>
<td>apple-SP</td>
<td>apple-SP</td>
<td></td>
</tr>
<tr>
<td>more-SP</td>
<td>more-SP</td>
<td>more-SP</td>
<td>more-SP</td>
<td>more-SP</td>
<td>more-SP</td>
<td></td>
</tr>
</tbody>
</table>

| DECEMBER: |        |         |           |          |        |          |
| more-SP  | more-SP | more-SP | more SP   | more SP  | more SP|
| more drink-SP | more drink-SP | more drink-Sp | more drink-SP | more drink-SP | more drink-SP |

**Symbol key:**
- **tp**- touch prompted
- **m**- molded
- **i**- imitation

**Blank Days:** no signs recorded
**C-Comprehension**
**U-Uses correctly in response**
**SP-Spontaneous Production (Imitates Use)**

Signs underlined when they meet five-day consecutive initiated use and no longer are recorded.
kinds of sign use and the frequency of each sign used could be easily checked. Signs were recorded on the calendar only if E.'s use of the sign met the criteria. E. may have used a sign several times during a given day and, on the basis of those uses, each of us decided whether the use indicated comprehension (C), use, (U), or if it was spontaneously produced (SP). If a sign was recorded as touch-prompted early in the day and later observed as initiated use (SP), we recorded it as (SP), for that day. Some days on the calendar are blank for one of three reasons: we did not have time to observe and record accurate data that day; E. was sick; or E.'s use did not satisfy the criteria. Sometimes initiated use (SP) was not an indication of comprehension; E. sometimes spontaneously produced a sign and then did not use it again for several days. However, spontaneous production usually occurred in the proper context, or as an appropriate response to a situation (not necessarily a question), such that after (SP) five days in a row, we agreed that the other criteria were satisfied and the sign was recorded as part of E.'s vocabulary. Another reason the calendar ends in mid-December is that we traveled away from home for three weeks and it was not possible to keep up the data collection during that period.

As E. began to acquire signs more rapidly (without molding or repetition) and as responses consistently indicated comprehension, the criterion of five days of consecutive
use was reduced to three days. As with vocalizations, E. sometimes used a sign several times before we observed use. Because we worked with a visual-manual mode of language, it was not possible to set up a tape recorder in the room to collect all of his utterances; nor was it financially or physically possible to use video equipment. We conducted a video tape session when E. was 18 months old. A family friend, an 11 year old girl who was familiar with the project conducted the session by having E. identify pictures and respond to her instructions in sign language. A person other than the parents was used to avoid the possibility of E.'s responses being interpreted as the result of parent-infant routine.

As E.'s utterances increased to two- and three-sign and sign/word combinations, use was recorded in a daily journal but the wall calendar was discontinued because E.'s utterances were too numerous and too long for the calendar. After the utterance was used three times, it was recorded on a long-term chart (Table 2). Notations were made to describe whether E. used a vocalization with a sign all of the time, or only some of the time. This was done to determine if E. was learning signs for words he did not articulate, or for words he did produce vocally, and to determine what sort of duplication there was between the two modes. As stated in Chapter II, D., the hearing child of deaf parents, developed two separate systems (Wilbur and Jones 1974).
TABLE 2

SUMMARY OF LANGUAGE ACQUISITION FOR A HEARING INFANT LEARNING SIGN LANGUAGE

<table>
<thead>
<tr>
<th>SIGN VOCABULARY ACQUIRED</th>
<th>13 Months</th>
<th>14 Months</th>
<th>15 Months</th>
<th>16 Months</th>
<th>17 Months</th>
<th>18 Months</th>
<th>19 Months</th>
<th>20 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>bye-bye</td>
<td>eat up</td>
<td>hat</td>
<td>fish(v)</td>
<td>orange (v)</td>
<td>eyes</td>
<td>pig</td>
<td>flower</td>
<td></td>
</tr>
<tr>
<td>drink</td>
<td>bed down</td>
<td>shoe</td>
<td>apple</td>
<td>cheese</td>
<td>feet</td>
<td>kiss</td>
<td>tree</td>
<td></td>
</tr>
<tr>
<td>duck</td>
<td>book poop(*)</td>
<td>out(*)</td>
<td>mouse (NRV)</td>
<td>want</td>
<td>ears</td>
<td>raccoon bug</td>
<td>grape(NR)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>bird cat (NR)</td>
<td>hush</td>
<td>more(v)</td>
<td>sit</td>
<td>toes</td>
<td>head</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>big dog (NR)</td>
<td>oh my (v)</td>
<td></td>
<td>walk(NR)</td>
<td>friend</td>
<td>seed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>tall</td>
<td>in</td>
<td></td>
<td>nose</td>
<td>care(v)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>toothbrush</td>
<td>over</td>
<td></td>
<td>all gone</td>
<td>love you</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>elephant(v)</td>
<td>bunny(*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>koala bear(*)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MULTI-SIGN UTTERANCES

read book    more drink    want apple    want shoes    more kiss    want drink
more eat     more shoe      want hat      want down    out shoes    all gone-more
more book    want more drink seeds-all gone-seeds read book "mama" want more "meat"
more apple   want more apple seeds "cow" over "cow" want "shovel mama"
more-all gone-more

SPOKEN VOCABULARY ACQUIRED

ba(book)     uh-uh(out)     ba(ll)      wad-dle     baby      na-gee (car)  sh(juice)  cow
num num (NR) horse       out         da (down)   ta (tower) noo(n)     moo(se)   meet
imitates:    cow           sh (shoe)   mo-mo(more) toe       ba-lu (blue) mit(ten) hee-haw
tall         owl           sh (hush)   da-do(cracker) imitates: please    moo(sa)   meow
rooster      chicadee     sh (fish)   oh my      bear      thank you    mi-men   hoo hoo
chicadee     mama-mee     ba (apple) sh (cheese)

Symbol Key:
V-Vocalizations used with sign all of the time
*-Home sign used
NRV-Sign not retained, replaced by vocalization
V-Vocalizations used with sign some of the time
NR-Sign not retained For multi-sign utterances, spoken words in "quotations"
If E. could not form the correct sign or if no sign fit the meaning, a home sign was created and so noted on the long term chart (p. 35). Also, notations were used to indicate signs that were not retained, and signs that were not retained because they were replaced by a vocalization. E.'s acquisition of spoken vocabulary was also recorded on this chart.

E.'s speech development followed the regular patterns of pronunciation as outlined by de Villiers and de Villiers (1979). Of particular relevance to the earliest phonetic development, E. reduced single syllable words to a consonant-vowel "word approximation" such that ba meant ball, da meant duck. Although all of his vocalizations were not transcribed phonetically, these reductions were recorded because the same "word approximation" (bã, da, sh, wã, sã) usually had several meanings. This is of note in that any particular sign used by E. had only one meaning and, in cases where he used an ambiguous approximation with a sign, his meaning was communicated by the sign, not by the vocalization.

**Techniques for Testing Comprehension**

The procedures developed to test comprehension fall into two categories. The first category involved asking the child to **choose** something. Tests used during Stages 1 and 2 concentrated on item (object) identification. The second category involved asking the child to **do** something. This category applied to Stage 2 and 3, because E. was given two
and three word/sign instructions to which to respond. During Stage 3 it became important to determine that E. was not responding on the basis of a key word (sign), or by using a practiced routine.

Comprehension tests need to be designed to ensure the researcher is: a) discovering what the child really knows, and b) not asking the child to do something he would anyway (deVilliers and deVilliers 1979). Because the researchers, as parents used routines and imitations as teaching techniques, it was necessary to prepare test instructions which varied from those routines. Some examples from State 2 are "KISS the APPLE", "Put BOOK UNDER CHAIR" (normal routines were "KISS the RABBIT", "Put BOOK ON table." In some cases we found it necessary to separate verbal comprehension from sign comprehension. In order to accomplish this, instructions were spoken only during some interactions, in an effort to eliminate the possibility of imitation. During other interactions, instructions were signed only, to avoid verbal cueing. These two sets of instructions were integrated into the everyday play session atmosphere.

Ferguson and Slobin (1973) outlined the following testing methods which were the basis for verifying acquisition of a sign throughout the study. The methods include:

1) Pointing to an object
2) Giving an object
3) Placement of an object
4) Finding an object

These testing methods were incorporated into play sessions,
meal preparation, and reading sessions. E. was asked to imitate a sign, then given the opportunity to identify objects (toys, animals, foods, etc.) in another book or situation by signing in response to "What is this?" The following type of instructions were used:

"Find the (SHOE, HAT)."
"Where is the (BIRD, BED)?"
"What is (IN, UNDER) the box?"
"Give (RABBIT, DUCK) a KISS."
"Bring ME(POINT) your (SHIRT, SHOE)."
"Show me the sign for ( )."
"Point to the (APPLE, FLOWER)."
"Ethan WANT (UP, DOWN, DRINK)?"
"Pick up the (TOOTHBRUSH)."

Although E. used the locative POINT, it was not recorded as a sign. If given a choice between an apple or an orange and he pointed, he was asked "What is this?" or "What is the sign for this?"

We were interested in determining E.'s comprehension of both oral and manual instruction but we were equally interested in his ability to communicate. E.'s ability to initiate and spontaneously produce multi-sign utterances along with his ability to respond appropriately suggest that he understood and used language.
CHAPTER IV
SIGN LANGUAGE DATA FOR E

E. started signing at 11 months with a wave for bye-bye and a locative POINT, gestures used by most infants. Actual sign instruction and recording began two months later when E. was 13 months old. By 16 months of age, he had acquired a vocabulary of 25 signs and 15 words, three of which were glosses for bā (book, apple, ball), three of which were for sh (shoe, hush, fish). He began vocalizing or using his first words at 13 months, bā (book), num-num (eat or drink).

E. produced his first two-sign utterance, READ BOOK at 15 months and used four different two-sign sentences by the following month. He produced three-sign sentences by 17 months of age, and continued to expand his sign vocabulary. At 20 months he had a vocabulary of 60 signs, and had produced 18 different multi-sign utterances and six sign/word combination sentences.

Several aspects of E.'s sign acquisition, summarized on Table 1, (p. 35), are explained here in more detail: pre-sign comprehension, signs used with vocalizations, signs dropped, signs not learned, home signs and substitutions, multi-sign utterances.

Before his first birthday, E. understood these vocal requests: "Give me a kiss." "Put your arms around me." "Go get a book." "Find your pants." We played a nose-
beeping game, a "routine" in which the instructions varied: "Beep Daddy's nose." "Does yours work?" "Does Mom's work?" "Operate it." "Operate your nose." "Operate his." Eventually any one of these requests would elicit the appropriate action. E. used a bye-bye wave appropriately, pointed at objects he could not reach. His first vocalization, "num-num" was a general reference to eating and drinking and he dropped it when he learned the signs EAT and DRINK.

Another sign E. learned in the first month of the study was a home sign for POOP. The use of home signs was a result of our inability to find a sign for the object or concept, or because it was a gestural representation used before we showed him the proper sign. The initial gesture stuck, often despite attempts to correct it. E. imitated the POOP gesture (holding fingers to nose) during changing and soon initiated or spontaneously produced it correctly, to let me know he had a soiled diaper. However, it became part of a routine in that when he signed POOP, I would reach to pick him up, he then crawled or ran away. He used the sign to initiate a "chase me" game. Because there were still times he used the sign appropriately, I include it as a sign acquired.

E. used some signs only once or twice; they were either molded or imitated. One possible explanation for discontinuing involved his ability to produce the corresponding word, or some vocal representation that was "fun" for E.
example, E's favorite animal was a horse, but he did not learn the sign HORSE. He used an exaggerated whinny that usually elicited positive feedback and imitation. Similarly, the sign SHEEP (which involves a complex action of fingers as scissors on one hand shearing wool off the other arm) was not acquired. E. had lambs and chose to imitate the bleating sound (baa-baa) often eliciting a response from the lambs.

Whether or not E. was making a choice between the manual or oral utterance cannot be substantiated by my data. It does seem possible, however, that the sort of feedback he received for both his horse and lamb imitations may have been a motivating factor for their use.

Examples of signs used and not retained are DOG, CAT, and MOUSE, WALK, JUMP, and GOOD. The sign for DOG (slap to thigh and snap fingers) was only approximated, then dropped and replaced by a point with a vocalization "out, out" (gloss) to imitate my reprimand to the family dog. The sign for CAT (open fingers moving over cheeks, imitating whiskers) was replaced after three imitations by a vocalization "meow". MOUSE (index finger twitching under wrinkled nose) was replaced because a picture book about "Dee Dee the Mouse" reinforced the notion that a mouse was "dee-dee".

WALK, JUMP, and GOOD were signs that were within E.'s manual ability but did not become part of his natural repertoire; possibly these signs referred to something beyond
E.'s cognitive ability or interest. Referential signs (like words) are sometimes used briefly, then stored in memory while others are being learned. Signs may have been abandoned simply because an appropriate context did not arise to use them.

The other sign E. was able to produce, but did not acquire was COOKIE. Rather, he used his own vocal representation for cracker, "dā-dō" to refer to cookies, and cracker-like foods.

Another reason some signs were not acquired involved the difficulty of the sign. If the corresponding word was not within his verbal ability either, E. used a substitute form. The home signs for elephant and koala bear are examples. In some cases E. tried an approximation of the word (following the consonant-vowel pattern). These approximations had multiple meanings (e.g., "bā": book, ball, apple; "moo": cow, moon, moose; "sh": fish, hush, cheese, juice, shoe; "wā": walk, water).

Substitutions were generally baby signs, that is, signs using handshape or movement approximations within his motor development. Unlike the vocal approximations, a baby sign had only one meaning and was generally more effective for communicating. The only instance of duplication was the sign OUT. E. learned the sign for IN but could not reverse the action to form OUT. His sign for OUT was a locative POINT. His sign for DOG was a similar POINT, but combined
with a vocalization, "out-out" (gloss).

Some signs seemed within E.'s cognitive and physical abilities but were substituted by another sign. WAKE UP and SLEEP, each iconic configurations involved the opening or closing of his eyes. WAKE UP uses finger and thumb of each hand together in front of each eye, opening as eyes open. SLEEP is a single downward motion of an open hand, palm in, over the face, eyes closing as fingers and thumb close. E. used the sign BED (laying the side of head onto palm of one hand with the other hand perpendicular at wrist, palm down) to indicate sleep or when identifying a picture of a person/animal with his eyes closed. When asked or told TIME to WAKE UP, E. also signed BED. He never expanded BED to MORE BED, so I do not think his use of BED was a request, rather a comment: I'm in BED.

In the cases that E. knew both the sign and the word, three circumstances were observed and recorded:

1) He used the vocalization all the time with the sign.
2) He used the vocalization some of the time with the sign.
3) He did not use the sign and word simultaneously.

Examples for the first circumstance are the signs PEE, WOOD-PECKER, SEAL, and DONKEY. Each of these signs had iconic features, and the vocalizations were imitations of the sound, "tap-tap-tap", the bark of a seal, "hee-haw". Examples of the second circumstance are the signs FISH, ORANGE, CAR, OH MY, and MORE. When the sign MORE was used as a
pivot word in multi-sign utterances, E. did not use a vocalization. The use of vocalizations with the other four signs followed no such pattern.

The final circumstance involved E.'s acquisition of both the sign and the word. BOOK, SHOE, APPLE, CHEESE, IN are examples of signs for which E. knew the corresponding word. The words, however, were approximations that had multiple meanings and in many cases E.'s use of these words was ambiguous and unsuccessful. He often followed the word with the non-ambiguous sign. IN was the exception because E.'s vocal production of "in" was correct.

E. acquired one-sign utterances to identify objects, actions, or to request objects. The sign BOOK was used to request the action "Read me a book", not just as a request for another book. His first two-sign production was the expansion of BOOK to READ BOOK. After acquiring this two-sign utterance, BOOK was used exclusively as a noun.

Similarly, DRINK and EAT had several functions: to identify the action, to identify objects as something to eat or drink, and to request something to eat or drink. The second two-sign utterance E. acquired reflects an expansion of the latter function, requesting MORE EAT, or MORE DRINK.

Other semantic relationships apparent in E.'s two- and three-sign utterances are recurrence MORE SHOE, MORE KISS, WANT MORE APPLE; non-existence MORE-ALL GONE-MORE (watching
dog eat biscuit and then eat another one), SEEDS, ALL-GONE, SEEDS; DRINK ALL GONE; action WANT DOWN; attributive-noun TALL TREE. There are not enough instances to draw any conclusions regarding syntactic development other than the one stated previously: early sign combinations express a range of semantic categories found in early speech.

E.'s acquisition of three-sign productions occurred at a point when he produced only six or seven distinct words, several consonant-vowel approximations and animal sounds. E.'s oral language development followed the normal rate and pattern discussed in the literature. Hearing children acquire three to twenty words between 15 and 18 months of age, with the first word appearing between 10 and 13 months of age. Between 18 and 21 months, the vocabulary size increases five times, but two-word combinations do not usually occur much before 24 months. Infants, deaf and hearing, who learn sign language produce combinations at least six months earlier. Some deaf infants produce sign combinations at 10 months of age, or 12 to 14 months in advance of hearing infants' first production of spoken combinations. E. produced combinations using two signs at 15 months and 16 months, using three signs at 17 months of age, whereas he did not produce his first spoken combination until he was 20 months.
CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Why would anyone teach a hearing infant sign language?

Although some studies point out that hearing infants acquire the rules of syntax regardless of varying levels of linguistic input, the fact that language "happens" without specific linguistic interaction, seems more a statement of an infant's need to communicate, than evidence limiting the significance of social interaction as a pre-requisite for language. Some linguists question the impact of mother-ese (modified adult speech) as a technique to teach language or to increase the rate of language learning. Similarly, deaf infants who cannot acquire an oral system, and who are not exposed to a manual system, develop a gestural system "with language-like properties" without parental modeling or feedback (Goldin-Meadow and Mylander 1983). However, Fowler (1983) concluded that appropriate linguistic stimulation is a pre-requisite for developing comprehension; and that language is less dependent on other sensorimotor skills than assumed. The primary conclusion of my study is that sign language is effective as a means of developmental stimulation and is useful for early communication between parents and infants.

Deaf language acquisition studies document earlier production of sign language, including multi-sign sentences. Deaf or hearing infants have the cognitive capacity to use
language as well as "greater manual dexterity than usually assumed in child development textbooks" (Schlesinger 1978: 80). Fowler (1983) claimed that infants who are given verbal stimulation produce speech at an earlier age (8 to 12 months) than Neo-Piagetians suggest (10 to 18 months).

The subject of this study, E., produced three-sign sentences at 16 months and combined signs and words to produce three and four unit sentences at 19 months, well in advance of his first two-word utterance. His sign vocabulary at 18 months was comparable to that of bimodal infants with deaf parents. His spoken vocabulary was also comparable to that of other oral language learners. Although this study does not provide long-term data sufficient to prove that use of sign language increases or speeds up verbal production, this is an area for future research. E.'s use of word-sign combinations followed the pattern suggested in research by Schlesinger and Meadow (1972) who reported that as children advance in knowledge of both oral and manual communication, their use of speech, either alone or with signs gradually increases and their use of signs alone decreases. Certainly, E.'s use of sign did not interfere with his acquisition of speech.

The data presented in this study do support the hypothesis presented by Hoffmeister and Wilbur (1980), Wilbur and Jones (1974) and Schlesinger (1978), that an infant has the cognitive capacity to learn one language in two modalities.
Furthermore, it disputes the oralist assertion that learning sign language interferes with an infant's capacity to think or to learn to speak. Finally, this study provides an example of a child using sign language to communicate before he can produce spoken language.

In the past, studies of 'normal' language development were used to assist in designing educational procedures for the deaf and hearing impaired (the presumed language-handicapped). Recent studies of language acquisition of the deaf indicate not only that sign language (ASL and Signed English) allows the learning potential of deaf children to be realized; it may provide insight into the sources of individual differences or variability in the rate and patterns of language acquisition. Potentially, deaf language acquisition studies will assist in designing educational procedures for developing speech.

Future research of bimodal infants, deaf and hearing, should be designed to analyze whether or not signs are acquired because articulation of specific words is beyond the infant's capacity, or whether other factors are involved. My only observation of this point is that some vocalizations were "fun" and perhaps initiated positive feedback. Another possible area of research is the effect of early sign use on an infant's rate of development of motor coordination. Finally, "motherese" of the deaf needs to be more carefully examined as a contributing factor of early sign language
acquisition. Parent-infant interaction with deaf infants is aimed toward maximizing visual attention and message reception (Maestas y Moores 1978). Deaf parents form signs both with the infant's hands and on his body. The eye contact between parents and infant's ability to focus on and imitate facial gestures should be studies for clues about early development of sensorimotor skills and comprehension capacities.

The importance of social interaction in "realizing the potential of language development" is made clear by considering reactions by hearing parents who discover they have a deaf infant. During a period of psychological and emotional adjustment, some parents stop interacting with the infant, not only linguistically but physically. Some parents do not adjust; they deny the deafness until the child is two or three years old, often at the cost of retarding the infant socially and linguistically.

Hearing parents who do adjust are presented with a situation of learning a 'second language' and teaching it to their child. At first they are self-conscious about the speech they use. Once they get beyond seeing the deaf infant as a "Big Ear" (Bateman 1985), they begin to use sign and speech naturally and integrate language into the infant's life in the same ways as do parents with hearing infants. Using sign language (a bimodal approach) allows hearing parents to communicate and to reduce the trauma and
separation deafness created for both infants and parents in the past.

Teaching sign language to deaf and hearing infants not only helps nourish curiosity and sociability, it gives the child incentive to communicate and the subject matter with which to work (Schlesinger and Meadow 1972).

A social interaction experiment using sign language yields both intellectual and personal conclusions. I would like to close with a comment about the more personal and emotional benefits felt throughout the study, the reasons that kept the experiment going. From as early as 13 months of age, E. could tell us if he wanted a drink or an apple or if his stomach hurt; there was simply less anxiety for us as parents and less discomfort for him because he could tell us exactly what he needed. Vocabulary lists of words or signs acquired only tell part of the story; those words or signs met the criteria, but there was a lot more "talking" going on. As a parent and as a researcher, I feel that the positive "bi-directional effects" of the parent-infant interaction motivated E. to learn sign.

To summarize, early sign communication allowed us to more directly participate in the language learning process of our infant, to respond more appropriately to his needs, and to observe his developing ability to perceive his world. Each of these processes became part of a very intimate bonding with our infant.
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