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**THE DEVELOPMENT OF LANGUAGE AND
COMMUNICATIVE BEHAVIORS IN
DEAF/HEARING TWINS**

by

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**An independent study submitted in partial
fulfillment of the requirements for the degree of**

Master of Science in Speech and Hearing

Emphasis in Audiology

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The Development of Language and Communicative Behaviors in Deaf/Hearing Twins

Despite significant technological improvements in sensory aids in the past 20 years, studies continue to show language delays and deficiencies for hearing impaired children who have hearing parents compared to normally developing hearing children (Spencer 1993; Yoshinaga-Itano & Stedler-Brown, 1992). While positive actions such as early diagnosis, immediate amplification, and an appropriate support system may lessen the negative effects of hearing loss on communication and language development, prelingual deafness remains a major obstacle in the acquisition of spoken language (Mogford, 1993b).

Research has shown that hearing impaired children have difficulties in lexical, syntactic areas (Spencer, 1993). In general, a deaf child remains in the pre-linguistic and one word stages for an extended period of time. The typical hearing impaired child does not use two-and three-word combinations until five years of age (Nicholas, Geers, & Kozak, 1994). Because these children are unable to completely perceive the spoken language of their caregivers, their language problems are likely related to their lack of an adequate language model (Spencer, 1993).

Unlike preschool-aged hearing children, who primarily communicate with words and gestures, deaf preschoolers primarily use nonlinguistic means. Deaf preschoolers also communicate less and are more passive in interactions with their mothers (Lederberg & Everhart, 1998). In a longitudinal study, Lederberg and Everhart (1998) observed 20 deaf and 20 hearing children during play with their hearing mothers at 22 months and 3 years of age. Results showed that deaf children were severely language delayed in comparison to hearing children. At 3 years of age, deaf children used less language than hearing 22

month olds. The deaf children communicated mainly through nonlinguistic vocalizations. In addition, the deaf children used an increasing number of gestures from 22 months to 3 years of age. The study revealed that the deaf 22-month-old rarely used language and the majority of the deaf 3-year-olds in their sample were using only infrequent one word utterances at best.

In contrast to preschoolers, the communication skills of deaf and hearing infants may be very similar. Spencer (1993) found no differences in the frequency of deaf and hearing infant's communication with their mothers at 12 and 18 months. The types of gestural and vocal expressive prelinguistic communication behaviors used were also similar between the deaf and hearing infants. In addition, both groups of infants showed an increase in their nonlinguistic vocalizations from 12 to 18 months. However, the hearing impaired infants failed to increase in the metaphonological or symbolic aspects of vocal communication (Spencer, 1993). Most deaf toddlers continue to rely on nonlinguistic vocalizations and gestures to communicate until after 3 years of age (Lederberg & Everhart, 1998).

Several recent theories of language development propose the idea that pragmatic skills are important precursors to language acquisition. Early pragmatic skills, such as the ability to express communicative functions, may serve as the basis for the development of spoken language. A study by Nicholas, Geers, & Kozak (1994) compared the development of communicative functions in hearing and deaf children to determine if they developed communicative functions in the same sequence with the same timing and frequency or if the deaf children were delayed. Subjects consisted of nine severely to profoundly hearing impaired children between 14 and 34 months of age, nine hearing chronologically age matched children, and nine hearing children matched to the hearing impaired children on language age. Results from the study indicate that for hearing

impaired children, communicative functions develop earlier than for language age matched normal hearing children. In other words, when a group of hearing-impaired children was at a stage in which they used an equivalent number of spoken words as a group of normally-hearing children, the hearing-impaired children used more communicative functions. In that comparison, the hearing-impaired children were approximately 1 to 1.5 years older than the normal hearing children who were their language matches. These results show that nonverbal cognitive development or social maturity may be important in the emergence of communicative functions. The study also showed that the chronologically aged matched normal hearing children produced more communicative functions than the hearing impaired children (Nicholas, Geers, & Kozak, 1994).

Another study by Nicholas and Geers (1997) examined 18 deaf oral children and 18 normally hearing children at 36 months of age. This age is important because research has shown that at approximately 36 months of age, many oral deaf children switch from using gestures and vocalizations to using speech in social communication. The study observed the children in play sessions and coded their communicative behaviors for communication modality and communicative function. The communication function categories that were coded in that study were: Response, Statement, Question, Directive, Imitation/Repetition, Marking, and No Clear Function. Results showed that the oral deaf children used a normal range of communicative functions, but the amount and proportions of their communicative functions differed from normally hearing children. The communicative functions that were used most often by the deaf children were less informative. For example, they used more Directives, Imitations, and Markings than Responses, Statements, and Questions. In addition, the normally hearing 3 year olds used almost all speech while the deaf children used about equal speech, gesture, and vocalization. The study found that a deaf child's language scores at five years of age were

best predicted by their use of speech, frequent use of the Statement function, and infrequent use of the Directive function at 36 months. The results indicate that an early use of informative functions are more likely to produce better later language skills (Nicholas & Geers, 1997).

Yoshinaga-Itano and Stredler-Brown (1992) looked at 82 hearing impaired babies from 6 months to 36 months of age. The study was based on the assumption that pragmatics or the desire to communicate is a precursor for the development of certain language functions. The study mapped a general progression of the development of communicative functions in the hearing impaired child. In general, from 6 to 18 months of age the deaf infant uses vocalization and gesture to acquire the pragmatic categories of commenting and requesting an action or object, answering or protesting, and pointing or showing. Between 12 to 24 months of age the deaf infant finishes differentiating non-verbal categories and increases the quantity of all nonverbal categories. Acquiring the non-verbal requests for information is a critical milestone. Between 18 months and 30 months of age the deaf toddler develops the beginning of verbal communicative intention and category differentiation. The non-verbal communicative intention categories stabilize. This transition from non-verbal to verbal communication is also a critical milestone. Between 24 months and 36 months, the child finishes differentiating verbal categories and increases the amount of communication intentions in all verbal categories (Yoshinaga-Itano & Stredler-Brown, 1992).

Language Development in Twins:

Often in language development studies, it is extremely difficult to account for differences in parenting, socioeconomic status, and other environmental variables that differ among children. However, language development studies that involve twins with virtually the same genetic constitution and environmental factors allow the researcher to

control for these variables. Studies comparing language development in twins and singletons suggest both quantitative and qualitative differences in language development. Previously, twin and singleton studies have emphasized the negative effects of being a twin on the rate of development. However, recent studies look for qualitative differences in development that show a positive adaptation to the twin situation. They also try to predict aspects of language development that may be accelerated or develop in a different order as a result of being twins. Twin-singleton studies try to identify aspects of the environment that influence rate and pattern of language development. Research has shown that twins have increased birth risks that suggest a higher number of disabilities in twins which may include direct and indirect effects on language (Mogford, 1993a).

Research shows that language acquisition of twins compared to singletons generally concludes that twins' language development is delayed. Certain environmental factors contribute to the delay. Factors include less frequent communication between parent and twins, less complex parental sentence structure, and the occasional development of a secret language among other factors (Gaines & Halpern-Felsher, 1995). In the literature there are two frequently cited studies from the 1930's, which have been confirmed by more recent studies comparing language development of twins and singletons. Day (1932) studied development of 80 twins from 2 to 5 years of age and a control group of singletons. Day found the twins to be delayed in all aspects of language when compared to singletons. The onset of their language was delayed by an average of 25 months. They had immature sentence construction and reduced expressive language and vocabulary. This language delay increased over the preschool years. As the twins became adolescents, their language came closer to the development of singletons. However, research notes that small language deficits may still persist (Mogford, 1993a).

Language delay in twins has been confirmed in a number of studies using different

methods of assessing language development. A study by Lenneberg (1967) estimated that 35% of identical twins and 40% of fraternal twins had normal onset of language. Mittler (1970) found a 6 month delay in language development for 4 year old twins. However, at least two studies (Savic, 1980; and McCormick & Dewart, 1986) demonstrated that under good social conditions, in multiple birth situations, early language delay is not certain. The previous two studies included families with high levels of education and social positions in which the twins were not born with risk factors. However, other studies show language delay when the twin pairs studied are more representative of the population. In other words, non-selective studies, regardless of the measure used, show a significant but moderate early language delay in twins (Mogford, 1993a). This early language delay appears to be temporary and may disappear before the age of six (Malmstrom & Silva, 1986). Although Day (1932) found the language delay to increase during the preschool years, both of the studies agree that the delay is temporary.

A paper by Tremblay-Leveau, Leclerc, and Nadel (1999) held the position that most studies regarding twins' language competence found delays because the context for assessment was a dyad. Assessments using dyadic environments were thought to underestimate the twin's linguistic skills. The study suggests that assessments should be made in a triadic context, which includes interactions between the mother and both twins simultaneously. This study investigated 16 and 23 month old twins and singletons in a triadic context. Results showed that 23 month old twins' language production was better in terms of quantity and quality than singletons. However, criticism of this research is that by using a triadic context the examiner is giving an unfair advantage to the twin pair.

A general though mild delay has been found in most areas of twin development. The delay lessens towards the end of the preschool years. However, the largest and most consistently recorded delay is for language development. Twins are at risk for acquiring a

language delay from a number of biological and social factors. These risk factors arise from a sharing of resources. A possible explanation for language delay in twins is increased perinatal risk factors and social disadvantages due to an increased family size. Studies show that the second born twin is at greater risk of perinatal injury and usually has a greater language delay than the first born twin. Identical twins are expected to be more at risk for language delay than fraternal twins. A possible cause of language delay in twins involves the twin relationship itself. It is believed that the twin relationship produces a reduced need for verbal development and decreased opportunities and motivation to communicate. Another view is that parents of twins have a limited amount of time and attention to divide between their twins for the interactions needed for language learning (Mogford, 1993a).

Not all of language development associated with twinship is negative. Savic (1980) found that twins had a greater need for an earlier use of linguistic markers such as personal pronouns and used all forms of the first person pronoun more quickly than singletons. Twins also showed competence in discourse at an earlier age than singletons (Mogford, 1993a).

Twin language that is developing normally may also be qualitatively different. A study by Malmstrom and Silva (1986) examined a set of twin girls from ages 2:3 to 3:1. Thirty-one hours of crib talk was recorded and analyzed for evidence of language development unique to the subjects' twin status. The subjects developed normal syntax and vocabulary, but with some modifications that were unique to twinship. The twins used a double name for themselves as a team, such as "Krista-Kelda", singular verbs in reference to themselves together, and the use of the singular pronoun me in reference to themselves as a team. The subjects used the double names until the age of 3:2. The use of "me" to refer to themselves as a team developed later and continued until after age 5.

Language Development in Twin Pairs of Deaf and Hearing Children:

The relationship between twinship and deafness is one that is not well researched. To date only two articles examine the topic. There was a study by Siple, Akamatsu, & Loew (1987; cited in Gaines and Halpern-Felsher 1995) that looked at fraternal twins in which one member was deaf. These twins were born to deaf parents and communicated by sign language. The results found that the twins did not exhibit language delays. In another study (Gaines and Halpern-Felsher, 1995) researchers looked at different issues regarding twinship and deafness. This study examined a set of identical twins in which one twin was profoundly deaf. The twins' communication development was analyzed from 13 months until 36 months of age. The twins were born to hearing parents and were enrolled in a total communication program. Although both children were able to learn language and communicate successfully, the hearing twin preferred a vocal form of language, while the deaf twin used mostly sign language. The hearing twins' communication was more responsive and the deaf twins communication was mostly imitative (Gaines & Halpern-Felsher, 1995).

Parental Input to Children with Special Conditions:

A possible cause of language delay in twins is limited parental time and attention for interacting with language learning infants (Mogford, 1993a). Lytton (1980) compared several pairs of twin boys between the age of 2 and 3 years of age to age matched singletons. The study found that twins had reduced verbal interaction when interacting with their parents in comparison to singletons. The twins initiated and responded less to their parents than singletons. Parents of twins initiated and responded less to each twin than parents did to each singleton. The outstanding factor was the parents failure to respond to their twins. It was thought that parents' initiation and response was influenced by their children's level of language development. Savic (1980) looked at twins

between 15 months and 3 years of age interacting with their parents and found an increased amount of turn taking in a triadic situation. A triadic situation includes competition for a communication turn that ultimately results in a shorter MLU.

Bornstein and Ruddy (1984) examined mother-child interaction in infancy. The study found that mothers of twins encouraged their babies to focus on the environment less than singleton mothers. Mothers of twins also spoke less to their twins. Results showed no difference in the twins' abilities at 4 months, but at 12 months twins used fewer words than singletons. The study found that maternal behaviors, rather than initial abilities, account for early language differences. Tomasello, Mannle, and Kriger (1986) looked at language development of twins between 15 and 21 months and compared the language learning environment of first born singleton children with twins, matched on age, sex, maternal education, and time spent with parents. The results showed that the language learning environment of twins and singletons differed and that these differences were not only determined by the twins' language development level. The examiners concluded that mothers have limited resources in terms of quantity and quality of their interactions with children. The triadic environment constrains the interaction between the mother and each twin. Mothers of twins are just as active as mother of non twins, but it is their division of time and attention that is detrimental to language development (Mogford, 1993a).

The amount of linguistic and gestural parental input has also been shown to be related to early language development in deaf children. These children's communication problems are not a result of their mothers speaking less than mothers of hearing children. Lederberg and Everhart (1998) performed a longitudinal study involving 20 deaf and 20 hearing impaired children. They observed the children during play with their hearing mothers at 22 months and 3 years of age. The study found that mothers of deaf children relied more on visual communication than hearing mothers. However, mothers of deaf

children still mainly communicated through speech. Deaf children did not attend visually to their mothers communication. As a result, deaf children received much less communication than hearing children. Mothers of deaf and hearing children communicated to the same extent with their children. Mothers of deaf children showed some adaptation to the visual needs of their children, but speech still predominated as a means of communication. Studies have found that the speaking rates of hearing mothers are the same for deaf and hearing children between 12 months and 5 years of age (Lederberg & Everhart, 1998). Studies show that mothers simplify their speech to deaf children in a comparable way that mothers of hearing children do to hearing children with similar linguistic abilities. Deaf children are provided with the same amount and type of maternal input as hearing children. However, they don't receive the same amount of language. Most deaf people rely at least in part on visual input to perceive communication. In order for deaf children to receive their mother's communication, adaptations must be made for their visual needs. Mothers may use a visual linguistic system while speaking or use gestures to accompany speech. Mothers of deaf and hearing infants used gestures with the same frequency. However, mothers of deaf toddlers gestured more than mothers of hearing toddlers. Therefore, mothers of deaf children start to use visual communication towards the end of their child's second year of life. Even when mothers use visual communication, receiving information is based on the coordination between a deaf child's visual attention and the mother's communication. Deaf children must learn to divide their attention between the world and the communicator. Mothers of deaf children must be able to coordinate their communication with the child's visual attention. Hearing mothers and deaf preschoolers are not very skilled at coordinating communication and visual attention. A deaf child misses a third of the mother's visual communication. Oral deaf children do not visually attend to the speaker's face until about the time they start

speaking (Lederberg & Everhart, 1998).

Hypotheses:

Since the majority of hearing impaired children demonstrate significant delays in language development as compared to normally developing hearing children, the deaf twin in this study will most likely show a delay in language development as compared to her hearing twin. Based on research, the deaf twin is at risk for both lexical and syntactic difficulties. We also expect to find that the deaf child remains in the prelinguistic and one word stages for an extended period of time. Upon completion of the study, the 36 month old deaf twin may not use two and three word combinations. We expect the deaf and hearing twin to be similar as infants with no significant differences in their frequency of communication or types of communicative functions used. However, we anticipate that the language delay will become more evident as the deaf toddler approaches 36 months of age. It is expected that the deaf twin will communicate less often and use primarily nonlinguistic ways of communicating. The deaf twin should use a normal range of communicative functions. However, it is predicted that the deaf twin will use a greater number of communicative functions that are less informative. For example, we anticipate that she will use more Directives, Imitations, and Markings than Responses, Statements, and Questions.

Research shows that language acquisition of twins compared to singletons is generally delayed. Therefore, the hearing twin might also exhibit a language delay as compared with other hearing children her age. The hearing twin may have immature sentence construction and reduced expressive language and vocabulary. This early language delay appears to be temporary and may disappear before the age of six.

Research shows that speaking rates of hearing mothers are the same when addressing deaf and hearing children between the ages of 12 months and 5 years of age. Deaf children

do not receive the same amount of language because of their hearing impairment.

However, research regarding maternal input to twins concludes that mothers have limited time and attention to divide between twins. Since the mother will interact separately with each twin, it is anticipated that the mother will communicate equally with each twin.

However, the mother may use more visual communication with her hearing impaired daughter.

Methods

Participants.

Participants for this study included a set of female fraternal twins. One twin was profoundly deaf while the other twin exhibited normal hearing sensitivity. The profoundly deaf twin was diagnosed at 12 months of age and was fit with binaural hearing aids. Her unaided mean better PTA was 106 dB. The cause of the deafness was unknown. The Vineland Adaptive Behavior Scale was administered to both twins at 12, 24, and 36 months of age. At 12 months, the deaf twin scored at a 9 month old language age. At 24 months her score was consistent with a 10 month old language age. While at 36 months, she exhibited a 13 month old language age. At 12 months, the hearing twin scored at a 11 month old language age. At 24 months she scored at a 2;1 language age and at 36 months she scored at a 3;2 language age. The deaf twin was enrolled in a parent infant program at an oral school. With exception of the deaf twin's hearing loss, the twin's health history was unremarkable.

Procedure.

Communication samples were collected by videotaping each twin interacting separately with their mother in 30 minute play sessions at 15, 18, 24, 30, and 36 months. The session was a loosely-structured interaction in which the mother and child were provided with several boxes of toys to play with. The mother was given a brief

description of the purpose of the study and instructed to talk and play with each twin as she normally would. All speech, vocalizations, and gestures produced by the child and mother were transcribed by an experienced transcriber. The entire videotapes along with the transcripts were reviewed by a "verifier" and any omissions or errors were corrected. The transcription followed the Codes for the Human Analysis of Transcripts (CHAT) format of the CHILDES system (MacWhinney, 1995). Every intentional communication behavior was coded for communicative function by two coders independent of each other. For a behavior to be coded as an intentionally communicative act, it had to be first identified as intentional by both coders. Next, a communicative function category was assigned to the intentionally communicative behavior. The nine communicative function categories used in this study are as follows: Response, Statement, Question, Directive, Imitation/Repetition, Marking, Commitment, Evaluation, and No Clear Function. The communicative acts could be expressed through gesture, vocalization, verbalization, or any combination of these methods. Only those communicative acts for which both coders agreed on communicative function category assignment were counted in this study.

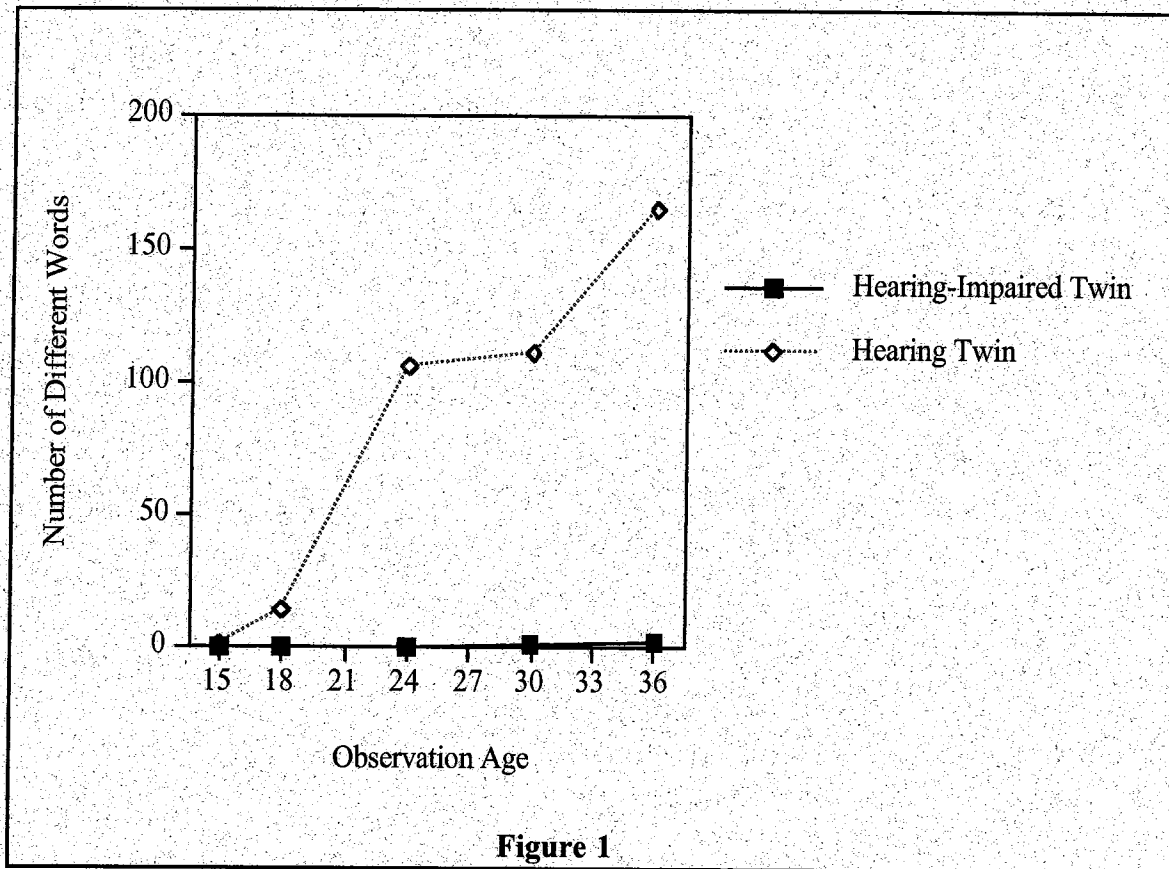
Results

The final transcripts were analyzed by using the Computerized Language Analysis (CLAN) program to obtain measures of vocabulary, rate, syntax, communicative function, and modality.

Child Variables

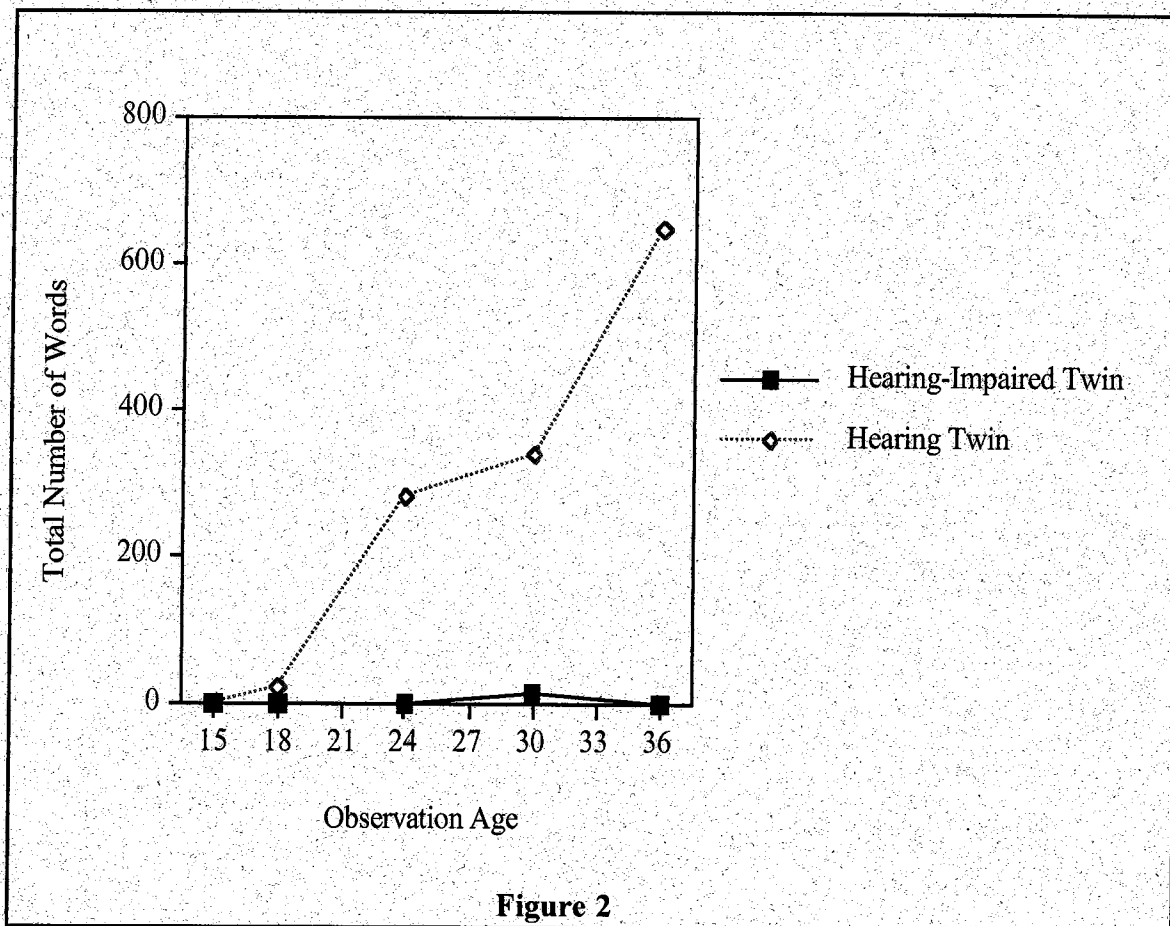
Vocabulary. The vocabulary variable is a count of the number of different words produced by each twin at each observation age in the videotaped session. At 15 months, both twins produce almost no words. The hearing twin develops normally by significantly increasing her vocabulary to 106 different words at 24 months and continues to expand her vocabulary to 165 different words at 36 months. The deaf twin, on the

other hand, develops a significant vocabulary delay around 24 months (still producing no words) and remains delayed at 36 months (producing only two words). The hearing impaired twin used roughly the same number of different words at 36 months as her hearing twin used at 15 months. A graphic depiction of the number of different words used at each age by each twin is shown in Figure 1.

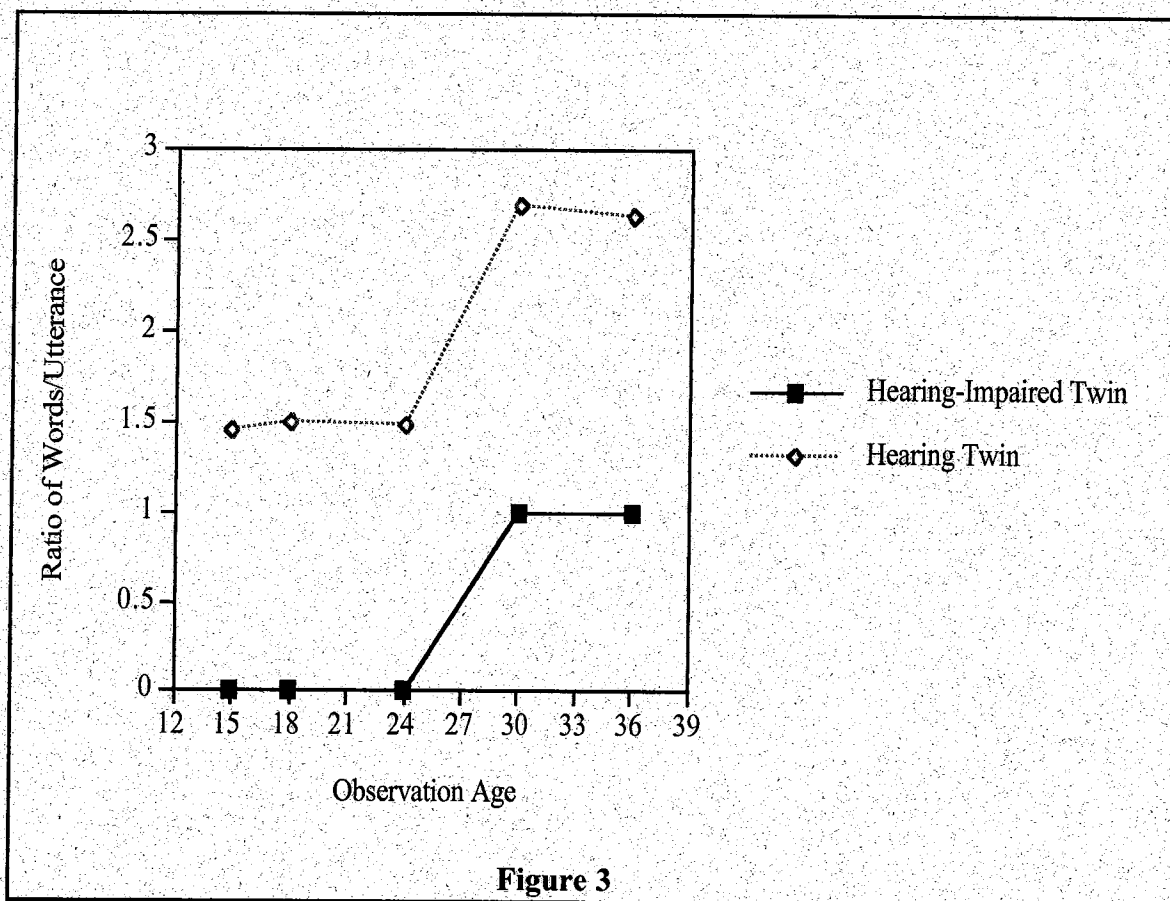


Rate. Rate is a measure of the total number of words used by each twin at each observation age. These results follow the same pattern as vocabulary. At 15 months, the twins are using no words. The hearing child progresses normally by significantly

increasing her total number of words to 280 at 24 months and continues to increase her total number of words throughout the remainder of the study. At 36 months, the hearing child is using over 640 total words in the 30 minute play session. The deaf twin develops a significant delay at about 24 months with no words. This delay persists throughout the study. At 36 months, the deaf twin is using relatively the same number of total words that the hearing child used at 15 months. A depiction of the total number of words used (rate) by each girl is provided in Figure 2.



Syntax. The measure of syntax used in this study was the number of words per utterance for each twin at each observation age. This measure shows a significant delay for the hearing impaired twin versus the hearing twin. Even at 15 months, the deaf twin is delayed in comparison to the hearing twin, who is producing about 1.4 words per utterance. Both twins show an increase in words per utterance between 24 and 30 months. At 30 months, the hearing twin increases to 2.7 words per utterance and the deaf twin increases to 1.0 word per utterance. Even though both twins increase in their words per utterance, the deaf twin is still delayed in comparison to her hearing twin. The hearing impaired twin does not produce a word in these play sessions until 30 months of age. Figure 3 plots the number of words per utterance for each twin at each age point.



Communicative functions. This is a measure of the occurrence of different types of communicative functions at various observation ages. At 15 months the twins are similar in their use and type of communication functions. At this age, both twins have limited communication with mostly Directive functions. At 18 months, the twins are still similar. However, the hearing twin is starting to use Statements and Responses in addition to Directives. At 24 months, the hearing twin's amount of communication increases dramatically and she uses a variety of different functions which include mostly Statements and Responses. The deaf twin, however, is still primarily using Directives and Markings. The deaf twin is also using Questions which is unusual. A closer look at the videotapes was undertaken to determine the form of the deaf twin's Questions. It was revealed that they were all expressed through gesture by shrugging her shoulders, which is a typical method of expressing this function by children without a linguistic means available to them. At 30 months, the hearing twin is switching to more informative function types and using fewer Imitations and Markings. The deaf twin starts to use a broader variety of communicative functions, but communicates less often than her hearing twin. At 36 months, the deaf twin is still using a broad variety of communicative functions but with low frequency. The hearing twin has an increased amount of communicative functions with more Responses, Statements, and Questions than Directives, Imitations, and Markings. The hearing impaired twin's communicative functions at 36 months are comparable to the hearing twin's functions at 18 months. Figures 4, 5, and 6 display the breadth of communicative functions used at each age point for each twin.

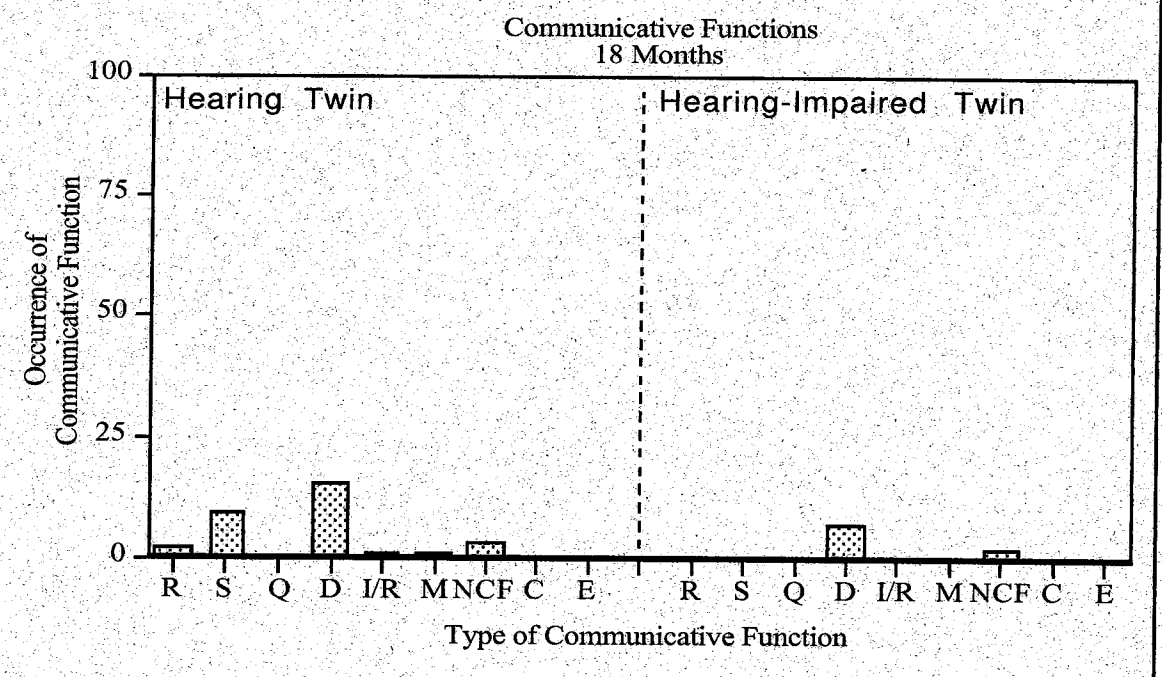
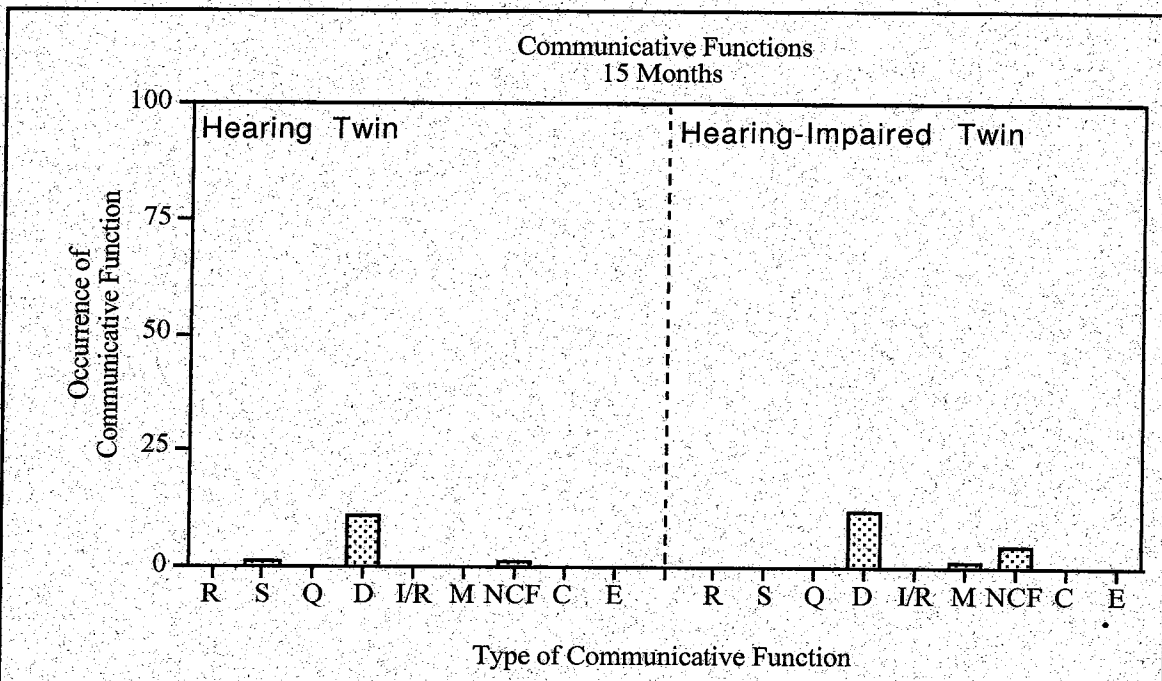


Figure 4

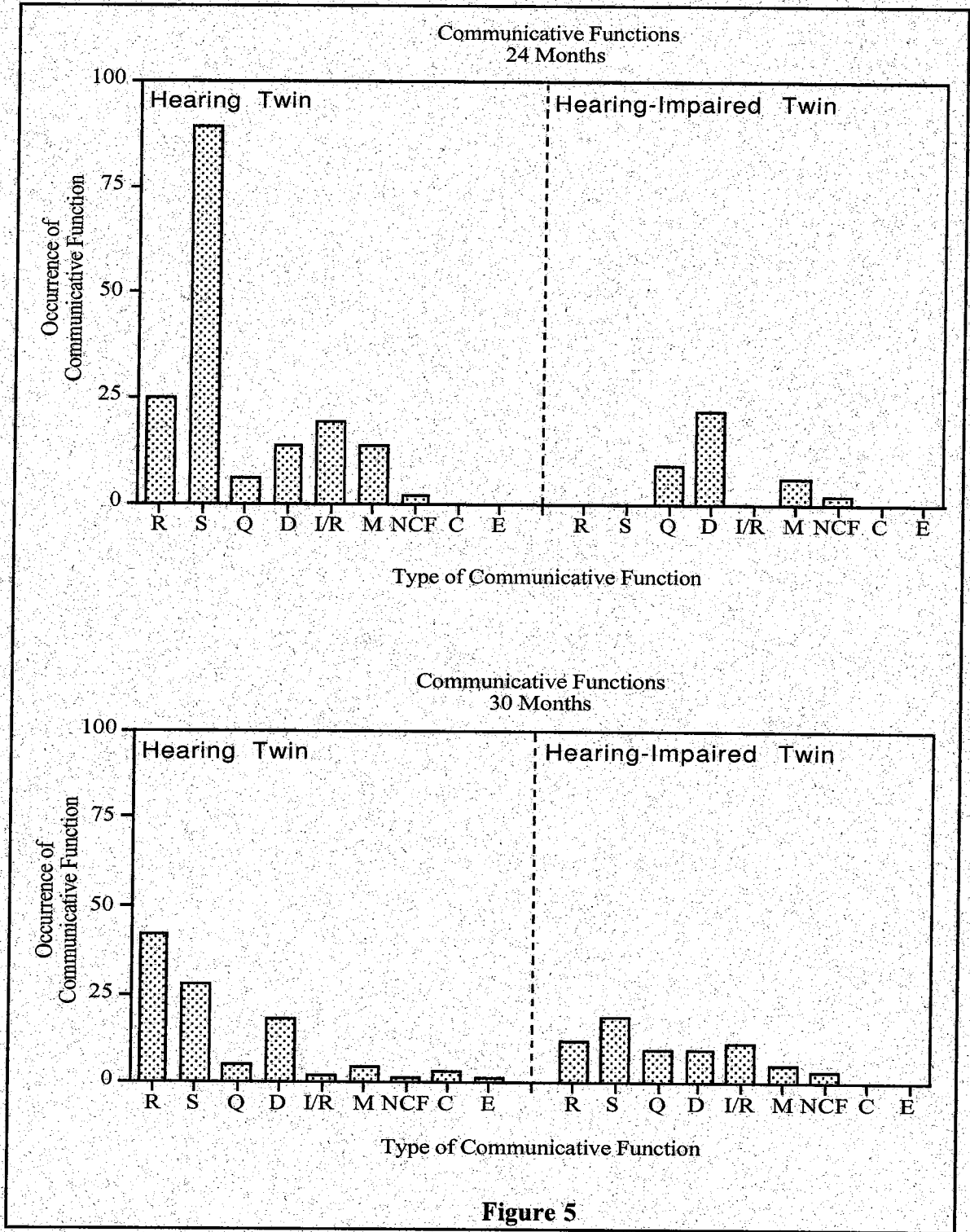
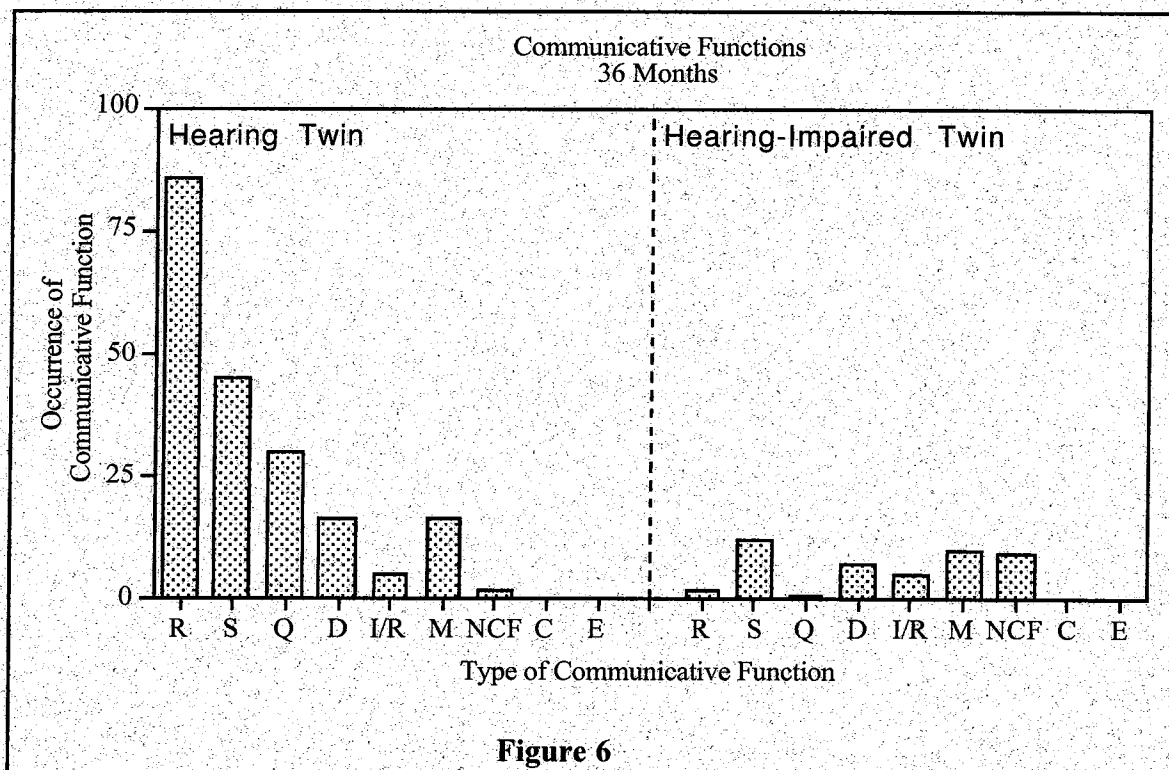
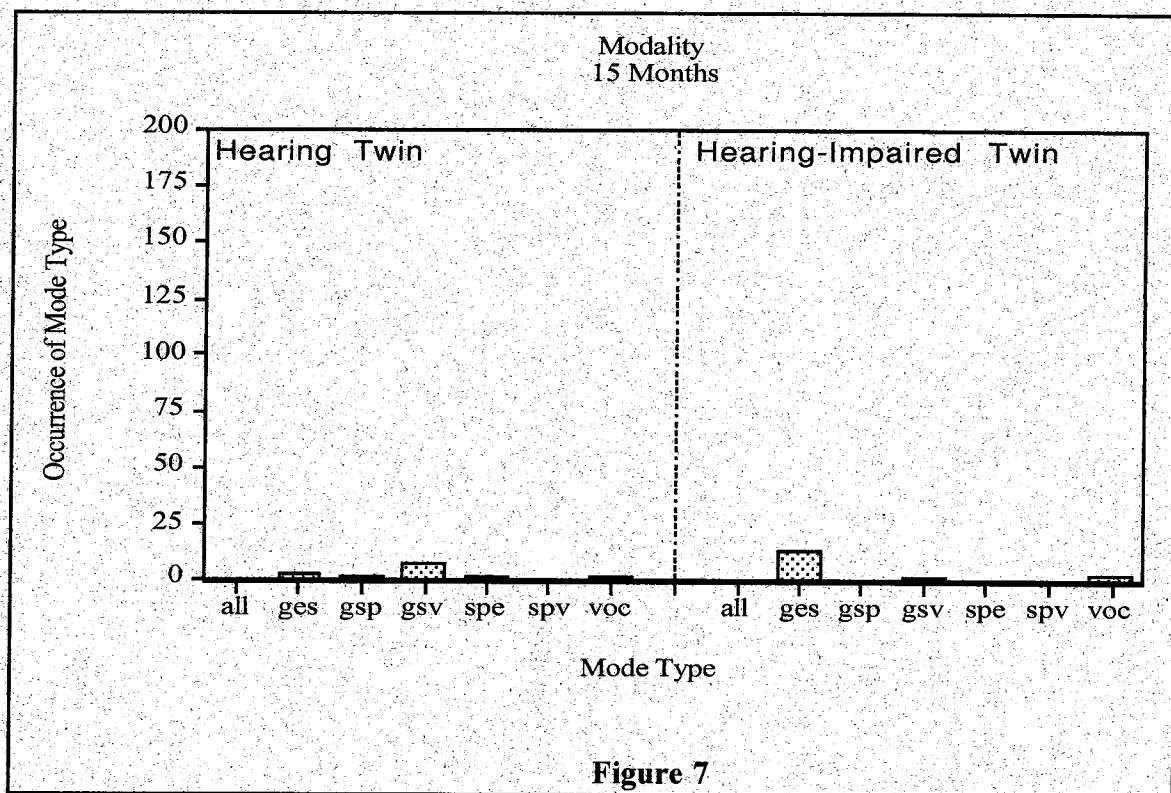


Figure 5



Modality. The preferred method of communication that the twins use to express their communicative functions was also considered. The communicative acts could be expressed through gesture, vocalization, verbalization, or any combination of these methods. At 15 months, even though the twins are both communicating minimally, the hearing twin is using gesture with vocalization to communicate while the deaf twin is only using gesture. At 18 months, the hearing twin still primarily uses gesture with vocalization, but has added some speech (with or without gesture) and sometimes vocalization alone. The deaf twin is primarily using gesture (alone or with vocalization) or vocalization alone. At 24 months, the hearing twin uses speech significantly more than any of the other modes of communication. On the other hand, the deaf twin still uses mainly gesture with some use of gesture with vocalization and vocalization alone. At 30

months, the hearing twin is still using a significant amount of speech with decreased use of gestures and vocalizations. At 30 months, the hearing impaired twin increases her communication through gesture and speech emerges. At 36 months, the hearing twin is using a great amount of speech with little use of gesture or vocalization. The deaf twin is using both gesture and gesture with vocalization about equally, and no speech. These trends are depicted in Figures 7, 8, and 9.



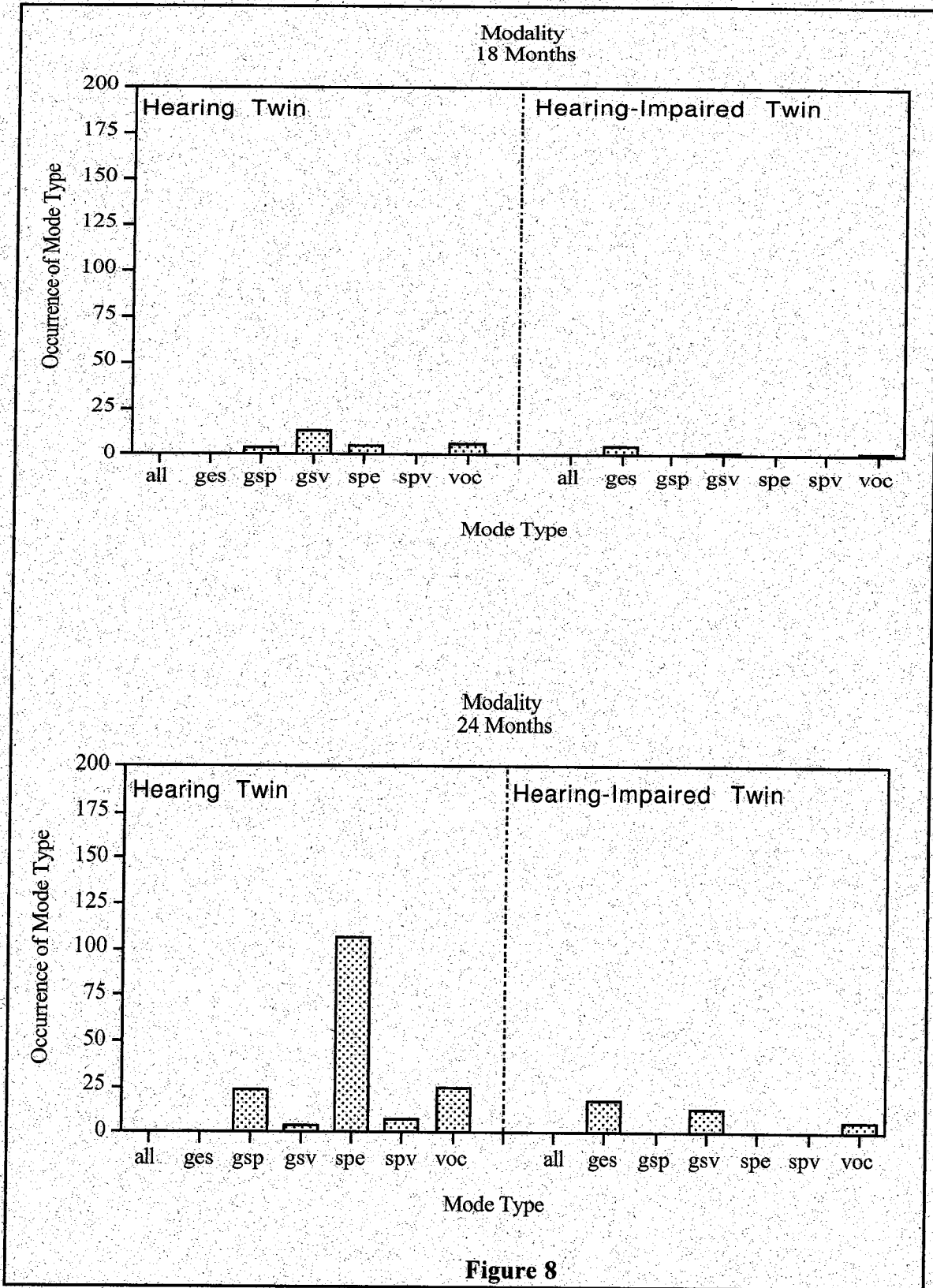
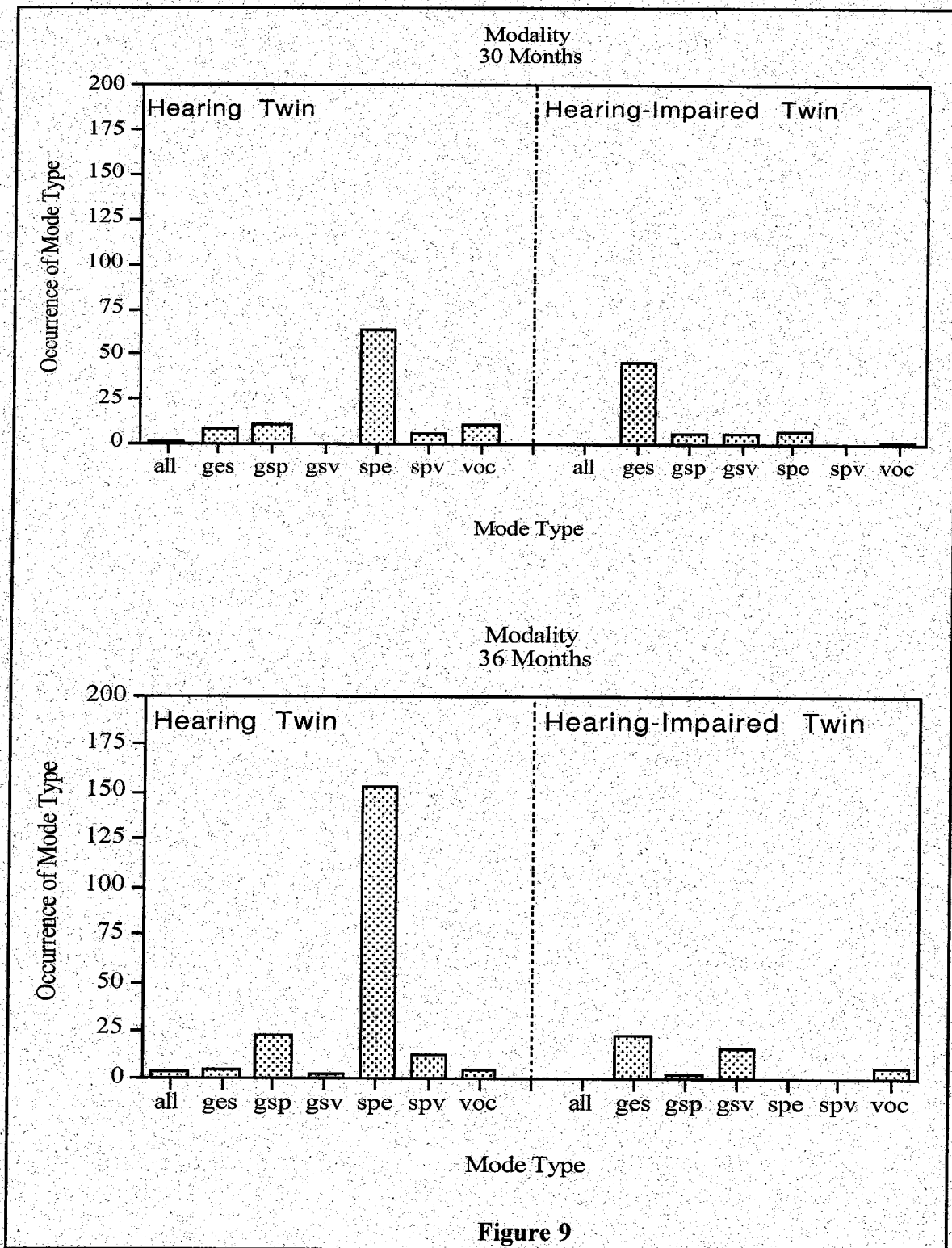
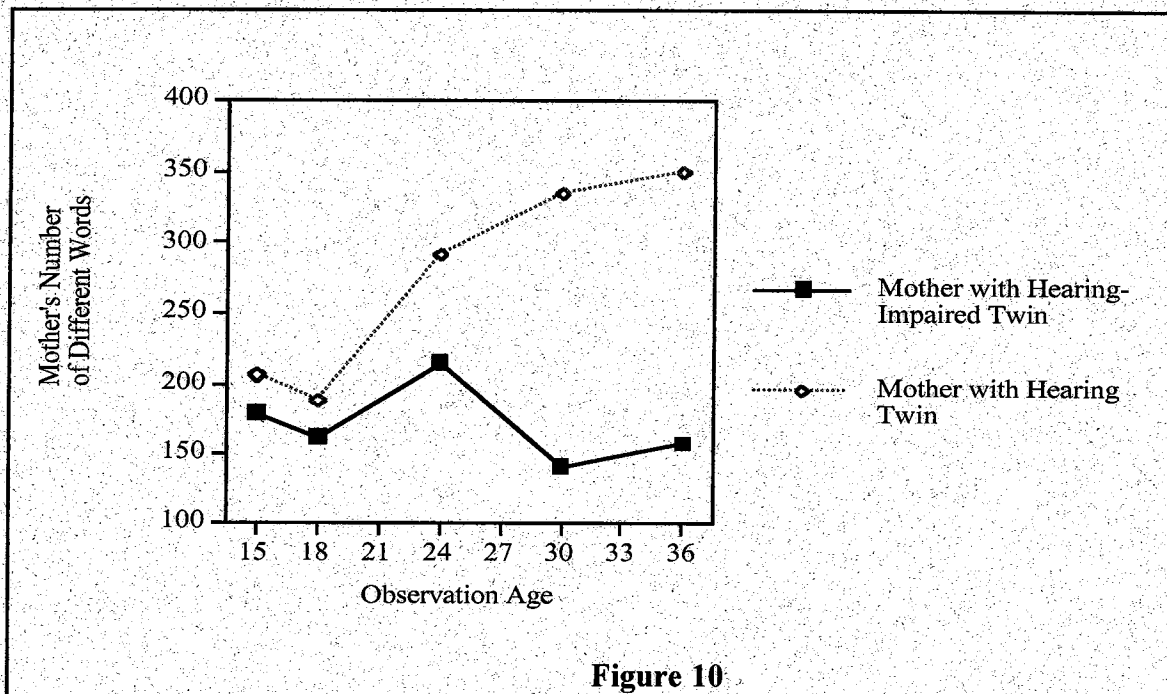


Figure 8

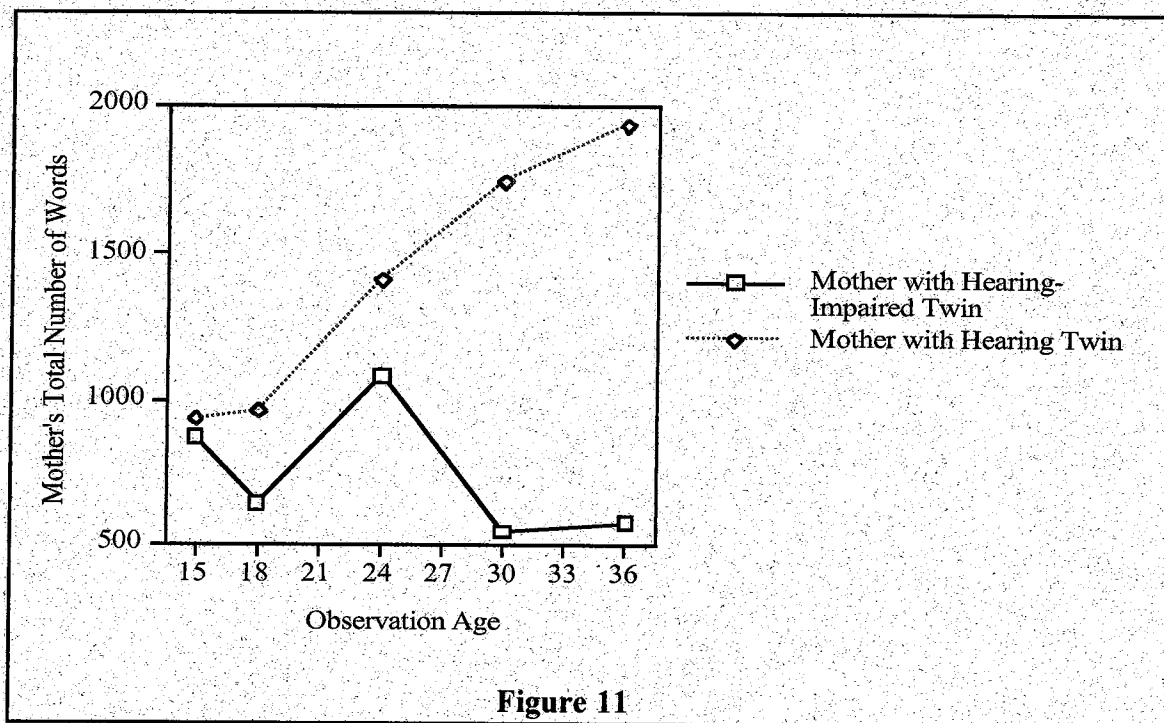


Mother variables.

Vocabulary. The number of different words used by the mother during interaction with each twin were also counted and were found to be significantly fewer with the deaf twin than the hearing twin. This difference is most apparent at 30 and 36 months. At 15 and 18 months the mothers communication was about equal for both girls. However, after 24 months she starts decreasing the breadth of the vocabulary she directed toward her deaf twin and continues to increase the vocabulary to her hearing twin. The increase in vocabulary for the deaf twin at 24 months could be due to the fact that the mother was trying to elicit the same communication from the deaf twin that the hearing twin was producing at 24 months. The subsequent decrease in vocabulary at 30 months to the deaf twin could be due to the mother's realization of how delayed her deaf twin was in comparison to her hearing twin. The differences in the vocabulary directed toward the two girls are depicted in Figure 10.

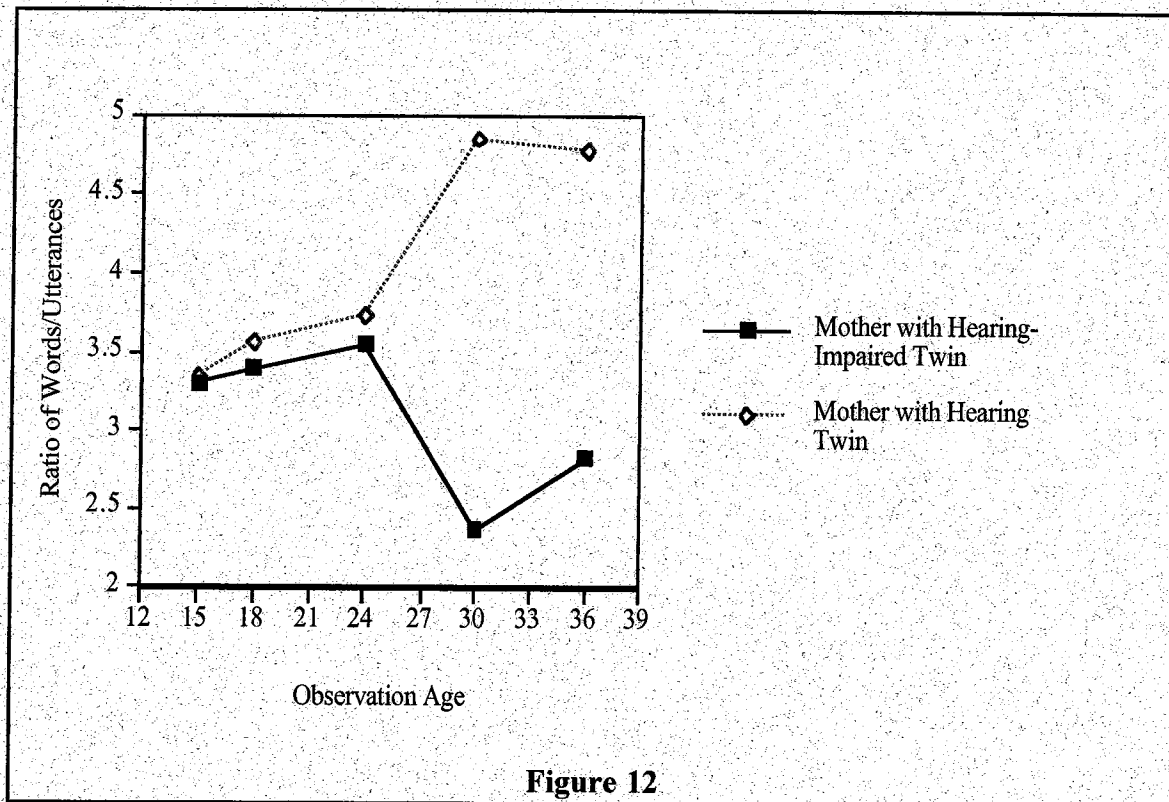


Rate. The total number of words used by the mother to each twin was recorded and is shown in Figure 11. The result is similar to that found with the vocabulary measures. The mother used significantly more words with her hearing twin than her deaf twin and this was especially evident at 30 and 36 months. At 15 months, the mother was using about the same number of words with each twin. The mother increased the number of words spoken to both twins at 24 months, but proceeded to decrease her rate of speaking at 30 months for the deaf twin.



Syntax. The mother's mean number of words per utterance (wpu) was also calculated. Even though the mother's wpu to the two girls start out similarly at 15, 18, and 24

months, it becomes significantly smaller for the deaf twin at 30 and 36 months in comparison to her hearing twin. The mother actually decreases her words per utterance for the deaf twin at 30 and 36 months to a less complex level than she used at 15, 18, and 21 months. This result can be seen in Figure 12.



Discussion

These results suggest that the hearing impaired twin was delayed in language development when compared to her hearing twin. The hearing impaired twin was delayed in measures of vocabulary, rate, syntax, communicative function, and modality. For

measures of vocabulary and rate, the hearing impaired twin evidenced a significant delay beginning at 24 months of age. The deaf twin did not use her first word until approximately 30 months of age and was only using two words at 36 months. When measuring syntax, the deaf twin exhibited a delay as early as 15 months when compared to her hearing twin. At all other observation ages the deaf twin also used a significantly lower ratio of words per utterance. Initially, both twins were communicating about the same amount and using the same types of communicative functions. However, at 24 months the hearing twin's amount of communication increased dramatically and she developed a broad variety of communicative functions including mostly Statements and Responses. The deaf twin was not communicating as much as her hearing twin and was using primarily Directives and Markings. At 36 months, the deaf twin was still using a broad variety of communicative functions but at a very much lower rate. The hearing twin, however, had an increased amount of communicative functions with more Responses, Statements, and Questions than Directives, Imitations, and Markings. At 15 months, the hearing twin used both gesture and vocalization as the preferred mode of communication while the deaf twin used only gesture. At 24 months of age the hearing twin used speech significantly more than any other mode of communication, while the deaf twin continued to use mostly gesture and vocalizations. At 36 months the hearing twin used a huge amount of speech with little gesture or vocalization, while the deaf twin used both gesture alone and gesture with vocalization, but no speech. It is clear that the deaf twin preferred gesture as the mode of communication, while the hearing twin preferred speech. The hypothesis, which stated that the deaf twin would most likely show a delay in language development, was confirmed.

It was also predicted that the hearing twin might have a language delay as compared to other hearing children as a result of the twinship. However, the hearing twin did not

appear to have any language delay as a result of being a twin. The hearing twin's vocabulary, rate, syntax, communicative function, and modality development were all consistent with normally developing hearing children.

The results regarding maternal input to the twins showed that the mother did indeed communicate more overall with her hearing twin than her hearing impaired twin. In measures of vocabulary, syntax, and rate the mother communicated significantly more to the hearing child at 30 and 36 months of age. These results run counter to the hypothesis that the mother would communicate equally with each twin.

From this study it is not possible to ascertain whether the mother's decrease in communication to the deaf twin was due to a perceived lack of understanding on the part of the deaf twin or whether their verbal interactions had become less rewarding or fruitful over time. Further analysis of these dyads and other deaf-hearing twin pairs may yield a greater understanding of the dynamics underlying language learning in this unusual circumstance.

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