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Communication of Oral Deaf and Normally Hearing Children at 36 Months of Age

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Eighteen orally educated deaf and 18 normally hearing 36-month-old children were observed in a play session with their mother. Communicative behavior of the child was coded for modality and communicative function. Although the oral deaf children used a normal range of functions, both the quantity and proportions differed from normally hearing children. Whereas the normally hearing 3-year-olds used speech almost exclusively, the deaf children exhibited about equal use of speech, vocalizations, and gestures. Spoken language scores of the deaf children at 5 years of age were best predicted by (a) more frequent use of speech at age 36 months, (b) more frequent use of the Statement function, and (c) relatively infrequent use of the Directive function. It is suggested that some communicative functions are more informative or heuristic than others, and that the early use of these functions is most likely to predict later language competence.

KEY WORDS: communicative function, communicative intention, deaf, pragmatics, intentionality

Examination of communicative functions, or communicative intentions, has emerged as an important means to evaluate the conversational competence of children with communication disorders. In this type of analysis, a communicative behavior is categorized according to the type of *function* it serves in the conversation, regardless of whether it is expressed in a verbal or nonverbal form. For example, a child who says “What is that?” may be seeking information. Likewise, the child who points to an object, shrugs his shoulders, and looks to another person with raised eyebrows may also be expressing the same communicative function—seeking information. As typically developing children become more linguistically competent, the variety and number of communicative functions they express should increase.

Review of the Literature

Communicative function analysis has been used to examine the social interactions of children with autism (Loveland, Landry, Hughes, Hall, & McEvoy, 1988; Wetherby, 1986), specific language impairment (Leonard, Camarata, Rowan, & Chapman, 1982), and mental retardation (Cirrin & Rowland, 1985). Similarly, researchers have examined the communicative functions of children with profound hearing loss (Curtiss, Prutting, & Lowell, 1979; Day, 1986; Nicholas, Geers, & Kozak, 1994; Pien, 1984; Schirmer, 1985). Duchan (1988) reviewed several studies of deaf children who received oral input (Curtiss et al., 1979; Kricos

& Aungst, 1984; Skarakis & Prutting, 1977) and reported a general consensus that at the prelinguistic and early verbal stages of language development, the children appeared to use the same communicative functions as normally hearing children.

In contrast, other researchers (Day, 1986; Pien, 1985) found that although deaf children used a widely varying set of communicative functions that generally matched that of normally hearing children at the youngest chronological ages, they used the functions that are considered informative or heuristic less frequently by the age of 3 years. These functions are those that are used to transmit or acquire information, such as asking questions or providing answers to the questions of a communicative partner. This finding was replicated in a recent study by Nicholas, Geers, and Kozak (1994). Additionally, Yoshinaga-Itano and Stredler-Brown (1992) reported that nonverbal requests for information proved to be the communicative function category that was most highly predictive of a successful transition to verbal (signed or spoken) communication, again pointing to an information-seeking function as holding possible special significance in the development of the communication of deaf children.

Although the coding schemes used in all of these studies differ somewhat, there are many categories that appear in almost every scheme. Thus, some preliminary comparisons across studies are justified. The results of these comparisons should be interpreted with caution, however, as there is no guarantee of identical definitions or coding rules across studies by different researchers.

The studies cited above involved children using differing language-learning approaches—some studies involved children learning spoken English, some involved children using simultaneous oral and manual communication. Where hearing/deaf differences in communicative function were found in the literature they did not appear to be systematically related to communication method.

Nicholas et al. (1994) compared the development of communicative functions in oral deaf children with both chronological age and language age matched groups of normally hearing children. They found that communicative functions emerged at earlier language ages for deaf children than for normally hearing children of the same language age. The normally hearing chronological age-mates produced significantly more communicative acts than the deaf children, who in turn produced more than hearing language-age matches. Although only 3 deaf children reached 36 months of age within the time-frame of that study, all 3 of those children were producing all of the communicative functions under consideration nonverbally and were beginning the transition to the verbal mode in their social interactions. This result

suggested that 36 months might be an important age at which to examine emerging communication in oral deaf children with respect to function/modality interactions.

Although the present study examines the communication of children learning spoken English only, modality issues are an important consideration, as these children may achieve much of their communication with gestures and nonverbal vocalizations in the very early stages of their language development. In this paper, the words *mode* and *modality* refer to the actual behaviors of the child (i.e., speech, vocalization, sign, gesture, and various combinations thereof) that were used to communicate, rather than as a reference to an educational method.

Normative data on the Scales of Early Communication Skills for Hearing-Impaired Children (Moog & Geers, 1975) provide evidence for the development of communication in young orally educated children. The 2-year-olds in that sample communicated primarily through simple gestures, such as pointing, and through vocalization rather than intelligible speech. Most 2-year-olds in that sample used speech only in imitation. However, the 3-year-olds were using speech to communicate. They used a variety of one-word utterances (i.e., at least 20 different words). The 3-year-old deaf child “may still be simply naming or he may accompany the one-word utterances with gestures to express a complete idea” (Moog & Geers, 1975, p. 18). Thus, at 36 months the oral deaf child is making a transition from gestures and vocalization to speech in social communication. One important reason to study communicative functions along with modality in these children is that usage may relate to subsequent spoken language success and may provide guidance for oral rehabilitation strategies.

Rationale for the Present Experimental Design

In addressing the purposes outlined above, the present design offered an increased sample size and a focus on a specific and important age group, as opposed to a heterogeneous grouping of preschoolers.

Conclusions in the literature to date were drawn from small samples, as indicated in Table 1. The sample sizes also typically included a *range* of ages, so that the number of children at any *particular* age was quite small indeed. The problem of small samples is widespread in the study of deaf children’s language; sufficient numbers of children of a particular age are often hard to find in a given location. When they are identified, it often is the case that they have a wide range of biological and experiential differences, making them an exceptionally heterogeneous group. Important and widely varying subject differences include: age, the degree of hearing loss, age of onset, method of language instruction,

Table 1. Studies of deaf children's communicative functions in the preschool years.

Author and year	Number of profoundly deaf children	Age range (in months)	Length of observation in minutes	Language input (method of instruction)	Normally hearing comparison group?
Skarakis & Prutting, 1977	4	24-48	not specified	Oral	No
Curtiss, Prutting, & Lowell, 1979	10	24-60	~15	Oral	No
Greenberg, 1980	12	36-60	30	Total communication	No
Kricos & Aungst, 1984	5	24-36	~60	Oral	No
Pien, 1984	5	16-40	not specified	Total communication	No
Schirmer, 1985	20	36-60	60	10 Oral; 10 Total communication	No
Day, 1986	5	35-42	45	Total communication	No
Yoshinaga-Itano & Stredler-Brown, 1992	43	6-36	30	Both methods; Not specified by child	No
Nicholas, Geers, & Kozak, 1994	9	14-40 (longitudinal)	30	Oral	Yes

intelligence, history of sensory aid use, presence or absence of concomitant disabilities, parental involvement, and socioeconomic status of the family. Various combinations of these factors lead to wide variability in the communication of young deaf children, limiting generalization. This paper presents a larger database, from a single age group and instructional method.

Studying children who are 36 months of age is important because function and modality interactions become much more meaningful at this age, especially for oral deaf children. This is the age that they begin to acquire some verbal language (Moog & Geers, 1975); at younger ages their communication is limited largely to gestures and vocalizations. There is a need to know whether the emergence of verbal language precedes an increase in the variety of communicative functions, or whether an increase in variety occurs independently, possibly as a precursor to verbal language.

Also, 36 months is about the age at which many parents begin to make long-range decisions about their child's school placement and communication method. Information regarding the communicative competence of the deaf child compared to normally hearing peers can be beneficial when deciding whether to include the child in a mainstream preschool. Furthermore, in any educational program for deaf preschoolers, an important instructional objective might be the promotion of the normal range of functions.

Purposes

There were three purposes for the present study. The first was to compare the communicative acts of chronologically matched deaf and hearing children. The following questions were addressed: Do deaf children who use aural/oral communication express the same range of functions as normally hearing children at 36 months

of age? Do they exhibit a similar pattern of relative frequency of use of the various functions?

Based upon the literature and our own previous work with a smaller number of subjects, we hypothesized that the range of functions expressed may be the same in deaf and hearing children at age 36 months. However, the specific functions related to the transmission or acquisition of information (as opposed to action) would be used much less frequently by the deaf children. The results may have important ramifications for education. Those children who have not mastered the appropriate use of basic communicative functions may be unprepared to successfully enter mainstream school settings, and these skills may need to be included as instructional goals.

The second purpose was to relate modality to communicative function. The following questions were addressed. Do oral deaf children express a wide range of functions in both nonverbal and verbal modes? How do communicative function and communicative modality interact in children learning a spoken language? We hypothesized that even though the children in the present study received a model of language that was primarily spoken English, they would rely on gestural communication at 36 months for expressing some communicative functions, particularly those that are informative and heuristic.

The third purpose was to examine the relationship between measures of communicative function and later measures of expressive language. Specifically, it was predicted that four variables measured at 36 months of age would be related to expressive language test scores at age 5 years: (a) use of speech and (b) the three communicative functions that are informative/heuristic in nature (i.e., Statements, Questions, and Responses). Significant positive correlations involving these factors might suggest that these areas of early intentional communication are precursors of more formal language development.

Method

Participants

The participants in this study were 36 preschool-aged children who were video-recorded in a play session at 36 months of age (± 1 month). Eighteen were severely-profoundly deaf and 18 were normally hearing. The mean age of the deaf children was 36.4 months ($SD = 1.0$) and the mean age of the normally hearing children was 36.2 months ($SD = 0.4$). The deaf children were enrolled in one of two oral-emphasis parent-infant programs at the time of observation. The mean better-ear unaided pure tone average threshold (500, 1000, 2000 Hz) of the group was 104.5 dB HL (ANSI, 1969) ($SD = 8$; range 93–118) and the average age at diagnosis was 12 months ($SD = 6.2$; range 1–23 months). The mean aided sound field threshold of the group (available for 12 out of the 18 participants) was 49.5 dB ($SD = 25.48$; range 30–88). In all cases the age of onset of deafness was known (or assumed by the parent, pediatrician, and clinician) to be earlier than 18 months. Other important characteristics of the deaf children are outlined in Table 2.

The normally hearing children were recruited through local birth records. All of these children had a hearing screening at 500, 1000, and 2000 Hz and were found to have hearing within normal limits. Additionally, they were

administered two language screening measures: the Peabody Picture Vocabulary Test–Revised (PPVT-R; Dunn & Dunn, 1981) and the Communication Scale of the Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984). The group mean for the PPVT-R was 112 ($SD = 9$) and the mean on the Vineland Communication Scale was 111 ($SD = 10$) indicating typical language skills for their chronological age.

Procedure

Videotaping Sessions

Participants came to a comfortable play room within a speech and hearing clinic to be videotaped in a 30-minute play session with their mother. The mother was given a brief description of the purpose of the study and instruction for her role in the play session. She was asked to play naturally with her child and not to “teach” the child or try to elicit communication any more than she normally would.

Play Materials

The child and parent were provided with one set (four boxes) of toys during each play session. The session was divided into four 7–8 minute intervals, with a different box of toys for each interval to maintain interest.

Table 2. Characteristics of the deaf children.

Participant number	Mos. of age at diagnosis	Cause ^a	Unaided PTA	Aided sound field ^b	Sensory aid ^c
1	17	meningitis	93	48	BHA
2	9	Mondini	118	45	TA
3	9	unknown	106	32	CI
4	17	genetic	100	+	BHA
5	17	unknown	98	43	BHA
6	6	unknown	100	+	BHA
7	16	unknown	110	55	TA
8	23	unknown	96	+	BHA
9	8	genetic	100	58	BHA
10	4	CMV	116	30	CI
11	9	CMV	101	57	BHA
12	12	unknown	111	+	BHA
13	23	unknown	116	88	BHA
14	16	unknown	105	62	BHA
15	8	ototoxic	95	42	BHA
16	7	unknown	115	+	BHA
17	15	unknown	98	47	BHA
18	1	genetic	103	+	CI

Note. $N = 18$ (9 males, 9 females).

^aCMV = Cytomegalovirus

^b+ denotes information unavailable

^cBHA = Binaural hearing aids, CI = Nucleus 22-channel cochlear implant, and TA = Tactaid VII tactile aid

Data Preparation

Transcription and Verification

All speech, vocalizations, and gestures or signs produced by the child and parent were transcribed by a trained graduate student from the videotape. The entire videotape was then reviewed along with the transcript, and the omissions or errors were corrected by a second experienced transcriber. The transcription followed the CHAT (Codes for the Human Analysis of Transcripts) format of the CHILDES system (MacWhinney, 1995).

Coding

Every potentially communicative behavior was coded for three features of communication: (a) the intentionality of the behavior (i.e., Was the child intending to communicate?), (b) the modality (or modalities) used by the child in producing that act, and (c) the communicative function expressed by that act. All behaviors were coded directly from the videotape onto a computerized transcript file, using the Coder's Editor software available from the CHILDES project (MacWhinney, 1995).

Every videotape was coded independently by two people, one of whom was an experienced teacher of the deaf and the other a graduate student in a teacher-of-

the-deaf training program. Both had participated in lengthy training sessions in which they coded tapes to a minimum of 80% point-by-point agreement with the first author.

Dependent Variables Coded

Intentionality

Intentionally communicative acts (ICA) can sometimes be difficult to distinguish from (a) acts that are not intentionally directed to another person but which can nonetheless be understood by and responded to by another person (e.g., talking to oneself); or (b) acts by infants or other prelinguistic children that are precursors to true intentional communication and are often treated as if they were intentional by an adult. An example of the latter might be a random arm wave by a 4-month-old child interpreted as an attention-drawing gesture. In other words, the decision to include an act as an ICA is a judgment by coders about whether the child intends to communicate. This is in contrast to a judgment that a given behavior was not intentional, but was accepted by the mother as such for purposes of conversational flow. The reader may refer to Snow (1977) for a discussion of how mothers accept approximations as conversational turns in order to “teach” the structure of conversation and to Harding (1982, 1984) for a complete discussion of the emergence of intentionality in communication.

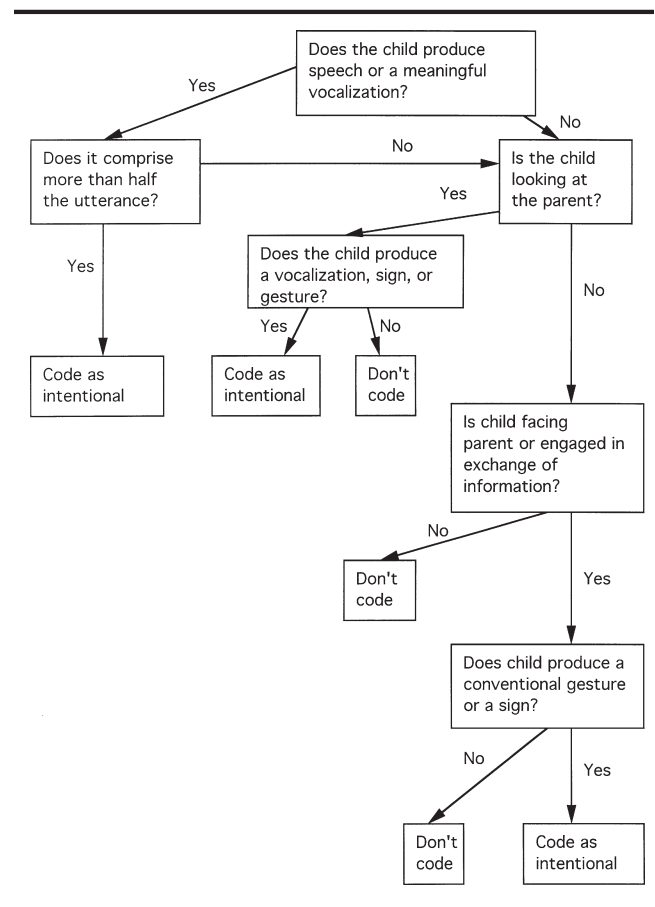
A set of rules was established for making the determination of ICAs uniform, using a flow chart depicted in Figure 1. The chart uses various components of communicative behavior (i.e., gesture, speech, sign, visual contact) and illustrates how combinations of these behaviors might be grouped to allow for decisions that reflect what the language community regards as evidence of purposefully, or intentionally, communicative behavior.

For example, if a child used speech or a meaningful vocalization, this was coded as intentional communication whether or not the child was looking at the parent if it comprised more than half of the utterance (i.e., sporadic speech embedded in unintelligible vocalizations required visual contact in order to be coded as intentional). In the absence of speech, if the child faced the parent while producing a vocalization, gesture, or sign, this behavior was coded as intentional. Although not all researchers agree on the particular decision rules adopted, this procedure proved helpful in standardizing the decision-making process.

Communicative Function

For each act that was identified by both coders as being an ICA, a communicative function category was

Figure 1. Criteria for determining intentionality of a communicative act.



assigned (independently) by each of the same two coders. The categories used in this study were derived from the literature, though this area of research appears to have spawned as many coding schemes as researchers. Many of the existing coding schemes reviewed were found to be either too narrow or low-level (e.g., Coggins, 1987) or too broad and complex (e.g., Ninio, Snow, Pan, & Rollins, 1994) to accurately and efficiently characterize the social interactions of this population. The nine categories chosen for the present study were those that were found (although sometimes by slightly different category names) in almost every previously published study in this area. Those categories of function that were included in the present study were Directive, Marking, Statement, Response, Performance, Question, Commitment, Evaluation, Repetition or Imitation, and Function Not Clear. Definitions and examples of these categories are included in the Appendix. Each coder had a manual that included detailed definitions and many examples of each category to facilitate decision making. As will be discussed later in this paper, the Performance, Commitment, and Evaluation categories were so infrequently used that they were eventually excluded from most analyses in this study.

Mode

Each ICA was also coded for the modality used by the child. In this step, the ICA was assigned a code indicating whether it was made with speech, vocalization, gesture, sign, or any combination of these. An utterance was considered to be speech if it matched a contextually plausible spoken English word on two of the following three dimensions: (a) number of syllables, (b) a vowel, and (c) a consonant. Any nonverbal vocal behavior was coded as a vocalization. Those vocalizations that carried a standard meaning in the language community were deemed “meaningful vocalizations” (relevant for intentionality decisions). Arm, hand, or finger movements that were not formal signs but which carried a recognizable meaning were considered to be gestures.

The modalities were then grouped into the following categories: (a) *gesture or sign alone*, (b) *vocalization*, which was quite often accompanied by a gesture, and (c) *intelligible speech*, which may or may not have been accompanied by a vocalization, gesture, or sign. Although there were many possible ways of grouping and presenting the modality information, this grouping allowed for a view of the child’s progress toward the spoken language goal of this particular population.

Reliability

Researchers often employ two coders to establish intercoder reliability. The coders independently view videotaped interactions and make decisions about the categorization of communicative acts with respect to the functions of those acts within the conversation. Disagreements in the categorization decisions made by the two coders are often resolved by a process known as “conferencing,” wherein the two coders review the videotaped communicative acts and discuss them until a mutually agreed upon coding assignment is reached.

A more conservative approach, chosen for the present study, bases the analysis only on the clear and unambiguous communicative acts on which both coders agree. Although this approach may exclude some acts in which the child intended to communicate, the fact that two independent observers interpreted them differently suggests that they were not fully developed examples of communicative behavior. (See Nicholas & Geers, 1996; Nicholas, Geers, & Rollins, 1997).

Intentionality

For the study overall, 87% of potentially communicative acts were coded as intentional by both coders. This figure was an average of 79% agreement for the deaf children and 95% for the normally hearing children. Only those acts that both coders independently identified as “intentionally communicative” were used in subsequent analyses.

Communicative Function

The percentage of ICAs for which the coders independently agreed, point by point, on a communicative function category, was 69% (74% for the normally hearing group and 65% for the deaf). The corresponding Cohen’s kappa statistics were .65 (total), .68 (normally hearing), and .56 (deaf). For the purposes of all the analyses that follow, only those acts that both coders categorized the same are used (i.e., 100% agreement).

Mode

Point-by-point coder agreements for mode were (with Cohen’s kappa in parentheses): for all children combined, 92% (.83), for the deaf, 82% (.74), and for the normally hearing, 97% (.87). These figures were calculated without regard to the corresponding function agreement. In other words, agreement for mode and function were calculated separately, not simultaneously.

Errors of omission (one person assigns intentionality and the other coder does not) are reflected in the “intentionality” reliability statistics. Errors of commission (both coders assign intentionality but then disagree on the particular function or modality assignment) are reflected in the reliability statistics for communicative function and modality, respectively. In the analyses of the interaction of communicative function and modality, only those ICAs for which the coders agreed on *both* function and modality were included.

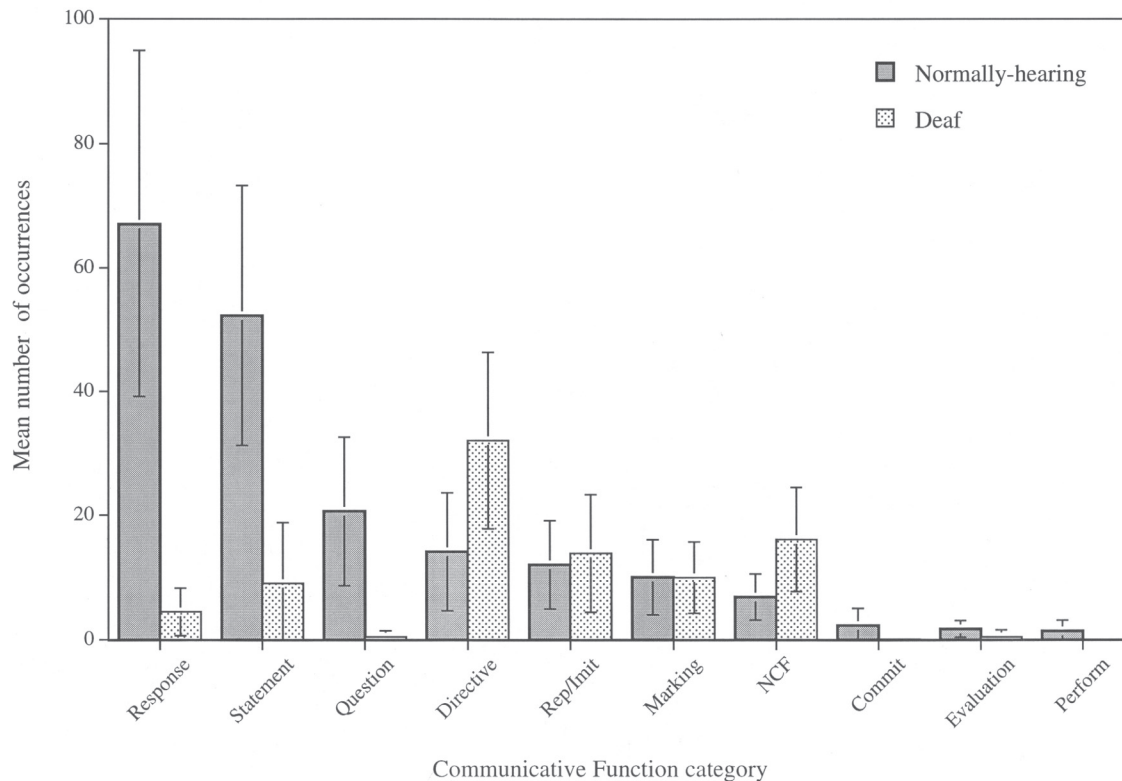
Results

Intentionality

There were 7,009 acts identified as ICAs by both coders. The mean number of ICAs were significantly different, $t(27) = -7.83, p < .0001$, for the deaf, $M = 86.28, SD = 27.27$, and the normally hearing children, $M = 184.94, SD = 45.92$. These numbers may also be considered in terms of rate of ICAs per minute (over the 30-minute period) as is often reported in the literature. For the normally hearing group, the rate was 8.53 per minute and for the deaf group the rate was 4.45 per minute. These figures reflect all ICAs, regardless of modality used or function expressed. The lower communication rate of the deaf children may reflect both less frequent attempts to communicate and less clear attempts, that is, those attempts that did not meet the criteria set forth in Figure 1 for one or both coders.

The mean frequency of occurrence for each of the communicative function categories are presented in Figure 2. In this figure, the function categories are ordered along the x-axis in order of frequency of occurrence in the normally hearing group. This figure is presented to illustrate the difference between deaf and normally

Figure 2. Mean number of Intentionally Communicative Acts in each communicative function category for deaf and normally hearing children. Key to abbreviations: Rep/Imit = Repetitions and Imitations, NCF = No Clear Function, Commit = Commitments, Perform = Performance.



hearing children in relative *frequency* of communication across all function types.

Communicative Functions

The distribution of communicative function (CF) types was then examined separately for the deaf and normally hearing groups. In the analyses that follow, the Commitment, Performance, and Evaluation function types were excluded due to their extremely low frequency of occurrence in the play sessions (see Figure 2). In addition, because of the very different rates of communication occurring within the two groups of children, the following analyses were performed on proportions of total ICAs in each function category. Figure 3 is a depiction of the communicative function means plotted as a percentage of total ICAs.

Visual inspection of the distributions of these variables revealed considerable differences, ranging from normal to very skewed. Since no single transformation was likely to be effective for these distributions, the adjusted significance levels of the Geisser-Greenhouse correction were used to interpret the significance of all of the F ratios in this paper. The most likely consequence of having non-normal distributions is the introduction of unequal variances in the ANOVA procedure. The

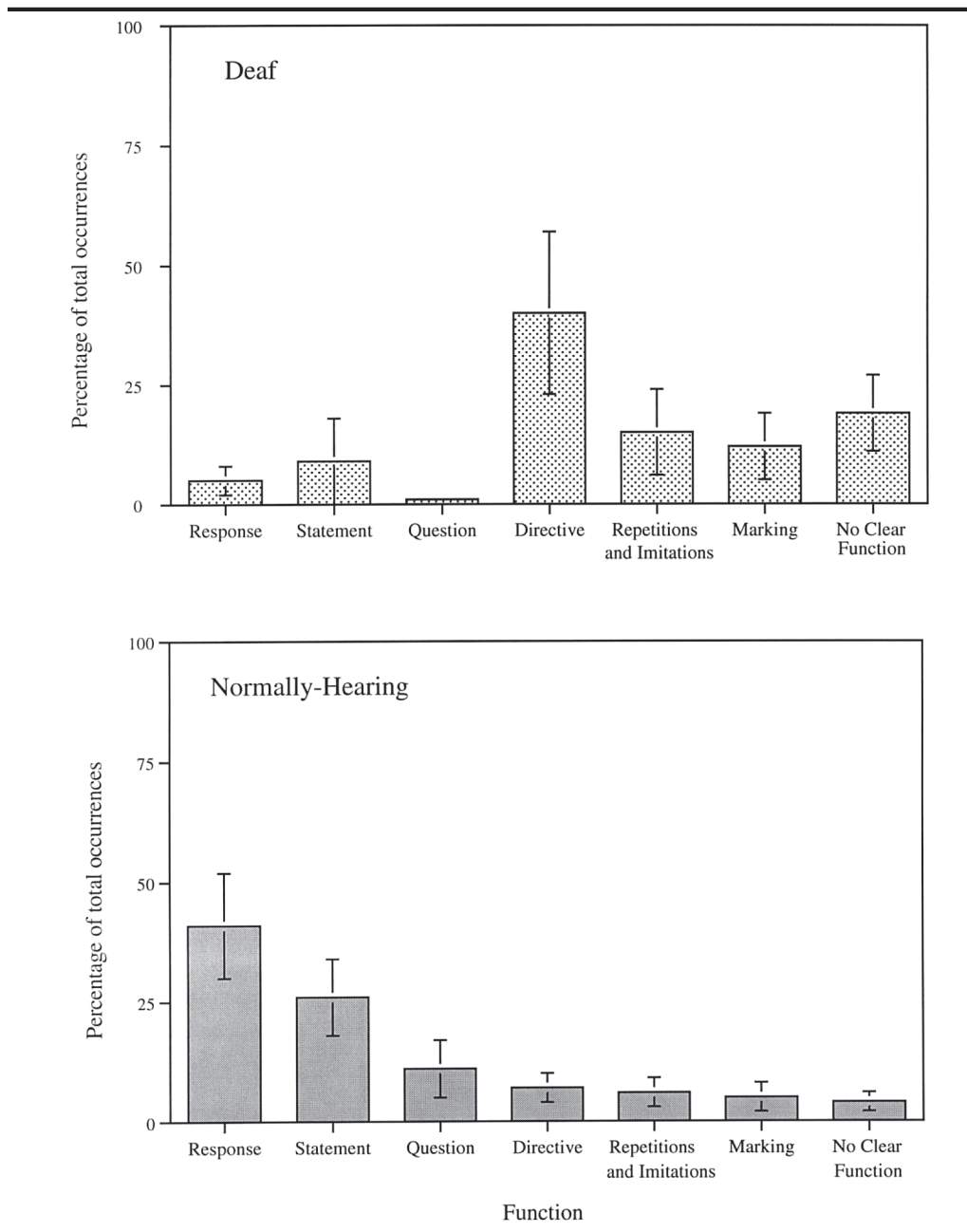
Geisser-Greenhouse correction assumes maximal heterogeneity of variance and hence is a highly conservative correction (Keppel, 1991).

The CF means for the deaf group were subjected to a repeated-measures ANOVA procedure and found to be significantly different from one another, $F(6, 102) = 29.98, p < .0001$. Table 3 provides the function means and results of post-hoc mean comparisons. For all post-hoc comparisons reported in this paper the omnibus error term was used (to maintain consistency across comparisons) and a Bonferroni correction was made for alpha ($p = .05$).

Pairwise comparisons revealed that, for the deaf group, Directives were produced more frequently than any other function. Repetition/Imitation and No Clear Function occurred more frequently than both Response and Question. The remaining categories were not significantly different from one another.

An identical repeated-measures ANOVA procedure found the means of the CFs for the normally hearing group to also be significantly different from one another, $F(6, 102) = 81.97, p < .0001$. The summary of the post-hoc comparisons of these means are likewise found in Table 3. For these children, the mean comparisons revealed that the proportion of Responses are significantly greater than all other categories. Statements were used

Figure 3. Percentage of Intentionally Communicative Acts in each communicative function category for deaf and normally hearing children.



a larger proportion of time than all categories except Response. Questions were used significantly more than No Clear Function and the remaining categories were not significantly different from one another.

Modality

Figure 4 depicts the mean proportion of ICAs produced in each modality by the deaf and normally hearing groups. Looking first at the deaf children’s communication, a repeated-measures ANOVA revealed that the

means of the proportion of ICAs in the various mode categories did not differ significantly from one another.

For the normally hearing group, the repeated-measures ANOVA indicated that the means of the proportion of ICAs in the various mode categories differed significantly, $F(2, 34) = 1205.23, p < .0001$. Post-hoc tests revealed, not surprisingly, that speech was used significantly more than any other mode and that there were no significant differences among the remaining categories.

In terms of the content of the speech used, the deaf children produced a mean number of 26.94 different

Table 3. Post-hoc mean comparisons among communicative function types for both deaf and normally hearing children.

Variable	Mean	Response	Statement	Question	Directive	Repetition/ Imitation	Marking	No Clear Function
Deaf children								
Response	4.5	—						
Statement	9.0	—	—					
Question	0.5	—	—	—				
Directive	39.44	*	*	*	—			
Repetition or imitation	14.94	*	—	*	*	—		
Marking	12.28	—	—	*	*	—	—	
No Clear Function	18.83	*	—	*	*	—	—	—
Normally hearing children								
Response	41.05	—						
Statement	26.28	*	—					
Question	10.83	*	*	—				
Directive	7.05	*	*	—	—			
Repetition or imitation	5.94	*	*	—	—	—		
Marking	5.22	*	*	—	—	—	—	
No Clear Function	3.83	*	*	*	—	—	—	—

**p* < .05

words (*SD* = 15.76, Range = 6–54) in the 30-minute session. The normally hearing children produced a mean of 225.83 (*SD* = 47.42, Range = 133–326) per session, which was significantly more than the number produced by the deaf children, *t*(17) = -15.46, *p* < .001.

Function and Modality

Figure 5 depicts the frequency of each function that was expressed in each of the three modality categories

of interest. The figure clearly suggests that the normally hearing children expressed most communicative functions with speech. The deaf children, on the other hand, did not have a uniform method of communication (as indicated also by the previously discussed results of the ANOVA on modality percentages) and did not distribute the use of the different modalities evenly across communicative function types. For example, in the categories of Statement and Repetitions/Imitation, utterances containing intelligible speech were predominant for the

Figure 4. Percentage of Intentionally Communicative Acts in each modality category for deaf and normally hearing children.

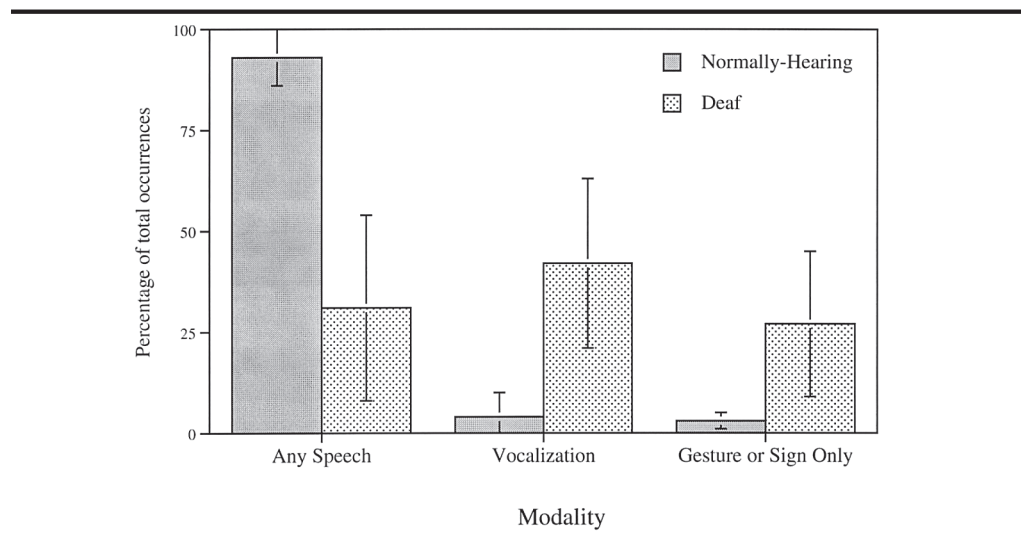
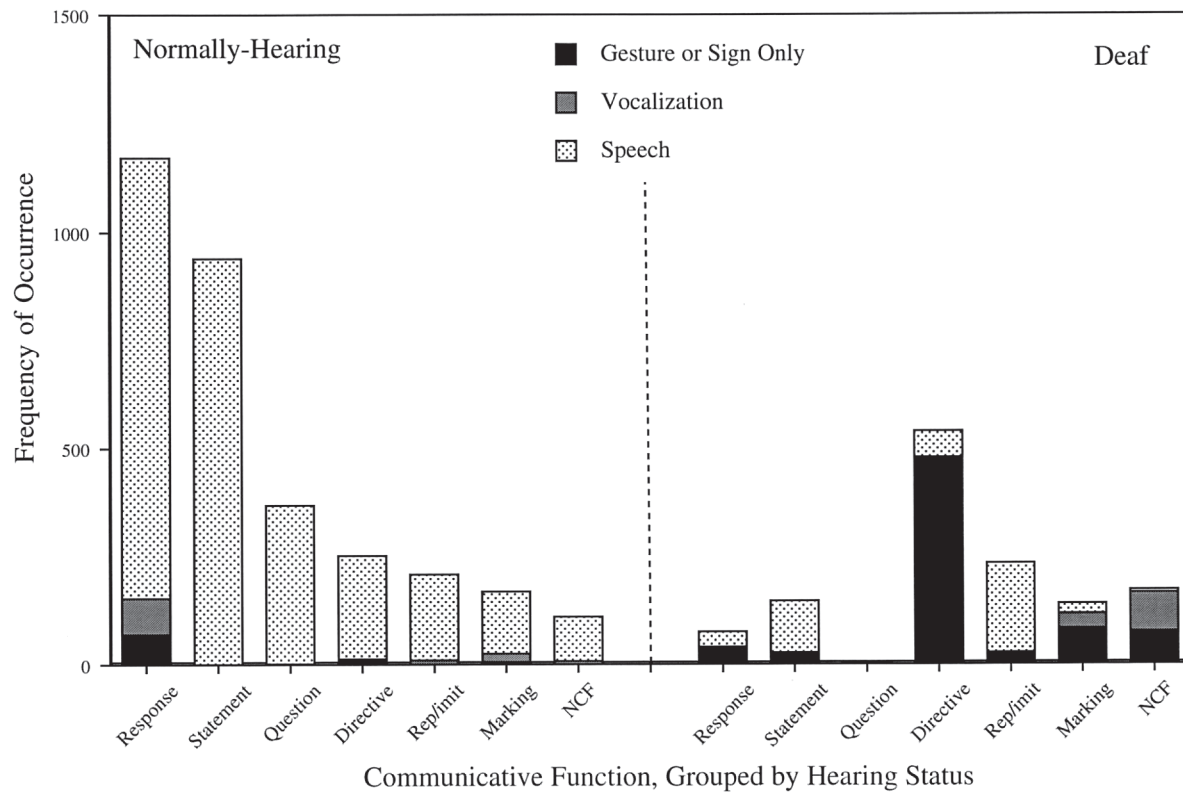


Figure 5. Frequency of Intentionally Communicative Acts in each modality by communicative function type. The left- and right-hand sides of the graph depict values for the normally hearing and deaf children, respectively.



deaf group. For two categories, Markings and No Clear Function, the dominant mode was the category of vocalization. For the most frequently used communicative function category, Directives, the children used gestures alone about as frequently as the vocalization category, followed by a smaller percentage of utterances containing speech.

Relation to Later Language

Spearman rank-order correlations were computed to determine whether there were significant relationships between certain of the variables discussed above and expressive language performance of the deaf children 2 years later. The variables of interest from the 36-month session were (a) the seven communicative function categories used in the preceding analyses, (b) the total number of ICAs, and (c) the three modality categories. These variables were correlated with the child's percentile ranking at age 5 compared to other deaf age-mates on either the Grammatical Analysis of Elicited Language–Pre-Sentence Level (GAEL-P; Moog, Kozak, & Geers, 1983) or the GAEL–Simple Sentence Level (Moog & Geers, 1985) test. The percentile ranks for Imitated Production and Prompted Production were averaged to arrive at a single percentile rank for expressive language.

Percentile ranks ranged from scores considerably below average for 5-year-olds (27.5%) to above average for that group (100%) with a median percentile rank of 82.5. For all test session variables except (b), the percent of total ICAs was used, as opposed to the frequency of occurrence. A listing of the resulting correlations appears in Table 4.

To interpret the significance of the correlations, an “ensemble-adjusted” approach was used, which allows for greater power when examining variables of theoretical importance and lesser power for examining the relationships among remaining variables (Rosenthal & Rubin, 1983). Hence the .05 level was used for interpreting the significance of the four target variables that were predicted to be related to later expressive language (use of speech, Statements, Questions, and Responses), and the .007 level was used to evaluate the significance of the remaining seven correlations. The .007 level represents a Bonferroni correction to the correlations that did not involve predictions.

The proportion of ICAs in the Statement category was positively correlated with later language scores ($r = .60$) whereas use of the Directive category was negatively correlated ($r = -.67$). No other function category was significantly correlated with later spoken language performance. With regard to modality, the use of speech at 36 months was significantly correlated with spoken

Table 4. Correlations between communicative function and modality types at 36 months of age and expressive language scores at age 5 years, for oral deaf children.

Communicative function	Correlation with later spoken language	p value
Response	.43	.067
Statement	.60	.015*
Question	.18	.474
Directive	-.67	.006*
Repetition/Imitation	.54	.029
Marking	-.24	.191
No clear function	.42	.071
Total number of ICAs	.46	.057

Modality (N = 13)	Correlation with later language	p value
Gesture alone	-.28	.150
Vocalization/Gesture combination	.38	.101
Includes speech	.69	.005*

Note. (N = 13). GAEL scores were not available in school record at 5;0 for 5 of the study participants.
ICA = Intentionally communicative act
*Significant at corrected significance level

language ability at 60 months. The correlation between the total number of ICAs at 36 months and the GAEL percentile rank at 60 months was not significant.

Discussion

The primary reasons for making these observations of the oral deaf child's successful attempts to communicate are to better define those factors that predict later spoken language development and to provide a focus for early language intervention. The present study makes these observations on at least twice the number of oral deaf 3-year-olds as any previous study, thereby increasing the confidence with which we make conclusions. Observing similar communication behaviors in normally hearing age-mates provides the means to examine the degree to which hearing impairment interferes with the development of social communication.

The results support the conclusion that oral deaf children communicate less often and with more ambiguity than normally hearing children of the same chronological age. The difference in the frequency of intentionally communicative acts produced by these oral deaf children relative to their normally hearing age-mates is not surprising, nor is the difference in the number of different words produced. Many aspects of communication are known to be affected by hearing impairment.

Our previous work indicates, however, that when deaf infants were matched in terms of verbal language age to their hearing counterparts, their use of communicative functions appeared to be developing in a similar pattern, but with significant delay (Nicholas, Geers, & Kozak, 1994). Whether this apparent delay can be overcome is, of course, not clear from these data. Further research is needed to document changes in frequency of communicative function use as these children learn spoken language.

These oral deaf children demonstrated the ability to use all of the same functions as normally hearing children, but they differed significantly in the distribution of functions expressed and mode of expression. This finding supports the conclusion of Duchan's (1988) review on the completeness of the range of functions that deaf children express and that of Day (1986) who found that those functions are distributed in different proportions.

As expected, the communicative functions that were clearly conveyed most frequently by these deaf children tended to be those that were less informative and heuristic (i.e., Directives, Imitations, and Markings rather than Responses, Statements, and Questions). The Directive function dominated the early communicative behavior of these deaf children. The more frequent production of Directives by oral deaf than by normally hearing children (a result also found in Nicholas et al., 1994) may reflect the relative importance of this category for oral deaf children or the ease with which it can be expressed nonverbally. Attracting the parent's attention and getting needs met encompassed most of the deaf child's communicative goals. Alternatively, they may have been more successful in conveying Directives without needing to use speech. There may have been attempts to use other communicative functions that were not understood when expressed using only gestures and/or vocalizations (45% of the deaf children's communicative attempts were eliminated from these analyses because coders did not agree on the assignment of function). Regardless of the interpretation, if increased speaking is a goal for deaf children, then parents and teachers might encourage their children both to speak and gesture before they respond to the child's Directive. By doing so, they can capitalize on the child's already established communicative need to encourage increased speech use.

In terms of modality, normally hearing 3-year-olds communicated almost exclusively in speech whereas their orally educated deaf age-mates were as likely to use gestures alone as they were to use vocalizations or speech. In addition to encouraging more use of speech, oral intervention programs should target use of heuristic functions to close the communication gap between the orally educated deaf and normally hearing 3-year-old.

At age 36 months, these deaf children, who were receiving an oral language emphasis in their educational program, used at least some speech in almost a third (31%) of their intentional communication. These communicative acts sometimes also contained either a gesture/sign or an unintelligible vocalization. A slightly larger percentage of acts was produced with vocalization (either alone or with an accompanying gesture/sign) and fewer were produced with a gesture or sign alone. The same rank order of mode proportions (Any speech, Vocalization, Gesture or Sign alone) was found by Greenberg (1980) for the children in his study who were in an oral program.

Speech use by these deaf children appeared most often in imitation of the parent's model, suggesting that imitation may be an effective tool for encouraging speech development. Characteristic of children at the early stages of verbal language development, these oral deaf children used speech primarily in imitation of the parent's model. However, the use of speech in other categories was evident, particularly for Statements. This suggests that speech skills originally developed in imitation are beginning to emerge in more communicative interactions, such as naming or labeling. Such behaviors are characteristic of the earliest speech of normally hearing children.

Amount of nonverbal communication did not appear to be an important predictor of spoken language development in these deaf children. In fact, use of the Directive function was significantly negatively correlated with spoken language development, and this function was expressed primarily using gestures and/or vocalizations rather than speech. Overall use of gestures or vocalizations to communicate failed to correlate with spoken language level at age 5. The lack of significant correlations between spoken language at age 5 years and the other modality variables measured at age 3 years may also be related to instructional method. It could be the case that other modalities (e.g., gestures) may turn out to be important predictors of language development for children whose educational programs include a signed language.

Of our previously identified informative/heuristic function variables, only the use of Statements proved to be positively correlated with later spoken language development. The Question and the Response variables did not significantly predict later language scores. Yoshinaga-Itano & Stredler-Brown (1992) found that nonverbal Requests for Information were significantly related to the concurrent production of verbal communicative acts. In the present study, acts that represent this function (a subset of our Question category) occurred so infrequently in any mode (<1% overall) that it did not appear fruitful to separate nonverbal from

verbal Requests for Information as a predictor. In addition, the general category of Questions in the present study did not occur frequently enough to allow a powerful test of its usefulness as a predictor of later spoken language competence. These results cannot confirm or disconfirm Yoshinaga-Itano's conclusion that (at least the nonverbal portion of) this function category may be an important predictor. The same may be true of our third informative/heuristic variable, Response, which failed to be significantly related to later expressive language, but which also occurred with very low frequency.

The deaf children who were beginning to use speech to communicate at 36 months of age were most likely to be ahead of their deaf age-mates on a spoken language measure administered at 60 months of age. Those who developed good spoken language skills for their age and hearing loss when they were 5 years old were those who used the Statement function most frequently when they were 3. This function was one that was usually produced by oral deaf children using speech. In fact, correlations of spoken language performance and modality indicated that across all function categories, use of speech was a significant predictor of spoken language acquisition. This finding suggests that, even as these oral deaf children acquire their first spoken words at the end of their second year, their use of these words for communication is an important indicator of their eventual spoken language competence.

Final Notes

Because coding criteria and function categories employed are different in all studies to date, it is difficult to compare function proportions and rate (acts per minute) information across studies. The latter is especially influenced by the method employed for determining intentionality, the criteria for which are almost never described in studies in this literature. Until common methodologies are agreed upon, direct comparisons on these two aspects of communication may be misleading.

The pattern of communicative functions and modalities observed in this sample of oral profoundly deaf children may vary with degree of hearing loss or with speech perception skill. For example, our studies involving children who are using various sensory devices (cochlear implants, tactile aids, hearing aids) show that different patterns of function and modality use are associated with differences in speech perception ability in profoundly deaf children who are learning via an oral method (Nicholas, 1994). Children who acquired improved speech perception with a cochlear implant over a 33-month period used speech in twice as many communication attempts as did matched children with other

sensory aids. In addition, the pattern of functions exhibited by children with implants more closely resembled that of normally hearing children. Similarly, Yoshinaga-Itano (1992) found significant differences in deaf and hard of hearing children in their use of verbal communication. Therefore, intentional communication may develop differently depending upon speech perception skills.

It is recognized that the strategy of excluding potentially communicative behaviors that coders did not agree upon leaves a corpus of unanalyzed behaviors. This corpus is larger for the deaf children than for the normally hearing children and is potentially a very interesting source of information about the ambiguities of the communicative attempts of children at the earliest stages of spoken language production. The present paper determined (a) what proportion of these children's actions are clear and unambiguously communicative, (b) what the communication of oral deaf children at age 3 consists of in terms of function and modality, and (c) which of these variables might be related to spoken language development. It will be useful, in the future, to look at the ambiguous material from the corpus of the deaf children to see whether there are systematic factors that lead it to be different from other, more successful, communicative attempts.

It is also possible that children who have differing histories (educational strategies, communication mode, age of onset, etc.) may evidence a different pattern of development. Obviously, these data bear only on questions related to orally educated children. Data collection is currently underway to examine these patterns for a relatively large, cross-sectional sample of children who are being educated using simultaneous communication. Likewise, it would also be of interest to see how these patterns differ or remain the same for children who are learning to communicate with American Sign Language (ASL). For those children who are learning ASL from parents who are native signers, the communicative function patterns should closely match those of normally hearing parent-child dyads.

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Appendix

Directive: includes CAs used to direct the parent's attention or action. For example, a child could point and say, "Look!" to get the parent to look in a particular direction, or the child could hand an object to the parent while saying, "open," to get the parent to open a box.

Marking: comprises CAs used to mark a variety of events. Usually these markings would be exclamations such as "oh," "ow," and "uhoh" to mark attentiveness, emotion, and an event, respectively, or it could be a short phrase such as "Thank you." Acknowledgment of an utterance by another person, such as agreement or disagreement with a statement, was coded as a Marking.

Statement: indicates CAs describing a past or present activity, "I'm cooking"; an object, "It's big"; an event, "It popped up"; or a desire, "I want a new truck for my birthday."

Response: indicates that the CA was made in response to a parent's question, including implied questions.

Performance: includes the announcement of pretend roles such as "You be Spiderman and I'll be Venom;" the performance of a social routine such as "Please," when prompted by the parent; counting; and self-initiated reading, reciting, or singing.

Question: comprises requests for information, "When are we going home?," permission, "Can I play with it?," or clarification, "Huh?"

Commitment: includes future statements such as the announcement of intention, "I'm going to play with the puppet next"; a promise, "I promise to make my bed"; or a conditional statement, "If it rains, we can't play outside."

Evaluations: indicates children's assessment of either themselves or another ("I can't do it") or the parent ("You're doing it wrong").

Repetition and Imitation: indicates that the child either copied a parent's communicative act or repeated his own previous communicative act.

The No Clear Function code was used when the coder found that although the act did meet the criteria for being intentionally communicative, the coder was not able to judge the purpose for which the child was communicating.
