Conversations Between Deaf Children and Their Hearing Mothers: Pragmatic and Dialogic Characteristics

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We examined communication between hearing mothers and their deaf or hearing children longitudinally at child-ages 22 months and 3 years. Specifically, we analyzed both the effects of child deafness and developmental change on pragmatic and dialogic characteristics of communication. From 22 months to 3 years, deaf and hearing children's communicative skills improved similarly along some dimensions: as they grew older, both deaf and hearing children increased the amount they communicated, became increasingly responsive to their mothers' attentional focus, and were responsible for initiating a higher proportion of the dyads' conversations. On the other hand, deaf children were less skilled at maintaining topics, and the pragmatic function of their communication was more likely to be unclear compared to hearing children. Deaf children were also more likely to direct their mothers and less likely to ask questions than hearing children. Communication by hearing mothers was primarily examined to determine the degree to which they controlled the interactions. Overall, mothers of deaf children were only more controlling along one dimension. Mothers of deaf children used more response controls than mothers of hearing children. However, the majority of measures suggested they did not exert more topic or turn-taking controls than did mothers of hearing children. In addition, mothers of deaf and hearing children seemed equally sensitive to their children's communication abilities. Communication by mothers of both deaf and hearing children changed in similar ways as their children developed. Most of the differences in communication by mothers of deaf and hearing children seemed attributable to the deaf children's linguistic delays. The results suggest that intervention efforts should be focused on fostering linguistic development and not general communication skills or changing maternal conversational control.

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During the last two decades, researchers have firmly established that prelinguistic hearing infants and toddlers develop communication skills that predate and form the foundation for linguistic communication (i.e., the use of conventional symbols such as spoken words) (Adamson, 1995). Through the use of nonlinguistic gestures (e.g., pointing) and nonlinguistic vocalizations (e.g., daaa), toddlers engage in "conversations" with adults in their environment. During the last few months of the first year and throughout the second year of life, children continually develop the skills necessary to engage in *dialogues* and to use vocalizations and gestures for a variety of *pragmatic* purposes (Dromi, 1992). Dialogic abilities develop as toddlers increase their ability to both initiate conversations and respond to their partners' communication. In addition, toddlers and their adult partners become increasingly able to maintain joint attention or communicate about shared topics (Prezbindowski, Adamson, & Lederberg, 1998). Research also shows that infants' and toddlers' communications serve an increasing variety of pragmatic functions, including commenting on the environment, requesting actions from people, and asking for information. The use of prelinguistic vocalizations and gestures to perform these dialogic and pragmatic func-

tions typically are replaced by conventional language between 18 months and 2½ years (Adamson, 1995). During the preschool years, children become increasingly responsible for initiating and maintaining dialogues with their partners and continue to use their language for different pragmatic functions.

We know much less about the development of these skills among young deaf children of hearing parents (Hd). Research with older Hd children suggests that they have deficits in their dialogic and pragmatic skills. In past studies, compared to age-matched hearing preschoolers, Hd preschoolers (3–5 years old) have been found to communicate less, to use fewer spontaneous communications (i.e., communications that are not a direct response to maternal communications), to be less responsive to maternal directives, and to maintain conversation about a topic for shorter duration when playing with their hearing mothers (Cross, Nienhuys, & Kirkman, 1985; Henggeler & Cooper, 1983; Meadow, Greenberg, Erting, & Carmichael, 1981). They also use more directives, ask fewer questions, refer less to their activities/feelings, supply information less, refer to objects more, and imitate their mother more than age-matched hearing children (Brinich, 1980; Curtiss, Prutting, & Lowell, 1979; Day, 1986; Meadow et al., 1981; Nicolas & Geers, 1997; Nicholas, Geers, & Kodak, 1994; Pien, 1984; Power, Wood, Wood, & MacDougall, 1990).

Some researchers have proposed that these deficits are consequences of the way hearing mothers inappropriately respond to their deaf children's communicative attempts. Gallaway and Woll (1994) summarized this point of view: "[F]indings from these studies . . . gave rise to the notion that deaf children might be suffering the secondary handicap of controlling, discouraging, and negative interactions with their mothers which would provide a less facilitative environment for language acquisition" (p. 199). Hearing mothers' communication styles have also been hypothesized to be detrimental to the development of Hd children's general communication skills (Schlesinger, 1988; Wedell-Monnig & Lumley, 1980). Mothers who are constantly correcting their children and controlling their activities are likely to have less enjoyable conversations with their children. As a consequence, these children may withdraw from interactions, initiate interactions rarely, communicate infrequently, and maintain conversations for short periods of time. Thus, from this point of view, Hd children's communication deficits are a direct result of their interactions with their mothers.

Others have hypothesized that Hd children's dialogic and pragmatic difficulties may be an inevitable consequence of their language delay. When Nicholas et al. (1994) compared the pragmatic function of Hd children with *age-matched* hearing children, they found deaf children severely delayed. In their 6-month longitudinal study, they also found that the pragmatic skills of the Hd children and *language-matched* hearing infants showed similar progress over a 6-month period. Specifically, the children increased their comments, requests for information, and acknowledgments of their mothers' communication over time. There was some evidence that the advanced cognitive development of the older Hd children slightly facilitated the growth of their communication skills. The Hd children communicated more, asked more questions, made more comments, and used more directives than *linguistically matched* (but chronologically younger) hearing infants. However, as the authors conclude, these latter differences, although significant, were "small" (p. 124).

Research on communication development during the transition from prelinguistic to linguistic communication also supports the conclusion that deaf children's communication difficulties result from their language delay, not from general communicative difficulties. Only when language differences become apparent do deaf children seem to fall behind their hearing counterparts. In a longitudinal study, Spencer (1993) found no differences in the frequency deaf and hearing infants of hearing parents communicated to their mothers, suggesting equivalent intentions to communicate. In addition, both deaf and hearing infants from 12 to 18 months increased their communications. Although there were no differences in frequency of communication (i.e., linguistic and nonlinguistic productions combined) by 18 months, hearing toddlers were more likely to use language whereas deaf toddlers continued to use nonlinguistic methods of communication. In a longitudinal study of the next developmental period, Lederberg and Everhart (1998) examined developmental change in deaf and hearing toddlers' (22 months to 3 years) communication (linguistic and non-

linguistic) with their hearing mothers. As in Spencer, deaf and hearing 22-month-olds communicated with their mothers at similar rates. They also primarily communicated through the use of voice: Deaf toddlers used nonlinguistic vocalizations, whereas hearing children used spoken words and nonlinguistic vocalizations. Both deaf and hearing toddlers significantly increased the amount they communicated from 22 months to 3 years of age. However, the increase was more dramatic for the hearing children; by 3 years, they communicated twice as often to their mothers as did deaf children. Deaf children used *more* nonlinguistic communicative devices (i.e., points, gestures, and exaggerated facial expressions) than hearing children, but the quantity and complexity of their spoken and signed language resembled that of the hearing 22-month-olds. This pattern of results suggests that the lower rate of communication by the deaf 3-year-olds was not caused by a lack of desire to communicate. Rather, there may be limits to how much nonlinguistic communication can be used to support complex interactions.

Spencer (1993) and Lederberg and Everhart (1998) examined only the quantity and modality of early communication. One purpose of this study was to extend this research by examining the pragmatic and dialogic characteristics of the communication by the deaf and hearing children previously examined by Lederberg and Everhart (1998). We selected to study the impact of child deafness on the areas of communication shown to be problems among deaf preschoolers (Meadow et al., 1981; Nicholas & Geers, 1997; Nicholas et al., 1994). Specifically, we examined dimensions that capture the child's participation in conversations (topic initiation and maintenance, communication about joint topics) and the pragmatic functions (directives, statements, and questions) of their communications. We believe that, although nonlinguistic communication can develop early dialogic and pragmatic skills, linguistic communication becomes necessary to achieve a higher level of skill. Therefore, we expected that child deafness would increasingly affect communication, as the difference in linguistic skills between the deaf and hearing children widened. We expected differences between deaf and hearing children would emerge in their abilities to maintain conversations, make comments, and ask questions. We also expected deaf children's communicative abilities to show similar but slower progress than those of hearing children from 22 months to 3 years of age (Nicholas et al., 1994; Yoshinaga-Itano & Stedler-Brown, 1992).

A second purpose of this study was to test the commonly held view that communication by hearing mothers to their deaf children discourages the active participation of their children in dialogues (Rodda & Grove, 1987; Schlesinger, 1988; Wedell-Monnig & Lumley, 1980). In their earlier analysis, Lederberg and Everhart (1998) found that mothers of deaf and hearing children communicated to their children at a similar rate, decreasing the amount they communicated from child-age 22 months to 3 years. Mothers of deaf children were more likely to use gesture and touch and less likely to use language (either spoken or signed) with their children than mothers of hearing children. This study extended this analysis by examining the pragmatic and dialogic characteristics of the communication of the hearing mothers of the deaf and hearing children.

Differences along these dimensions have primarily been interpreted in terms of the amount mothers use their communication to control their children. Past research has almost uniformly found that mothers of deaf preschoolers (as well as mothers of children with developmental delays) are more directive than are mothers of hearing children (see Gallaway & Woll, 1994; Lederberg & Prezbindowski, 2000; Musselman & Churchill, 1993, for reviews). This increased directiveness has been cited as a contributing factor to deaf children's language delay and general communication problems. During the last decade, researchers have realized that "maternal directiveness or control" is not a unitary dimension. Most researchers have followed the lead of Tannock (1988), who described three distinct ways mothers can control interactions with their children. "*Response control* refers to a mother's tendency to use commands, questions, and other behavior to elicit a response from the child. *Topic control* refers to the mother's tendency to redirect the child's attention to mother-selected topics by using utterances or turns that are unrelated to the child's ongoing activity or topic. *Turn-taking control* addresses the extent to which mothers dominate the interaction by contributing long and frequent turns" (p.154). These types of control are usually derived from pragmatic and dialogic analyses

of communication: Response control is measured by examining the pragmatic function of communications; topic control by examining the degree to which communication is about joint topics (i.e., shared attentional focus); and turn-taking control by examining the degree to which mothers dominate, or are responsible for, dyadic communication and initiation of topics.

Research on the impact of child deafness during preschool on response and turn-taking control has been extensive. Mothers of deaf and hard of hearing children (2½–5 years) used more response controls (e.g., directives such as "get the ball," "look at me") and fewer acknowledgments and questions than mothers of age-matched hearing children (Brinich, 1980; Cross et al., 1985; Henggeler, Watson, & Cooper, 1984; Power et al., 1990; White & White, 1984; see Gallaway & Woll, 1994, for a review). Hearing mothers of deaf children seem to contribute a higher frequency and proportion of the dyad's communicative acts or initiations (measures of turn-taking control) than mothers of age-matched hearing children (Nienhuys, Horsborough, & Cross, 1985; Meadow et al., 1981).

Although some have suggested that maternal control is a reaction to a sense of powerlessness (e.g., Schlesinger, 1988), research suggests that it is an intuitive adaptation to deaf children's linguistic delays: Mothers of deaf children use the same amount of response and turn-taking controls as mothers of *language-matched* hearing children (Cross et al., 1985; Power et al., 1990), and the use of response and turn-taking controls correlates with linguistic competence among deaf children (Gallaway, Hostler, & Reeves, 1990). In addition, these kinds of maternal control do not become evident until after deaf children's language lags behind that of their hearing peers. Spencer (1993) found no differences in turn-taking control (as measured by the proportion of communication acts) in her study of deaf and hearing infants at 12 and 18 months. In this study, we hypothesized that the effect of child deafness on hearing mothers' response and turn-taking controls would increase from 22 months to 3 years as the linguistic abilities of the hearing and deaf 3-year-olds diverged.

Topic-control, the third type of maternal control, has been found to have the most influence on hearing children's language development (Adamson, 1995). Unfortunately, there is little research in topic control in Hd dyads. In the only large-scale study published to date, communication by mothers of deaf and hearing infants was highly contingent on their infant's attention (Spencer, 1991). At child-age 12 and 18 months, approximately 80% of mothers' visually based social responses to deaf and hearing infants were contingent on the infants' attention, although the spoken communication of mothers of hearing infants was significantly more contingent than that of mothers of deaf infants (88% vs. 82%, respectively). This study suggests that, during prelinguistic development, group differences in maternal topic-control may be minor. However, communication by mothers of deaf children may become less contingent as their children become more language-delayed. In two small-scale studies, communication by mothers of older deaf 2-year-olds was less likely to be related to the child's focus of attention than communication by mothers of hearing 2-year-olds (Cross, Johnson-Morris, & Nienhuys, 1980; Spencer & Gutfreund, 1990). This study will fill an important gap in our understanding of this component of maternal control. Based on the small-scale studies, we expected mothers to be less sensitive to their deaf children's attentional focus and therefore exert more topic control on dyadic communication than hearing mothers with hearing children.

In summary, this study examined the dialogic and pragmatic characteristics of communication between hearing mothers and their deaf or hearing children. We analyzed the impact of child deafness on these characteristics at both 22 months and 3 years of age. Because the study was longitudinal, we could also examine how these characteristics changed with age. Specifically, we examined developmental change in deaf and hearing children's communication and how their mothers changed the characteristics of their communication as their children's skills developed.

Method

Participants

Deaf children and their hearing mothers (Hd dyads). Twenty Caucasian children with a severe-profound hearing loss and their hearing mothers participated in the study

(unaided PTA HL, averaged at 500, 1000, 2000 Hz, $M = 105$dB, $SD = 11$; aided PTA HL $M = 67$dB). At initial testing, all these children were enrolled in one of the five parent intervention programs for children with hearing loss in a major metropolitan area. Parent advisors from these programs referred to us all children with hearing loss who were less than 24 months old and not multiply handicapped and who had hearing parents. Only three mothers declined to participate. From the larger referral sample of 41 toddlers, we did not include in this study 4 children who did not return at 3 years of age (2 moved, 2 declined to participate), 11 children who had a mild or moderate hearing loss, and 6 children who were African American or Hispanic. The latter 17 children were excluded to reduce the heterogeneity of the sample. The children were initially seen between the age of 18 and 26 months (M age = 22 months) and then again when 3 years old (M age = 38 months, range = 36 to 44 months).

The deaf children, on average, were identified as having a hearing loss at 10 months of age (range = 2 to 21) and were enrolled in an intervention program at 12 months of age (range = 3 to 22). Hearing loss was caused by meningitis ($n = 5$), genetic transmission ($n = 1$), birth complications ($n = 1$), and unknown causes ($n = 13$). None of the children had cochlear implants.

Early intervention followed the SKI*HI model, with families visited weekly by a parent advisor. Children began center-based, all-day educational programming when they were 36 months old. Parents and school programs used a variety of different language approaches. At the initial assessment, 3 children were enrolled in an auditory-verbal program, 13 mothers had taken at least one sign language class, 1 mother was using cued speech, and 3 mothers were using an oral (speech only) approach with their children. The latter three had started taking sign language classes by the second assessment. At age 3, 17 children (including the child whose mother used cued speech) were enrolled in Simultaneous Communication (SC) classes, (i.e., where an English-based sign system and speech were used), and 3 children continued to be in the auditory/verbal training program. None of the mothers were using American Sign Language (ASL). Although the majority of parents were learning sign, these parents primarily communicated through speech that was only occasionally accompanied by sign. At 22 months, less than 15% of the SC mothers' communications contained sign. By 3 years, 30% of the communications contained sign (see Lederberg & Everhart, 1998, for details).

Hearing children and their hearing mothers (Hh dyads). Twenty Caucasian hearing toddlers were selected from a larger sample of 56 hearing toddlers to be included in this study. These dyads were selected to match the Hd dyads in terms of gender, maternal employment and education, and marital status. Both Hd and Hh dyads included 12 girls and 8 boys. Nineteen mothers in each group were married at the beginning of the study. The parents had a range of levels of education and occupations (see Lederberg & Everhart, 1998, for more details.) Prestige scores for maternal and paternal occupations were assigned using the Hodge-Siegel-Rossi Index (1972). The two groups did not differ significantly for maternal education, $t(38) = 1.06$, $p < .30$, maternal occupation, $t(38) = 1.08$, $p < .30$, paternal education, $t(38) = 1.13$, $p < .26$, or paternal occupation, $t(38) = 1.60$, $p < .26$. The 20 hearing dyads were initially seen between the age of 18 and 25 months (M age = 21 months) and then again at 3 years (M age = 38 months; range = 36 to 42 months).

Language and cognitive levels of deaf and hearing children. We classified the children's language levels based on the quantity and complexity of linguistic utterances the children used during 10 min of free play with their mothers (see Lederberg & Everhart, 1998, for a complete description of the coding procedure and the children's language). Table 1 displays the language levels of the deaf and hearing children at 22 months and 3 years of age. The majority of the deaf children were severely language-delayed. At 22 months, 50% of the deaf children never used any language in 10 min of free play; an additional 30% used less than 9 single-word utterances. At 3 years of age, the language of 70% of the deaf children was still restricted to single-word utterances. Note that the language levels of the deaf 3-year-olds were similar to those of the hearing 22-month-olds.

At 22 months, the Denver Developmental Screening Test (excluding the language test) was administered

Table 1 Language levels of deaf and hearing children

	Language level[a]				
Children	Nonlinguistic	Low	Middle	High	Highest
22 Months					
Deaf	10	7	3	0	0
Hearing	2	4	9	3	2
3 years					
Deaf	0	8	6	3	3
Hearing	0	0	0	1	19

Language level was determined by the quantity and length of linguistic utterances used by children during 10 min of free play with mother. Nonlinguistic = no language. Low = 1–9 linguistic utterances. Middle (single-word) = more than 9 single-word utterances. High (two-word) = more than 9 two-word utterances. Highest (multi-word) = average of more than two words per utterance.

to each toddler. All children passed the three areas administered (i.e., social, cognitive, physical). At 3 years, nonverbal cognition was assessed by the Leiter International Performance Scale (Leiter, 1979). The deaf and hearing children did not differ significantly in their nonverbal IQ, $t(37) = .86$, $p < .35$. Thus, although the deaf children were significantly delayed in their language development, their nonverbal cognitive skills, at least in general, were typical for their ages.

Procedure

At both data collections, mothers were videotaped playing with their children "as they would at home" for 15 min in a laboratory playroom equipped with age-appropriate toys.

Coding procedure. All sign and speech were transcribed. Final transcripts were developed by consensus between two transcribers to be used as a resource by coders. Interobserver agreement of the sign transcripts was assessed by having five randomly selected tapes of deaf SC children, at each age, coded independently by a second researcher. Using point-by-point agreement, interobserver agreement for sign was 87%. Interobserver agreement for the children's speech was assessed by having four randomly selected tapes at each age, two deaf and two hearing, transcribed by a second researcher. Interobserver agreement for spoken words was 92%.

Pairs of researchers coded all communication that occurred in the middle 5 min of the play period for mothers and children. Although we initially planned to code 15 minutes of play, the time-consuming nature of the complex coding system made this cost-prohibitive (on average, 1 minute of tape took 1 hour to code). The coding scheme was adapted from several previous communication coding procedures (e.g., Goldin-Meadow & Mylander, 1984; Greenberg, Slough, & Crinic, 1984; Lederberg, 1984). We coded all intentional communication (linguistic or nonlinguistic, oral or visual) that occurred between mother and child. The coders first identified all communicative behaviors from the videotapes, using the transcripts of sign and spoken language as an additional resource. The coders had to determine which social behaviors were intentionally communicative. Communicative behaviors were defined as any oral (i.e., speech or nonlinguistic vocalizations) or visual (i.e., signs, gestures, or attentional touch) behavior used solely to communicate something to the other person. Two criteria were used to discriminate communicative behaviors from other social behavior (see Goldin-Meadow & Mylander, 1984; Nicolas & Geers, 1997, for similar coding systems). First, the behavior had to be intentional. Intentionality was indicated by a look toward the partner or by responding to a partner's communication. Second, the act could neither occur with an object nor serve a purpose other than communication. For example, the social behaviors of a mother sipping from a cup and then holding the cup out for the child to pour some more pretend tea would *not* be coded as communicative behaviors. Although these actions clearly convey meaning to the child, the actions also serve a playful or manipulative function. On the other hand, a mother's pointing to the cup and then pantomiming pouring tea into the cup (while not holding any objects) would be coded as communicative behaviors. Behaviors such as reaches and giving objects were not considered communicative behaviors in this coding scheme because these actions involve objects.

Communicative behaviors were then divided into communicative units (CUs) by using pause boundaries. A CU was analogous to an utterance except it could contain only linguistic behaviors, only nonlinguistic communicative behaviors (i.e., gesture, exaggerated facial expression, touch, or vocalization) or any combina-

tion. Thus, CUs could contain one or more communicative behavior and be any combination of linguistic and nonlinguistic communicative acts. Some example CUs are (1)"aaa"; (2)"oo," a point, and sign "dog"; and (3) "See baby?" Thus, a CU, although similar, was not identical to a linguistic *utterance* because it could include all types of communicative behaviors. In fact, for the deaf children, the majority of CUs contained no language. Specifically, for the deaf children, only 11% of CUs contained language at 22 months and 41% at 3 years of age. In contrast, language was contained in 53% and 75% of the hearing children's CUs at 22 months and 3 years of age, respectively (see Lederberg & Everhart, 1998, for a full description of CU modality).

After a CU was identified, it was coded along five dimensions. Two of the dimensions (modality and coordination with children's attention) were analyzed in Lederberg and Everhart (1998). This study reports the three additional dimensions described below. The first two dimensions examined the characteristics of the dialogue between the children and their mothers.

Dialogue: topic-coding. The dialogues between mother and child were divided into topic-based conversations. CUs were then coded into two, mutually exclusive and exhaustive, categories: (1) topic initiation: a CU that initiated a new topic for the dyad; and (2) maintained topic: a CU focused on the same topic as the previous CU (either by the speaker or partner). Topic initiations were either the first CU in the conversation after a 5-sec break in communication or a CU that changed the focus of the conversation. A topic was usually closely tied to the objects with which the dyad was playing (e.g., stacking rings, cars, baby, or cooking and eating). Thus, this code indicates which partner is responsible for starting conversations about a topic or theme. Because a topic could be initiated in response to a partner's behavior, this code does *not* measure topic-control, usually defined by the contingency of a person's response to his or her partner's attentional focus. For example, if a child picks up a truck after playing with some dolls and the mother says "Roll the truck here," the mother's CU would be coded as a topic initiation because she was the first one to communicate about the truck. Yet it is clear that the child is controlling the topic of conversation. Maintained-topic CUs measured how long the dyad continued conversing about a topic in terms of number of CUs.

Dialogue: CU redundancy and attentional focus. The second dialogic dimension measured how a particular CU related to both the previous CU and the partner's focus of attention. Each CU was coded into four mutually exclusive and exhaustive categories: (1) imitation: partially or totally repeating a partner's CU; (2) repetition: partially or totally repeating the speaker's (i.e., own) CU; (3) responsive: a CU that was related to the partner's focus of attention or behavior (e.g., saying "throw it" in response to a partner picking up the ball); (4) spontaneous: a CU that was not related to the partner's attentional focus (e.g., the child pointing to a wig while the mother is setting out the tea set).

The four categories were considered mutually exclusive and exhaustive. Because some CUs could fall in more than one category, the categories were considered hierarchical, such that if a CU fell in more than one category, the category listed earlier on the list was coded. For example, a repetition of a spontaneous CU was coded as a repetition, (e.g., Mom picks up a ball and says "catch," pauses, then says "catch" again; the first CU would be coded spontaneous, the second, repetition).

This code captured two attributes of the dialogue. The first attribute included repetition and imitation and measured how redundant a CU was with previous CUs. Although an important component of communication with young children, these types of CUs do not add to the content of dyadic conversations. The second attribute included responsive and spontaneous CUs and measured how much a speaker was responding to the partner's attentional focus. In other words, this second dimension coded whether CUs were based on the partner's or the speaker's agenda and, thus, was a measurement of topic-control. By excluding repetitions and imitations from this code, we measured the responsiveness of only those CUs that added information to the conversation.

Pragmatic function: child CUs. Each CU was also classified according to its communicative function or purpose. Nonlinguistic markers (e.g., facial expression, intonation), syntactic form of linguistic utterances, and

Table 2 Definition and examples of the categories used to classify the pragmatic function of mothers' CUs

Category name	Definition/ example from spoken utterances
Directives	
1. Direct directives	Behavioral commands/Push the car.
2. Indirect directives	Commands that are accomplished by questions or statements/ Will you give me the rings?
3. Attentional directives	Commands for attention/Look at this truck. See the Dolly?
Questions	
4. Information-real	Requests for information the communicator does not know/Are you hungry?
5. Information-constraint	Requests for information communicator knows/Is this a ball?
6. Rhetorical	Reflective statements made in question form/This is fun, isn't it?
Statements	
7. Statements-general	Declaration/ Labeling/ Comment of information/This doll is pretty. Girl.
8. Acknowledge-positive	Communication of acceptance of partner's behavior/Yes.
9. Acknowledge-negative	Communication of rejection of partner's behavior/No.
10. Teaching	Instruction through the use of statements/One, two, three.
11. Filler	Nonmeaningful conversational devices/Oh.

CU = Communicative unit.

context were all used in determining the communicative intention (i.e., the pragmatic function) of the linguistic and nonlinguistic CUs. Each child CU was coded into four mutually exclusive and exhaustive categories: (1) directive: a CU used to manipulate the partner's behavior; (2) question: an interrogative CU or a CU that seeks information; (3) statement: a comment or declarative sentence or phrase; (4) unclassifiable: CUs whose pragmatic function could not be determined. Coding the pragmatic category of the children's CUs was difficult because a large proportion of the children's CUs consisted solely of nonlinguistic communicative behaviors (e.g., vocalizations, points). To obtain reliability, certain guidelines had to be followed. First, when the function of a CU was ambiguous, coders usually used the "unclassifiable" category. Nonlinguistic vocalizations were almost always coded as unclassifiable. Second, the "default" guideline for points was to code them as directives. The pragmatic function of points, unaccompanied by language, is frequently ambiguous. On the one hand, they function most frequently as attention-getting directives (equivalent to "look at this"). But points can also be used to request information (e.g., "What is this?" See Yoshinaga-Itano & Stredler-Brown, 1992, for this interpretation of points). Because a question is a higher pragmatic function, coding points as directives was the conservative coding decision. We coded points as questions only when the child indicated that she or he was seeking information (e.g., had a questioning facial expression). Nicholas and Geers (1997) independently came to the same coding decisions we did. These decisions, although necessary, created the possibility that unclassifiable and directive categories are overrepresented in our description of children's communication.

Pragmatic function: maternal CUs. Because maternal CUs expressed a wider variety of functions, a system that included multiple subcategories of directives, statements, and questions was used. Each maternal CU was assigned to one of the 11 mutually exclusive and exhaustive categories listed in Table 2. Because of low frequency, constraint and rhetorical questions were combined into a category called "Not Real Questions" and teaching statements were combined with general statements in the analyses.

Reliability. Interobserver agreement for the communication coding was determined by having 26 randomly selected tapes (out of 80), with equal numbers of Hd and Hh dyads at each age, coded independently by a second pair of researchers. Interobserver agreement for coding the presence of a communicative CU was 91% (CU agreement included both the identification of behavior[s] as intentional communicative acts and the placement of CU boundaries based on pauses). Both point-by-point agreement and Cohen's kappa (which corrects for chance agreement) were then calculated,

Table 3 Means, standard deviations, and results of ANOVAs for topic-coding of children's CUs during 5-min of free play with hearing mothers

	Children				
Type of CUs	Age	Deaf	Hearing	ANOVA	*F* results
Frequency of CUs	22 mons.	24.8	32.4	A	49.98***
		(19.5)	(13.4)	H	15.49***
	3 yrs.	40.8	69.2	A × H	7.83**
		(21.7)	(19.2)		
Frequency of topic initiating CUs	22 mons.	2.1	1.7	A	4.09*
		(2.4)	(1.5)		
	3 yrs.	2.4	3.2		
		(1.5)	(2.6)		
Frequency of topic maintaining CUs	22 mons.	22.7	30.7	A	50.51***
		(18.3)	(12.9)	H	15.77***
	3 yrs.	38.3	66.1	A × H	7.61 **
		(21.2)	(19.4)		

A = Significant age effects. H = Significant hearing status effects. A × H = Significant interaction between age and hearing status. CU = Communicative Unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

pooled over sessions, for each of the three dimensions used to code the CUs. The coders agreed on topic-coding (i.e., initiation vs. maintenance) for 96% of the CUs (Cohen's $\kappa = .66$). Agreement for CU redundancy and attentional focus was 75% (Cohen's $\kappa = .55$). Agreement for pragmatic categories was 84% (Cohen's $\kappa = .81$).

Results

General Data Analysis

The main data analyses compared the dialogic and pragmatic characteristics of CUs at two ages for the two types of dyads using a series of 2 (child hearing status) × 2 (age) repeated measures Multiple Analyses of Variance (MANOVAs). Related dependent measures were analyzed in each MANOVA. When the overall MANOVA was significant, 2 (child hearing status) × 2 (age) repeated measures Analyses of Variance (ANOVAs) were computed for individual variables. Whenever there was an interaction between hearing status and age, two pairs of planned comparisons were conducted: (1) the effect of child hearing status within each age was analyzed by comparing Hd and Hh dyads at 22 months and again at 3 years, and (2) developmental change was examined by comparing communication at 22 months with that at 3 years for the two types of dyads using repeated measures planned comparisons (using the Bonferroni procedure, significance for the planned comparisons was set at $p < .01$). Because of the number of variables analyzed in this study, *only* variables that showed significant univariate effects are included in tables of descriptive statistics. Complete tables can be obtained from the first author.

Children's Communication

Dialogue: number of CUs. An ANOVA that analyzed the children's frequency of CUs showed significant main effects for hearing status, age, and an interaction between the two. Table 3 displays means, standard deviations, and results of ANOVAs. Both deaf and hearing children increased the frequency of CUs from 22 months to 3 years, $t(19) = 2.49$, $p < .05$; $t(19) = 9.56$, $p < .001$, respectively. However, hearing children increased the amount they communicated much more than deaf children. Therefore, hearing children had significantly more CUs than did deaf children at 3 years, $t(38) = 4.40$, $p < .001$, but not at 22 months, $t(38) = 1.43$, $p < .16$.

Dialogue: topic-coding. The next set of analyses examined the frequency that these CUs were used to initiate or maintain a topic of conversation. The two-way MANOVA that analyzed two dependent variables (frequency of topic-initiating and topic-maintaining CUs) showed significant main effects for hearing status, $F(4, 35) = 4.28$, $p. < .01$; age, $F(5, 35) = 15.88$, $p < .001$; and an interaction between the two, $F(5, 35) = 2.63$, $p < .05$ (see Table 3).

Topic initiations showed only a main effect of age, with no effects of hearing status. From 22 months to 3 years, both deaf and hearing children increased the number of topics they initiated.

The frequency of topic-maintaining CUs showed significant main effects for hearing status, age, and an interaction between the two (see Table 3). Both deaf and hearing children used significantly more topic-maintaining CUs at 3 years than at 22 months, $t(19) = 2.57$, $p < .01$; $t(19) = 9.28$, $p < .001$, for deaf and hearing children, respectively. However, this developmental change was much more dramatic for the hearing children. Consequently, hearing children used significantly more topic-maintaining CUs than deaf children at 3 years, $t(38) = 4.33$, $p < .001$ but not at 22 months, $t(38) = 1.59$, $p < .2$. This analysis indicates that group differences in the frequency of communication primarily occurred in maintaining conversations.

Dialogue: CU redundancy and attentional focus. The other dimensions of child communication were analyzed on proportional data (i.e., type of CU/total frequency of CUs) because the deaf and hearing children differed in the number of CUs they used with their mothers.

The two dimensions captured in the next code were analyzed separately. First, CU redundancy was analyzed using a two-way MANOVA (proportion of child CUs that were repetitions and imitations.) There was a significant main effect for age, $F(2, 37) = 3.40$, $p < .05$, and an interaction between hearing status and age, $F(2, 37) = 7.36$, $p < .01$. Follow-up analyses revealed only a significant interaction between age and hearing status for imitations (see Table 4). Hearing children decreased the amount they imitated their mothers as their language developed, with imitations common at 22 months but almost nonexistent at 3 years of age, $t(19) = 3.53$, $p < .001$. Deaf children did not significantly change the amount they imitated their mothers from 22 months to 3 years of age, $t(19) = 1.31$, $p < .2$. As a result, deaf children imitated their mother less than hearing children at 22 months but more at 3 years of age, $t(38) = 2.70$, $p < .01$; $t(38) = 2.44$, $p < .03$, respectively.

Next, the degree to which children communicated about topics related to their mother's attentional focus was analyzed. An ANOVA was conducted on the proportion of nonredundant CUs that were responsive (i.e., responsive CUs/spontaneous + responsive CUs). This excluded imitations and repetitions (which were mutually exclusive with responsive and spontaneous CUs and differed in frequency for the deaf and hearing children). There was a main effect for age, with both deaf and hearing children becoming significantly more responsive to their mothers' attentional focus from 22 months to 3 years of age. As is evident in Table 4, deaf and hearing children had almost identical rates of responsive CUs at both ages.

Pragmatic function: unclassifiable CUs. Table 5 lists the means, standard deviations, and results from ANOVAs for the four pragmatic categories used to classify children's CUs. Because almost all CUs that contained only nonlinguistic or unintelligible vocalizations were considered unclassifiable for pragmatic category, a major proportion of the deaf and hearing children's CUs were not classified for pragmatic function. An ANOVA of the proportion of all CUs that were unclassifiable revealed significant main effects of hearing status and age. Deaf children had a higher proportion of unclassifiable CUs than hearing children (see Table 5). For both deaf and hearing children, the proportion of unclassifiable CUs decreased with age.

Pragmatic function: classifiable CUs. The proportions of CUs for the three pragmatic categories were calculated excluding these unclassifiable CUs because the frequency of unclassifiable CUs differed for the deaf and hearing children.[1] A two-way MANOVA that analyzed two variables (questions and directives) showed main effects for hearing status, $F(2, 36) = 18.99$, $p < .0001$, for age, $F(2, 36) = 3.48$, $p < .05$ and an interaction between hearing status and age, $F(2, 36) = 3.62$, $p < .05$. (This MANOVA excluded statements because of

Table 4 Means, standard deviations, and results of ANOVAs for redundancy and attentional focus of children's CUs

	Children				
Type of CUs	Age	Deaf	Hearing	ANOVA	*F* results
Imitative					
(Proportion of total CUs)	22 mons.	.03	.11	A × H	12.47***
		(.06)	(.12)		
	3 yrs.	.06	.01		
		(.10)	(.01)		
Responsive					
(Proportion of non-redundant CUs)	22 mons.	.66	.67	A	40.56***
		(.24)	(.16)		
	3 yrs.	.87	.89		
		(.09)	(.07)		

A = Significant age effects. A × H = Significant interaction between age and hearing status. CU = Communicative unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 5 Means, standard deviations, and results of ANOVAs for pragmatic function of children's CUs

	Children				
Pragmatic Function	Age	Deaf	Hearing	ANOVA	*F* results
Unclassifiable CUs					
(Proportion of total CUs)	22 mons.	.67	.46	A	26.31***
		(.21)	(.21)	H	16.84***
	3 yrs.	.42	.22		
		(.23)	(.12)		
Directives					
(Proportion of classifiable CUs)	22 mons.	.59	.14	A	6.52**
		(.38)	(.20)	H	35.74***
	3 yrs.	.28	.19	A × H	7.40**
		(.19)	(.09)		
Statements					
(Proportion of classifiable CUs)	22 mons.	.38	.77	A	4.43*
		(.36)	(.22)	H	20.73***
	3 yrs.	.66	.74	A × H	6.86*
		(.20)	(.13)		
Questions					
(Proportion of classifiable CUs)	22 mons.	.02	.09	H	5.65*
		(.08)	(.13)		
	3 yrs.	.06	.11		
		(.09)	(.08)		

A = Significant age effects. H = Significant hearing status effects. A × H = Significant interaction between age and hearing status. CU = Communicative unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

the assumption of nonmulticollinearity for dependent variables in MANOVAs. However, statements were analyzed in the ANOVA analyses to examine which of the three pragmatic functions showed significant effects.)

The three ANOVAs (one each for directives, statements, questions) revealed significant main and interaction effects of age and hearing status for both directives and statements; and a main effect of hearing status for questions. As evident in Table 5, hearing children used their communication primarily to make statements, while occasionally asking questions and directing their mother. The pragmatic function of hearing children's CUs did not change developmentally. In contrast, at 22 months, deaf children primarily used their communication to direct their mothers (significantly more than hearing children, $t[37] = 4.55$, $p < .001$); were much less likely to make statements than hearing children, $t(37) = 4.17$, $p < .001$; and rarely asked any questions. From 22 months to 3 years of age, deaf children made fewer directives but more statements, $t(19) = 2.83$, $p < .01$, $t(19) = 2.66$, $p < .01$, respectively. As a result, by 3 years of age, deaf children still directed their mothers more than hearing children but did not differ significantly on quantity of statements, $t(38) = 2.66$, $p < .01$; $t(38) = 1.68$, $p < .2$, respectively. The deaf 3-year-olds still infrequently asked questions.

Maternal Communication

The analyses of the dialogic and pragmatic coding of maternal CUs was primarily conducted to determine dyadic differences in three measures of maternal control: turn-taking, topic, and response control (Tannock, 1988). In addition, the other dialogic and pragmatic characteristics of maternal communication that were coded were included in the analyses (i.e., redundancy, all pragmatic functions).

Dialogue: turn-taking control. Turn-taking control or maternal "dominance" has been measured in several ways. Tannock (1988) proposed that turn-taking control should be measured by the frequency of maternal communication. Another operational definition of turn-taking control or "maternal dominance" is the percentage of dyadic communicative acts produced by a mother (Musselman & Churchill, 1992; 1993). In this study, it was also possible to measure maternal dominance in a third way: the amount mothers were responsible for initiating conversations. This was measured by the proportion of dyadic topic initiations by the mother (i.e., number of topic-initiating CUs by mother/total number of dyadic topic-initiating CUs). The two-way MANOVA analyzing these three measures of maternal turn-taking control revealed significant main effects for hearing status, $F(3, 33) = 4.69$, $p < .01$, and for age, $F(3, 33) = 14.66$, $p < .001$.

As shown in Table 6, all three measures of turn-taking control showed significant main effects for age. For both deaf and hearing children, there was a decrease in maternal dominance from 22 months to 3 years of age. Specifically, mothers decreased the number of CUs they directed to their children, and maternal CUs accounted for a decreasing proportion of the dyads' CUs as the children developed from 22 months to 3 years of age. Although mothers introduced the vast majority of topics at 22 months, mother and child shared the initiation of conversations about a topic more equally at 3 years of age.

There were no effects of hearing status on two of the three measures of dominance. Mothers of deaf and hearing children did not differ significantly in frequency of CUs or initiations. Child hearing status did affect one variable: Mothers of deaf children contributed a higher proportion of the dyads' CUs than did mothers of hearing children. This difference was not caused by differential behaviors on the mothers' part. As is evident in Table 6, mothers of deaf children actually communicated (nonsignificantly) *less* than mothers of hearing children. However, because deaf children had fewer CUs than hearing children (see Table 3), their mothers dominated the interactions more than mothers of hearing children in terms of the amount of dyadic communication that was mothers'.

In summary, only one measure of maternal dominance showed a significant impact of child deafness: proportion of dyadic CUs that was mothers'. This difference seemed more attributable to differences in child than maternal behavior. When dominance was measured in the manner that Tannock (1988) suggested, mothers of deaf children did not dominate communication more than mothers of hearing children.

Table 6 Means (standard deviations) and ANOVA results for measures of turn-taking control by mothers

Measure of turn-taking control	Children				
	Age	Deaf	Hearing	ANOVA	*F* results
Frequency of maternal CUs	22 mons.	84.4	110.0	A	7.31***
		(34.7)	(30.5)		
	3 yrs.	79.9	90.5		
		(33.0)	(30.9)		
Proportion of dyadic					
CUs that were mothers'	22 mons.	.79	.77	A	47.13***
		(.12)	(.08)	H	4.88*
	3 yrs.	.66	.56		
		(.15)	(.10)		
Proportion of topic initiations					
that were mothers'	22 mons.	.70	.70	A	22.25***
		(.25)	(.27)		
	3 yrs.	.53	.36		
		(.25)	(.26)		

A = Significant age effects. H = Significant hearing status effects. CU = Communicative unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Dialogue: topic-control/attentional focus. Similar to Tannock (1988) and Spencer and Gutfreund (1990), we defined topic-control as the degree to which mothers communicated about topics related to their children's attentional focus. An ANOVA was conducted on the proportion of nonredundant CUs that were responsive (i.e., responsive CUs/spontaneous + responsive CUs). This excluded imitations and repetitions (which were mutually exclusive with responsive and spontaneous CUs).

There were no effects for hearing status. As is evident in Table 7, responsiveness to their children's attentional focus was almost identical for the mothers of deaf and hearing children. There was a main effect for age (see Table 7). Mothers of both deaf and hearing children became more responsive from 22 months to 3 years of age.

Dialogue: CU redundancy. The MANOVA that analyzed the redundancy of communication (proportion of CUs that were repetitions and imitations) revealed significant main effects for hearing status, $F(2, 37) = 13.91$, $p < .001$; and age, $F(2, 37) = 34.13$, $p < .001$. Mothers of deaf children were more likely to repeat their CUs than mothers of hearing children. Maternal repetitions decreased from 22 months to 3 years of age (see Table 7).

Pragmatic Function

Three MANOVAs were used to examine differences in the nine categories of pragmatic functions of maternal CUs. Each MANOVA was used to analyze one of the three major types of pragmatic function (directives, statements, and questions). Table 8 displays the means, standard deviations, and results of ANOVAs for all pragmatic categories that showed significant main or interaction effects on follow-up ANOVAs. Only those variables that showed significant effects are discussed below.

Directives/response control. We used this analysis to indicate differences in response control. The MANOVA examined differences in the use of three types of directives (direct directives, indirect directives, and attention-getting directives). The MANOVA showed main effects for hearing status, $F(3, 36) = 3.25$, $p < .05$; for age, $F(3, 36) = 4.15$, $p < .05$; and an interaction between hearing status and age, $F(3, 36) = 3.23$, $p < .05$.

For direct directives, the follow-up ANOVA revealed significant main effects for hearing status and age but no interaction between the two. Mothers of deaf children were more likely to use direct directives than were mothers of hearing children. Mothers of

Table 7 Means (standard deviations) and ANOVA results of topic-control and redundancy of mother's CUs

	Children				
Type of CU	Age	Deaf	Hearing	ANOVA	*F* results
Responsive CUs					
(Proportion of nonredundant CUs)	22 mons.	.86	.85	A	15.73***
		(.11)	(.09)		
	3 yrs.	.92	.95		
		(.06)	(.05)		
Repetitions					
(Proportion of total CUs)	22 mons.	.19	.12	A	69.65***
		(.07)	(.06)	H	27.06***
	3 yrs.	.11	.02		
		(.06)	(.02)		

Note: A = Significant age effects. H = Significant hearing status effects. A × H = Significant interaction between age and hearing status. CU = Communicative unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 8 Means (standard deviations) and ANOVA results of pragmatic function of maternal CUs

	Children				
Type of CU	Age	Deaf	Hearing	ANOVA	*F* results
Directives					
Direct directives	22 mons.	.21	.15	A	11.98***
		(.13)	(.07)	H	7.34**
	3 yrs.	.15	.08		
		(.13)	(.06)		
Attention-getting directives	22 mons.	.06	.07	A×H	7.72**
		(.06)	(.05)		
	3 yrs.	.09	.04		
		(.05)	(.04)		
Statements					
Positive acknowledgements	22 mons.	.12	.09	A	6.67*
		(.08)	(.06)	A×H	12.68**
Questions	3 yrs.	.10	.17		
		(.06)	(.08)		
Real questions	22 mons.	.06	.07	A	51.14***
		(.04)	(.05)		
	3 yrs.	.16	.22		
		(.14)	(.09)		
Not real questions	22 mons.	.08	.09	A	30.38***
		(.03)	(.04)		
	3 yrs.	.04	.06		
		(.03)	(.04)		

Note: A = Significant age effects. H = Significant hearing status effects. A× H = Significant interaction between age and hearing status. CU = Communicative unit.

*$p < .05$.

**$p < .01$.

***$p < .001$.

both deaf and hearing children decreased their use of direct directives from 22 months to 3 years of age. At 3 years of age, mothers of deaf children used direct directives to the same degree as mothers of hearing 22-month-olds (see Table 8).

For attention-getting directives, there was a significant interaction between hearing status and age. At 22 months, the use of attention-getting directives did not differ for mothers of deaf and hearing children. Attention-getting CUs decreased between 22 months and 3 years of age for mothers of hearing children, $t(19) = 2.21$, $p < .05$, but not for mothers of deaf children. Therefore, by 3 years, mothers of deaf children used significantly more attention-getting CUs than mothers of hearing children, $t(38) = 3.27$, $p < .01$.

As shown in the analysis of the redundancy of communication, mothers of deaf children repeated their CUs more than mothers of hearing children. Meadow et al. (1981) suggested that differences in maternal response controls are caused by mothers of deaf children's repeating directives because their children did not understand their initial CUs. To ensure this was not the case, analyses for directives were conducted again, excluding repetitions. These analyses yielded similar results as those with the whole data set, indicating that the higher rate of direct and attention-getting directives was not an artifact of an increase in repetitions.

Statements. The MANOVA that examined the four types of statements (general, positive acknowledgments, negative acknowledgments, and filler) showed a main effect for age, $F(4, 35) = 3.56$, $p < .05$; and an interaction between hearing status and age, $F(4, 34) = 2.95$, $p < .05$. In follow-up ANOVAs, only positive acknowledgments showed significant effects (a main effect for age, and an interaction between hearing status and age). At 22 months, mothers acknowledged their deaf and hearing children to a similar degree. Mothers of hearing children increased their use of acknowledgments from 22 months to 3 years, whereas mothers of deaf children did not, $t(19) = 4.25$, $p < .001$; $t(19) = .71$, $p < .5$, respectively. Therefore, mothers of deaf children at 3 years acknowledged their children significantly less than mothers of hearing children, $t(38) = 3.27$, $p < .01$.

Questions. The last MANOVA that examined two types of questions (real, not real) showed only a significant main effect for age, $F(2, 37) = 36.15$, $p < .001$. ANOVAs revealed that there were main effects of age for both real and not real questions. Mothers of both deaf and hearing children increased their use of real questions and decreased their use of noninformation-seeking questions from 22 months to 3 years of age.

Discussion

This study, when combined with the results of Lederberg and Everhart (1998), gives us a multidimensional description of young deaf children's communication skills. Comparisons of deaf and hearing children's communication skills at 22 months indicate how communication is affected when linguistic differences between hearing and deaf children first emerge. As Spencer (1993) found with deaf and hearing infants, communication by deaf and hearing 22-month-olds was similar along several dimensions. Deaf and hearing toddlers communicated with equal frequency to their mothers (Lederberg & Everhart, 1998). They also used a similar mixture of topic initiation and maintenance; as well as spontaneous and responsive communications. Therefore, contrary to earlier suggestions (e.g., Wedell-Monnig & Lumley, 1980), deaf toddlers were not passive in their interactions with their mothers and showed no depression in their motivation to communicate. Deafness also did not have a major impact on the modality of communication; all toddlers primarily communicated through the use of their voice (Lederberg & Everhart, 1998). This shows that Spencer's surprising finding that deaf and hearing children's early nonlinguistic communication to their hearing mothers is not significantly different continues to be true even at 22 months.

Although deaf and hearing 22-month-olds' communication was similar in terms of quantity, modality, and dialogic characteristics, there were some important differences in pragmatic function. Deaf toddlers rarely used language to communicate. Because they almost exclusively relied on nonlinguistic vocalizations, the meaning or pragmatic function of the majority of the deaf toddlers' communications was unclear. Thus, deaf children's CUs seemed to serve more of a social orient-

ing function (i.e., "Pay attention to me/this") and only communicated meaningful information when combined with object-based social behaviors.

Communication that did have a clear function served different purposes for the deaf and hearing toddlers. Hearing toddlers were more likely to make statements, ask questions, and imitate their mother, whereas deaf toddlers were more likely to direct their mothers. Perhaps it is easier to command using nonlinguistic communication (e.g., with a point) than to ask a question or make a statement. Nicholas and Geers (1997) found pragmatic function of deaf children's communications tied to their linguistic abilities. In their study, oral deaf children used nonlinguistic vocalizations and gestures to direct their mothers and used speech to make statements. Thus, deaf children can direct their mothers by pointing and vocalizing to an object as if to say "Look at that." Language, even single words, may give children the means to comment on and question their mothers.

Deaf children's communication skills showed progress between 22 months and 3 years of age, albeit not as much as hearing children in some areas. The deaf children increased the amount they communicated as they developed but fell far behind their hearing peers. Deaf children did not increase the amount they maintained conversations around a topic as much as hearing children. At 3 years of age, although deaf and hearing children did not differ in quantity of new topic initiations, deaf children maintained topics for a much shorter time than hearing children.

Conversations became more mutual for both deaf and hearing children. Between 22 months and 3 years of age, deaf and hearing children became equally more responsive to their mothers' attentional focus. Thus, both deaf and hearing children increasingly communicated only while engaged in joint attention with their mothers such that by 3 years more than 90% of dyadic communication occurred while both members shared a common focus.

By 3 years of age, almost all deaf children transitioned from a purely nonlinguistic communication system to one that contained some language. However, most deaf 3-year-olds primarily used one-word utterances and less than half of their communicative units contained any language (sign or speech) (Lederberg & Everhart, 1998). This transition into language allowed the function of their communication to change. The function of the majority of the deaf 3-year-old CUs was clear. The deaf children also increased their statements and decreased directives to their mother. Despite these developmental changes, the function of communication by deaf and hearing 3-year-olds still differed. Deaf children were more likely to direct and less likely to request (by questions) information from their mothers than were hearing children. Nicholas and Geers (1997; Nicholas et al., 1994) found similar pragmatic deficits among language-delayed oral deaf children, suggesting these findings are not specific to one particular type of linguistic environment.

In summary, our results suggest that child deafness does not cause a "general communication deficit." Areas of development such as responsive communication and topic initiation seem to be unaffected by child deafness at 22 months and 3 years of age. On the other hand, being able to maintain a topic of conversation and use communication to comment and ask questions are areas of concern.

Researchers concerned with the lack of linguistic progress among deaf children have hypothesized that hearing mothers of deaf children create a linguistic environment less conducive for language and communicative development by being overcontrolling (Gallaway & Woll, 1994). This study is one of the few studies that examined the effect of child deafness on three different dimensions of maternal control. Mothers of deaf children were more "controlling" along only one dimension. As in past research, mothers of deaf children used more response controls than did mothers of age-matched hearing children. Such directiveness seems to be an intuitive adaptation to the children's linguistic development (Cross et al., 1985; Power et al., 1990). Mothers used the same amount of directives and acknowledgments to their deaf 3-year-olds as mothers used to their hearing 22-month-olds, who were similar to the deaf 3-year-olds in language level. These results are consistent with research (Cross et al., 1985; Power et al., 1990) that found no differences in the pragmatics of maternal communication of language-matched deaf and hearing children. Because this type of communica-

tion is *tuned to* the deaf children's language abilities, it is unlikely to be the *cause* of their language delay.

This study conflicts with others (e.g., Kenworthy, 1986; Wedell-Monnig & Lumley, 1980) that conclude that mothers of deaf children dominated communicative interactions by "flooding their child" with more language than mothers of hearing children. In this study, mothers of deaf children actually communicated (nonsignificantly) less to their children than mothers of hearing children. Mothers of deaf children also were responsible for initiating dyadic conversations at the same rate as mothers of hearing children. From 22 months to 3 years, both Hd and Hh dyads transitioned from topics being primarily initiated by mothers to more of a balance between mothers and children. Therefore, deaf children were allowed to initiate conversations and were not the target of a barrage of communication. The dominance sometimes observed with mothers of deaf children may be caused by the characteristics of the deaf children's intervention program, rather than an intuitive adaptation to child deafness. Meadow et al. (1981) found that maternal dominance occurred with orally educated deaf children but not when mothers used both sign and speech to communicate. Although this result suggests the use of sign decreased the mothers' tendency to dominate the interaction, it may be the kind of intervention program rather than the modality of communication that is important. In this study, although the majority of children were acquiring both sign and speech, most mothers used sign infrequently with their children. Therefore, use of sign per se did not cause the mothers of deaf children in this study to be less dominant than mothers examined in previous research. Perhaps earlier findings of dominance were an artifact of the kind of advice the mothers were receiving, rather than an inevitable consequence of communicating primarily through speech. For example, mothers may be encouraged to use certain language-eliciting strategies that result in a more dominant style of interaction.

Although two measures of maternal dominance or turn-taking control, the frequency of maternal communication and topic initiation, did not show group differences, there was one way in which mothers of deaf children were more dominant than mothers of hearing children. Because deaf children communicated less than hearing children, their mothers' communications accounted for a higher proportion of dyadic CUs. It is unclear how to interpret this type of turn-taking control. On the one hand, it may represent a *failure* of hearing mothers to appreciate the optimum rate of communication with deaf children. Deaf children's reliance on visual communication requires them to divide their attention between environment and communicator. In order to allow deaf children to divide their attention, optimum communication may require mothers to match their children's lower communication rate. However, results from Lederberg and Everhart's (1998) study suggest that this may not be the case at 3 years of age. They found that between 22 months and 3 years, maternal communication became increasingly coordinated with deaf children's visual attention. By 3 years of age, deaf children saw 98% of maternal CUs containing visual communicative acts. Therefore, decreasing the amount mothers communicate at 3 years does not seem necessary to adapt to deaf children's visual attention needs. The "imbalance" of maternal to child communication may be an inevitable consequence of deaf children's slower increase in the frequency of communication; something we have argued is a direct result of their slower linguistic progress. Therefore, hearing mothers' turn-taking control (in terms of a higher proportion of CUs) may be appropriate to the deaf children's level of language development.

Finally, contrary to the findings of several small-scale studies (Cross et al., 1980; Kenworthy, 1986; Spencer & Gutfreund, 1990), mothers of deaf children did not exert more topic control than mothers of hearing children. They were just as responsive to their children's attentional focus as mothers of hearing children were. Because topic control is most conclusively linked to language development, this result suggests mothers are not hindering their children's development by being more "controlling." Overall, therefore, although mothers of deaf children used more response controls (i.e., directives), their responsiveness to their children's agenda and their lack of dominance in the dyads' communicative interaction contradict the frequently repeated description of hearing mothers overcontrolling their deaf children.

Concern has been expressed by researchers (Musselman & Churchill, 1992; Nienhuys, Cross, & Horsborough, 1984) that hearing mothers of deaf children are not as sensitive to developmental change in their children's communicative abilities as mothers of hearing children. Because these studies have either been cross-sectional (Neinhuys et al., 1984) or lacked hearing comparison groups (Musselman & Churchill, 1992), there has not been an appropriate study to judge these concerns. This study suggests that these concerns are unfounded. For almost all dimensions examined, mothers of deaf and hearing children modified their communication to their children similarly as their children developed. From child-age 22 months to 3 years, mothers of both deaf and hearing children decreased the amount they communicated, allowed their children more of the responsibility for initiating a conversation, and became more responsive to their children's focus of attention. They also decreased their use of directives and of questions that solicited information the mother already knew and increased their use of real questions. In fact, only two characteristics showed an interaction between child age and hearing status. Mothers of deaf children did not increase their use of acknowledgments or decrease their use of attention-getting devices as much as mothers of hearing children. Both these differences seem adaptive to the deaf children's communication. Because deafness requires more arduous attention demands, it is likely deaf children will frequently elicit more attention-getting CUs. In addition, deaf children's lower rate of question-asking gives mothers fewer opportunities to say "yes" to their children (i.e., to use an acknowledgment) (Cross et al., 1985).

This study examined the communication of a relatively large group of deaf children who were enrolled in a range of language learning environments (except use of ASL). We successfully recruited almost all deaf children who were being served by urban and suburban schools in a metropolitan area. Its longitudinal design allowed us to describe developmental change in both children's and mothers' communication as the deaf children transitioned from prelinguistic to linguistic communication. However, there are several weaknesses of the study that should be kept in mind when generalizing from the results. First, the participants in the study differed from the general population in some ways: all were identified and enrolled in an early intervention program prior to the age of 22 months, although few prior to 6 months; only Caucasian English-speaking families were included; and multiple-handicapped children were excluded. In addition, due to the time-consuming nature of the coding system, only 5 minutes of communication were analyzed. Finally, because of the difficulty of defining topic and attentional focus, reliability for topic-related coding, although acceptable (Fleiss, 1981), is lower than we would have liked.

This study has some important implications for early intervention programs. The deaf children made progress in their communication development during the year they were followed. However, the slow progress in their development of linguistic skills limited the quantity and quality of their communication. Nicholas and Geers (1997) suggest that intervention programs can focus on developing the pragmatic functions that seem to be most affected by linguistic delay: questions and statements. However, these pragmatic functions may develop only as deaf children develop the linguistic means to express them. It will be interesting to see if intervention strategies suggested by Nicholas and Geers (1997) result in an improvement of deaf children's conversational skills even when children still have limited linguistic skills.

Our research suggests the negative image of hearing mothers' communication abilities may be exaggerated: Communication by mothers of deaf children (at least those that are identified relatively early and are advantaged) seemed to be appropriate in terms of its pragmatic and dialogic characteristics. Past descriptions of mothers being overcontrolling may have been particular to certain types of intervention programs (e.g., increased turn-taking control by mothers enrolled in some oral programs) or particular measures of control (e.g., response control). Of course, the appropriateness of mothers' communication in this study may be the result of particularly successful intervention programs. However, this seems unlikely. The mothers came from five different intervention programs. In addition, the amounts of time children were in intervention programs did not correlate with the characteristics of their mothers' communication (Lederberg & Everhart, 1998). Mothers of deaf children

may *intuitively* make adaptations to their children's linguistic abilities similar to the ways mothers of hearing children do (see Koester, Papousek, & Smith-Gray, 2000, for a discussion on intuitive parenting of deaf children). Intervention programs should build on these intuitive adaptations and make sure any intervention strategies taught to parents do not disrupt the parents' intuitive adaptations to their children.

Although the pragmatic characteristics of maternal input may not be a handicap for deaf children, hearing mothers' communication frequently does not supply an accessible language model for the children. For example, although the majority of deaf children in this study were enrolled in SC programs, those programs were not very successful in promoting signing among these mothers. Because the amount mothers' sign affects deaf children's (sign) language development (Spencer & Lederberg, 1997), clearly intervention strategies that facilitate sign use by mothers should be prioritized in SC intervention programs. Intervention programs also need to teach mothers strategies that make language (both spoken and signed) more visually accessible to deaf children (e.g., Mohay, 2000). Since these strategies are unique to interactions with deaf children, the goal of making maternal communication to deaf children similar to maternal communication to hearing children seems inappropriate.

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Note

1. CUs were unclassifiable only in terms of their pragmatic function for children. All CUs could be categorized for dialogic dimensions. Therefore, all CUs were included in the previous analysis.

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