This study examined early pragmatic skill development in a group of 38 children with severe or profound hearing loss between 1 and 4 years of age who were enrolled in a simultaneous communication (SC) approach to language learning. Both their use of intentionally communicative acts and their use of language were studied in an analysis of 30-min play sessions between a child and the primary caregiver. Results were compared with previously published data from two age-matched groups: 38 deaf children who were enrolled in oral communication (OC) programs and 84 normally hearing (NH) children. All groups showed a significant improvement with age in the communicative behaviors measured; therefore, the overall trend was toward growth—in all age groups—even when the rates of growth differed. By age 3 years, a pattern of communicative function use had emerged in all three groups. Patterns exhibited by deaf children in the SC and OC groups were similar to each other and to younger NH children but dissimilar to NH age mates. Although the use of signed input by normally hearing parents and teachers did not serve to ameliorate the profound effects of hearing loss on communication development in SC children, it did provide some early advantages. The children in SC groups did not exhibit an advantage over children in OC groups in their overall frequency of communication or the breadth of their vocabulary but they began using words earlier and used mature communicative functions significantly more often. Although children in the OC groups did not exhibit a significant advantage in the overall amount of speech used, they showed an advantage in the breadth of their spoken vocabulary in a conversational setting. Implications for early intervention programming are discussed.

It is well known that a lack of natural and complete linguistic input in early childhood contributes to significant language delays in children with severe and profound hearing losses. If a deaf child has deaf parents who are fluent users of a signed language, the child will develop a signed language in a normal, natural fashion, achieving language development milestones in sign at about the same ages as normally hearing children develop them in speech (Bonvillian, Orlansky, & Novak, 1983; Prinz & Prinz, 1985). It is the case, however, that the vast majority (more than 90%) of deaf children are born to parents who do not have a hearing loss and who are not familiar with a signed language (Van Cleve, 1987). The majority of these parents choose for their child either a simultaneous communication (SC) approach to language development, which emphasizes the combination of spoken language with corresponding manual signs, or an oral communication (OC) approach, which emphasizes the auditory signal with or without visual cues from the speaker’s lips.

Neither the SC nor the OC educational approaches have been completely successful in eliminating language delays for severely to profoundly deaf children (Geers & Moog, 1992; Geers, Moog, & Schick, 1984; Geers & Schick, 1988; Rodda & Grove, 1987). Children who par-
ticipate in the oral approach have difficulty receiving the linguistic input provided to them because the speech signal that they rely on for that input is degraded. Although they may be helped enormously by hearing aids or a cochlear implant, these children usually remain unable to extract enough auditory information to develop spoken language with the ease and efficiency of a normally hearing child. Those children whose parents opt for an SC approach also may not receive sufficient linguistic input because (a) the manual systems that have been developed to correspond to spoken words do not constitute natural languages themselves, (b) many of the parents do not develop proficiency with the sign system in the child’s early years or do not use it consistently (Moeller & Luette-Stahlman, 1990), and (c) the same problem of degraded auditory input exists for these children as for children using the OC approach.

**Early Pragmatics in Typical and Atypical Development**

One of the most important pragmatic skills of young children is the ability to express a variety of communicative functions, which are the social purposes of conversation (e.g., requesting, answering, calling attention to an event or object, directing, acknowledging, or attempting to get information). Various child language researchers have theorized that preverbal speech acts form the underlying basis on which verbal acts rest. In other words, at some point after the child has acquired nonverbal means of expressing communicative functions, he or she begins to substitute conventional, verbal means of expressing those functions (Bates, 1976; Ninio & Snow, 1988, 1999). Very young children with no sensory or language impairments have been shown to follow a rather predictable path in the emergence of these functions (Carpenter, Mastergeorge, & Coggins, 1983; Nicholas, 2000; Olswang, Stool-Gammon, Coggins, & Carpenter, 1987). Several researchers have observed or implied that the normal development of communicative functions proceeds from the directing or “instrumental” types to the informational or “heuristic” types (Nicholas, 2000; Olswang et al., 1987).

Examination of the development of communicative functions in deaf children has revealed varying degrees of deviation from a “normal” pattern, from minimal to substantial (Curtiss, Prutting, & Lowell, 1979; Kricos & Aungst, 1984; Skarakis & Prutting, 1977). In a study of five 3-year-old children who were receiving Signed English input, Day (1986) found that a relatively typical range of communicative functions was expressed, as was a normal rate of communication when nonverbal communication is considered. A close examination of the proportion of communicative function categories represented in the everyday interactions of these children with their parents, however, was different from that reported in the literature for normally hearing children. Though category names are different across studies in this field, it appears that the children in Day’s study used a relatively larger percentage of imitations, requests for objects, requests for actions, and attention-getting actions than did normally hearing children of the same age. There were lower percentages of such informative or heuristic communication function categories as requests for information (posed as Wh- or Yes/No Questions) or responses. Similar findings were reported by Yoshinaga-Itano and Stredler-Brown (1992), who found nonverbal requests for information to be notably lacking in deaf children younger than 36 months of age and by Pien (1984), who found a lack of informative functions in the same age group. A study of functional communication in parent–child dyads by Meadow, Greenberg, Erting, and Carmichael (1981) found that deaf children of hearing mothers produced no more than half the number of questions and responses produced by hearing children of the same age. This was true whether the child used an OC or an SC mode. Similarly, Lederberg & Everhart (2000) reported that deaf children were more likely to use instrumental functions and less likely to ask questions than were their normally hearing age mates.

Our own previous work, which focused on children whose families and schools took an oral approach to communication, suggested that these children (as compared with typically developing hearing children) were significantly delayed in the rate of communicative acts expressed, were restricted in the range of communicative functions expressed, and were more likely to use “less mature” types of communicative acts, for example, fewer of the informative or heuristic type of functions (Nicholas, 2000; Nicholas & Geers, 1997; Nicholas, Geers, & Kozak, 1994).
A strong positive relationship between the use of mature communicative functions and measures of linguistic development (such as rate of communication, breadth of vocabulary, and the ability to combine words in utterances) appears to exist in both normally hearing children and children with hearing loss who are a learning spoken language (Nicholas, 2000). There are several different ways that one may interpret this finding. It may mean that (a) advancing linguistic abilities allow for mature communicative functions to be expressed more easily, (b) a common underlying cognitive ability allows for their closely tied emergence, or (c) an increased amount of successful social interaction, made possible by the use of more varied and mature communicative functions, leads to increased competence in the realm of vocabulary and syntax.

Relationship of Parental Input and Language Development

Throughout the field of normal language acquisition research, much has been written about the influence of parental linguistic input on the child's emerging skills (Gallaway & Richards, 1994; Garton, 1992; Hart & Risley, 1995). Generally speaking, there is a strong positive relationship between the amount and quality of language input provided to a child and the child's subsequent language development. The finding that deaf children born to deaf parents and exposed to fluent sign language from birth achieve early language milestones at ages comparable to children with normal hearing confirms a similar effect of parental input in children with significant hearing loss. Some authors have reported that children who are exposed to sign language by a native signer tend to reach some early linguistic milestones at younger ages than deaf children who do not use sign (Bonvillian & Folven, 1990; Orlansky & Bonvillian, 1985; Prinz & Prinz, 1979). Although this finding has been challenged (Abrahamsen, Cavallo, & McCluer, 1985), there is nonetheless a general sentiment that exposure to any signed language imparts a linguistic advantage to deaf children (Hoff-Ginsberg, 1997; Thompson & Swisher, 1985).

On the other hand, studies have indicated that deaf children of hearing parents who are exposed only to spoken language through a focused OC approach can achieve linguistic skills in speech that are comparable to the speech and sign language skills of children with SC input. Furthermore, these children exhibit a superior ability to communicate using speech when compared with their peers in SC settings (Geers & Moog, 1992; Geers, Moog, & Schick, 1984; Geers et al., 2000).

Hearing parents with deaf children face the decision whether to educate their children with or without the use of signs early in the children's lives. For those hearing parents who choose to use sign (usually in combination with speech), it is presumed that their degree of competence in sign as well as their willingness to use it regularly will have an impact on their children's linguistic development. Therefore, there is an immediate need to learn enough sign to provide appropriate linguistic input to their children. For a variety of reasons, this endeavor has been met with varying degrees of success on the part of the parents (Lederberg & Everhart, 1998; Spencer & Lederberg, 1997). If it is indeed the case that advancing linguistic skill allows for more mature communicative functions, parents who sign to their children may provide an early advantage in the linguistic realm that should be followed by an accelerated acquisition of mature function use (Lederberg & Everhart, 2000).

This study also attempts to investigate the link between parental sign competence and the child's developing linguistic abilities.

Purposes of this Study

There are three purposes for this study. First, we sought to reassess the finding that very young deaf children use fewer informative or heuristic functions and exhibit a delayed pattern of communicative function use (and associated language variables), as compared with hearing children. This phenomenon had been reported in several small sample studies, including children from SC programs and some with a mix of children from SC and OC programs. Most previous studies did not include direct observation of a normally hearing comparison group. In this study, we sought to observe a relatively large number of deaf children who received SC input to be able to make direct comparisons of their communicative behavior with those of OC deaf children and normally hearing children using the same observational methodology.

Second, we sought to explore the hypotheses that
those children who receive SC input communicate more and have more sophisticated vocabulary and longer utterance length than their deaf chronological age mates who receive only spoken language input. In other words, will deaf children who are provided with an additional verbal “means” (the addition of signs) show an early linguistic advantage as well as greater communicative function maturity than deaf children with exclusively spoken language input?

Finally, we wanted to know whether deaf children who receive speech and sign input would lag behind OC children in their use of speech during the preschool period. For parents who have spoken language development as a major goal for their children, a close watch on this aspect of development is warranted.

Method

Participants

The primary participants in this study were 38 children; each sampled at one point in time when they were between 1½ and 4½ years old. All had hearing losses in the severe to profound or profound range and were being educated in programs that stated use of an SC (or Total Communication) approach to language learning, though in practice the input ranged from Pidgin Sign English (PSE) to Signing Exact English (SEE). These participants will be referred to hereafter as the SC group.

A total of six different educational programs (SC) from across the United States participated in data collection. All families enrolled in each of these programs whose children met the subject selection criteria were sent information and a consent form, and all those who consented were videotaped. Participant selection criteria were as follows: children of the appropriate age who had (a) a hearing loss with a better-ear pure-tone average (PTA) threshold of ≥ 80 dB HL, (b) no other significant disabilities, (c) parents who are not native users of ASL, and (d) English as the primary language of the home. Teachers were asked to identify only children with presumed normal nonverbal intelligence but this was not directly tested. Two of the children in the study (sisters) had one deaf parent; the rest had hearing parents.

For purposes of comparison, data from two groups of children who participated in an earlier study (Nicholas, 2000) were also included in the analyses and graphic presentations that follow. One comparison group was comprised of 38 severely and profoundly deaf children who were being educated at two private schools with an emphasis on learning spoken language as the primary means of communication (OC group). Again, all families enrolled in these programs with qualifying children were invited to participate. A second comparison group from the earlier study was comprised of 84 normally hearing, typically developing children sampled from the local community (NH group). The addition of these comparison groups brings the total number of children reported on in this article to 160.

It is worth noting that all of these children’s families selected a private program for their children’s early education. However, many of them attended at public expense. Although parents’ socioeconomic status was not reported for this study, financial considerations did not prohibit any child from attending these programs.

This study used a cross-sectional design with children who were between 18 and 54 months of age. For the purposes of the analyses that follow, the groups of children were subdivided by age: 18 months, 24–30 months, 36–42 months, and 48–54 months. The number of children in each of these age groupings can be found in Table 1. Because participants were not followed longitudinally and there are relatively small numbers in some groups, conclusions regarding developmental patterns must be made with caution.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Age groupings of the SC children and comparison groups</th>
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<tbody>
<tr>
<td>Communication mode group</td>
<td>Age groupings</td>
</tr>
<tr>
<td>Simultaneous communication</td>
<td>6</td>
</tr>
<tr>
<td>Oral communication</td>
<td>6</td>
</tr>
<tr>
<td>Normally hearing</td>
<td>12</td>
</tr>
</tbody>
</table>
Characteristics of the children in the SC group. Characteristics of the children with hearing loss can be seen in Tables 2 and 3. The average age of diagnosis of hearing loss was 10.42 months ($SD = 6.27$ months, range = 0–24 months). None of the children were known to have had normal hearing beyond 18 months of age. In other words, those who were diagnosed at later ages had never given any indication (through early speech or speech recognition, for example) of having once been able to hear, then losing that ability. All of the children were enrolled in preschool SC classrooms or in a parent-infant program that used an SC approach to communication instruction. The signing proficiency of the teachers was not evaluated for this study. The mean number of years of education for the mothers was 14.14 ($SD = 2.03, n = 35$).

For the seven children who had cochlear implants, the mean duration of implant use was 7.5 months, and the range was less than 1–24 months. All of the children in the SC group had severe to profound hearing losses with a mean better-ear PTA of 103.21 dB ($SD = 9.65$ dB, range = 85–125) (American National Standards Institute [ANSI], 1969). Aided thresholds were not consistently reported for children younger than 3 years of age. The children in this sample were administered the Communication Scale of the Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla & Cicchetti, 1984) with their mothers, fathers, or grandparents serving as informants. Most but not all of these children showed substantial communication delays on the VABS Communication Scale, as compared with their NH age mates ($M = 77, SD = 14.92, range 52–113$). The VABS Communication Scale scores are age-corrected standard scores with an expected mean of 100 and a standard deviation of 15. Therefore, scores below 85 can be considered below average for hearing children.

The amount of sign language use by the child’s conversational partner (adult family member, usually the mother) was variable. The mean number of different words (NDW) produced in sign by the conversational partner was 83.55 ($SD = 67.37, range 0–290$) words per 30-min session. The mean percentage of total words used by the conversational partner that were produced in sign (with or without accompanying speech) was 42.06 ($SD = 25.78, range 0–98.55$).

Characteristics of children in the comparison samples. The children in the OC group were similar to the children in the SC group in the characteristics of interest. The average age of diagnosis was 12.03 months ($SD = 6.02$, range 0–22 months), which was a bit later than the average age of diagnosis for the SC group. The mean better-ear PTA of the children in this group was 104.41 dB ($SD = 8.77$ dB, range 86–120; ANSI, 1969). Five of those children had received cochlear implants but all had received their implants within the immediately preceding 8 months, with a mean duration of use of 3.8 months. Age at first intervention was not available for the OC group but for the vast majority this occurred by 2 years of age. Average scores on the VABS Communication Scale indicated that these children also were delayed in language, with a few exceptions ($M = 65.39, SD = 9.69, range 49–99$). A two-tailed $t$ test showed that the SC group (collapsed across age) scored significantly higher on the VABS Communication Scale than did the OC group, $t(1,72) = 4.062, p < .0001$. The number of years of education was available for only 14 of the 38 mothers in this group and was 14.71 ($SD = 2.67$).

The NH children had been administered a hearing screening by an audiologist and were found to have hearing within normal limits. All of the children in this group were administered three language-screening measures and scored in the average range. Further detail about these comparison groups may be found in Nicholas (2000).

Table 2  Demographic variables for children with hearing loss

<table>
<thead>
<tr>
<th>Oral communication ($n$)</th>
<th>Simultaneous communication ($n$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at onset</td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>33</td>
</tr>
<tr>
<td>1–18 months</td>
<td>5</td>
</tr>
<tr>
<td>Cause of deafness</td>
<td></td>
</tr>
<tr>
<td>Heredity</td>
<td>4</td>
</tr>
<tr>
<td>Meningitis</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
<tr>
<td>Unknown</td>
<td>25</td>
</tr>
<tr>
<td>Sensory aid use</td>
<td></td>
</tr>
<tr>
<td>Hearing aid(s)</td>
<td>30</td>
</tr>
<tr>
<td>Tactile aid</td>
<td>3</td>
</tr>
<tr>
<td>Cochlear implant</td>
<td>5</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
</tbody>
</table>

426  Journal of Deaf Studies and Deaf Education 8:4 Fall 2003
Procedure

Each child was videotaped in a 30-min play session with one parent or primary caretaker. In 28 cases this was the mother, in 7 cases it was the father, and in 3 cases it was the grandmother. The communication sample was taken from the entire 30-min session. The adult-child dyad was given several boxes of toys spaced throughout the play session and asked to play and interact as normally as possible with whatever toys they chose. A complete description of the toys may be found in Nicholas and Geers (1997).

Data preparation. Communication that occurred during the play session was transcribed for the SC group by one of two experienced signers: One was a teacher of deaf children and the other a sign interpreter. Transcription of sessions for the OC group was completed by teachers of the deaf. Every spoken or signed word and every vocalization and gesture was verified by a different individual who had not done the initial transcription. Parent utterances were transcribed and verified as well. The next step was for a coder (also one of the two people mentioned above) to identify all intentionally communicative acts (ICAs) with the assistance of a flow chart designed for this purpose (Nicholas & Geers, 1997). Once an ICA had been identified, the coder assigned it to a category of communicative function. The communicative function categories employed in this study were Response, Statement, Question, Evaluation, Performance, and Commitment. Although these categories are not theoretically mutually exclusive, coders were instructed to select the category that appeared to be the primary function in this situation. Double-coding was not allowed. The coder also had the option of assigning an ICA to a No Clear Function category. Definitions and examples of these are listed in the Appendix.

Communicative function. In addition to overall rate of communication (number of ICAs per session), the number of ICAs in each communicative function category was determined. As in previous work (Nicholas, 2000), we have used a variable, Proportion of Informative or Heuristic Functions (PIHF), to represent quantitatively the child’s use of those communicative functions that are involved in the exchange of information (Statement, Response, Question, Evaluation, Performance, and Commitment) as opposed to the regulation of others’ behavior (Directive) or other non-information-bearing acts (Imitation, Repetition, Marking). This variable was created by adding together the frequency of Statements, Responses, Questions, Evaluations, Performance, and Commitments (yielding a total number of informative or heuristic acts) and dividing this total by the number of communicative acts of all types. Again, this provided an index of how often a child or a group of children engaged in informative or heuristic communicative functions, as compared with the total number of their communicative acts. It was viewed as an index of communicative maturity.

Intercoder agreement. A relatively conservative strategy was undertaken to confront issues of potential subjectivity in coding. As in previous studies done in this laboratory, all transcripts and videotapes were coded in their entirety by two coders who worked independently. The mean point-by-point agreement for determining intentionality was 72.5% for the children in the SC group (83% for NH comparison group, 64% for the OC group). The average number of ICAs for the groups were as follows: SC group $M = 87.55, SD = 72.88$; OC group $M = 89.21, SD = 74.48$; NH group $M = 212.69, SD = 86.38$. The mean number of agreed-upon communicative functions (collapsed across function types) were: SC group $M = 59.87, SD = 53.98$; OC group $M = 54.55, SD = 49.68$; NH group $M = 157.81, SD = 66.32$. The mean point-by-
point agreement for communicative function category assignment was 70.6% for the SC group (74% for the NH comparison group, 61% for the OC group). This relatively low agreement among coders regarding communicative acts is characteristic when coding the behaviors of less skilled communicators (Nicholas, Geers, & Rollins, 1999). For both hearing and deaf children, intercoder agreement increases with age and communication skill level. The communication of deaf children remains ambiguous for a longer time (Lederberg & Everhart, 2000).

Only those ICAs and communicative function assignments that both coders independently agreed upon were used in the statistical analyses. The practice of restricting data analysis to this subset allows the investigator to base conclusions on those behaviors that are expressed clearly enough that two independent observers agree on communicative function. Although very labor-intensive, this approach assures a conservative estimate of the abilities of the children. Data from previous work show that the overall patterns of ICAs and communicative function assignment are very similar between two independent coders (Nicholas, 2000; Nicholas & Geers, 1997; Nicholas, Geers, & Rollins, 1999). The Computerized Language Analysis programs of the Child Language Data Exchange System (MacWhinney, 1995) performed all word counts and subsequent averaging calculations.

Linguistic variables. The linguistic variables that were measured from the transcriptions included vocabulary (NDW) and utterance length (the mean number of words per utterance). Many of the children in this study were actually at a presyntactic level of development. It should be noted therefore that the term utterance length, as used in this article, loosely refers to the ability to combine words in utterances without regard to well-formed grammar. In the area of language modality, the proportion of the children’s words that were expressed with speech was examined.

Results
Development of Early Communicative Behavior with Age

The purpose of this analysis was to examine developmental trends in early communication behavior between 18 months and 4 years of age in children with and without severe to profound hearing loss. It was anticipated, based on our earlier findings (Nicholas, 2000), that the children with hearing loss would exhibit different communicative function use than chronologically age mates with normal hearing. The results in this section compare the communicative behaviors of both groups of deaf children (SC and OC combined; N = 76) with NH children (N = 84) across four age groups. This relatively large number of participants permits a more reliable comparison of developmental trends in these groups than has been possible in previous work.

Communication Variables

Rate. Rate was determined by the total number of communicative acts produced per 30-min session. A two-way ANOVA was performed with number of ICAs as the dependent variable and hearing status (deaf, NH) and age group serving as the two independent variables. The results revealed a main effect of hearing status, $F(1,152) = 132.53$, $p < .0001$, a main effect of age, $F(3,152) = 39.43$, $p < .0001$, and a significant interaction between hearing status and age, $F(3,152) = 4.21$, $p < .0068$. The interaction is associated with a greater increase by hearing children between the 18- and 24-month age groups, compared with that observed for participants with hearing loss. Within both the deaf and NH groups, post hoc comparisons (Fisher’s PLSD) revealed significant ($p < .01$) increases in ICAs between all adjacent age groups, with the exception of 3-year-olds and 4-year-olds. In this sample, there appears to be a leveling off between 3- and 4-year olds that is associated with age rather than hearing status or performance level.

Communicative function. Figure 1 depicts the frequency of use of the various communicative function categories: Response, Statement, Question, Directive, Repetition or Imitation, Marking, and No Clear Function. Though there were occasional instances of children using the functions of Performance, Commitment, and Evaluation, in all cases this was less than 2% of the total number of ICAs and therefore these categories are not displayed. The means for both the
Figure 1 Mean number of occurrences of communicative function types for deaf and NH children in four age groups. R = Request, S = Statement, Q = Question, D = Directive, I/R = Imitation or Repetition, M = Marking, NCF = No Clear Function.
and even by 4 1/2 years of age did not show the clear Directive and Repetition or Imitation in the older ages persisted in their use of the “immature” functions of any other age. The deaf children on the other hand were produced much more frequently than at 2 years old during which Repetitions or Imitations. There was a period of time when the children moved to profiles dominated by Responses and Statements (and No Clear Function), then quickly overrepresented in the NH children’s profiles and underrepresented in the deaf children’s profiles. The pattern produced by these children may be the same as that produced by normally hearing children prior to 24 months of age but the 6-month age sampling interval in the design of this study is too broad for a closer look at normal development in this period.

The categories comprising informative or heuristic functions (Response, Statement, and Question) are overrepresented in the NH children’s profiles and underrepresented in the deaf children’s profiles. This finding is included in Table 4, where the mean PIHF is listed for each age/hearing status group. A two-way (hearing status × age group) ANOVA with PIHF as the dependent variable yielded a main effect of hearing status, \( F(1,152) = 162.16, p < .0001 \), a main effect of age group, \( F(3,152) = 47.21, p < .0001 \), and a significant hearing status × age group interaction, \( F(3,152) = 5.43, p < .0014 \). Thus, the growth curve was steeper for the NH children than for the children with hearing loss. As was the case with ICAs, post hoc analysis revealed significant increases for both the deaf and the NH children between all adjacent age groups except between the ages of 3 years and 4 years. In this sample, the growth in “maturity” of communicative functions appeared to level off at about 36 months of age, regardless of the child’s hearing status or the absolute level of communicative maturity achieved by that age.

Linguistic Measures

Vocabulary size was estimated by counting the NDW used in the 30-min play session. These included signed and/or spoken words. In the case where a word was used multiple times with different morphological endings, it was counted as a single word (e.g., cat and cats were counted as only one vocabulary word). Average results for each hearing status and age group are listed in Table 4. A two-way (hearing status × age group) ANOVA with NDW as the dependent variable yielded a main effect of hearing status, \( F(1,152) = 384.95, p < .0001 \), and a main effect of age, \( F(3,152) = 82.79, p < .0001 \). There was also a significant hearing status × age group interaction, \( F(3,152) = 34.75, p < .0001 \), reflecting the faster growth with age in NH children. As expected, the deaf children’s vocabulary growth was extremely delayed, reaching only one fifth that of the children at 4 1/2 years of age. The large vocabulary spurt seen between 18 and 30 months of age for the NH children was not mirrored in the deaf children, even at a year or two later in age. As was the case with ICAs and PIHF, post hoc comparisons between adjacent age groups revealed significant increases except between the ages of 3 and 4 years, where a leveling off was observed in both hearing and deaf groups in this sample.

Utterance length. Utterance length was the mean number of words per utterance. Results are included in Table 4. A two-way (hearing status × age group) ANOVA with number of words per utterance as the dependent variable yielded a main effect of hearing status, \( F(1,152) = 315.79, p < .0001 \), a main effect of age, \( F(3,152) = 66.78, p < .0001 \), and a significant hearing status × age interaction, \( F(3,152) = 10.95, p < .0001 \). This interaction reflects a faster growth rate in NH children. As with the preceding variables, both the deaf and NH groups in these samples showed no difference in mean length of utterance between the ages of 3 and 4 years. Post hoc comparisons revealed significant differences in performance (for both the deaf and the NH children) between all other adjacent age groups.
Effects of Input Modality on Early Communicative Behaviors

The following analyses examined the language and communicative function differences that existed between the groups of deaf children with OC and SC language input. To increase the power of the statistical tests, the four age groups were combined into two: the younger (18–30 months; SC n = 16, OC n = 17) and older (36–54 months; SC n = 22, OC n = 22) groups.

Communication Variables

Rate. The mean numbers of ICAs are included in Table 5 for younger and older groups of children with OC and SC language input. A two-way (language input × combined age group) ANOVA with PIHF as the dependent variable yielded a main effect of language input, $F(1,72) = 13.68$, $p = .0004$, and a main effect of age, $F(1,72) = 38.83$, $p < .0001$. There was no significant interaction between the two independent variables. The older children used more mature communicative functions than the younger children, and the children with SC language input exhibited a significantly greater use of mature communicative functions. This PIHF advantage by signing children was most apparent for the younger age group.

Linguistic Variables

Vocabulary. The mean NDW is included in Table 5 for younger and older age groups of children with OC and SC language input. A two-way (language input × combined age group) ANOVA with NDW as the dependent variable yielded no main effect of language input but a main effect of age, $F(1,72) = 25.13$, $p < .0001$. Older children had a broader vocabulary than younger children but there were not significant differences in the vocabulary of children with SC input, as compared with OC language input.

Utterance length. The mean number of words per utterance is listed in Table 5 for younger and older age groups...
of children with OC and SC language input. A two-way (hearing status × age group) ANOVA with number of words per utterance as the dependent variable yielded a main effect of language input, \(F(1, 72) = 11.97, p = .0009\), and there was a main effect of age, \(F(1,72) = 52.63, p < .0001\). There was also a significant language input × age interaction, \(F(1,72) = 18.77, p < .0001\). The interaction and post hoc comparisons revealed a smaller difference in the SC children between younger and older ages than for the OC children between the same age groups. This is primarily due to the fact that the children with SC input began using single words (signs) sooner than the OC children began to use spoken words. By the time the children were in the older age range, the OC children were using single words and word combinations to the same extent as the SC children. Post hoc tests revealed that the children with SC input used more words per utterance than OC children in the younger but not the older age group.

**Total number of spoken words.** This variable is a count of all words spoken, including those spoken more than once. A two-way (language input × combined age group) ANOVA with total number of words spoken (with or without accompanying sign) as the dependent variable yielded no main effect of language input but a main effect of combined age group, \(F(1,72) = 6.57, p = .0200\). This means that an effect of exclusively oral language input was not seen on the total number of words spoken, primarily because there was so much variability in the OC group. These results are included in Table 5.

**Spoken vocabulary.** Table 5 also presents the mean NDW (excluding repetitions) produced using speech (with or without accompanying sign) for younger and older age groups of children with OC and SC language input. A two-way (language input × combined age group) ANOVA with number of different spoken words as the dependent variable yielded a main effect of language input, \(F(1,72) = 4.64, p = .0347\), a main effect of age, \(F(1,72) = 16.29, p < .0001\), and a significant interaction, \(F(1,72) = 5.15, p < .0262\). The interaction reflects the fact that there was a much steeper growth rate for the OC children than for the SC children on this variable. Post hoc tests revealed that the children with OC language input used a significantly broader spoken language vocabulary in the older but not the younger age group.

**Relationship of parent sign competence and child’s communicative development.** The importance of parental input to children’s communicative development has been documented in hearing children and is thought to be even more important to children with significant hearing impairment. Increasing and maintaining parental input has been the hallmark of most parent-infant intervention programs for deaf and hard-of-hearing children (Clark, 1994; Estabrooks, 1994). In oral programs, parents are encouraged to continue talking to their deaf children using their native spoken language. In SC programs, parents are encouraged to learn sign and to begin using it along with speech as soon as possible in family interactions. Parents differ in their rates of learning to

### Table 5 Mean counts, standard deviations, and numbers of participants for children in the Oral Communication and Simultaneous Communication subgroups by age at test

<table>
<thead>
<tr>
<th>Measure</th>
<th>Standard Communication (n = 16)</th>
<th>Oral Communication (n = 17)</th>
<th>Standard Communication (n = 22)</th>
<th>Oral Communication (n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Deviation</td>
<td>Mean Deviation</td>
<td>Mean Deviation</td>
<td>Mean Deviation</td>
</tr>
<tr>
<td>ICA</td>
<td>41.56 35.71</td>
<td>121.00 75.25</td>
<td>36.76 35.68</td>
<td>131.67 70.79</td>
</tr>
<tr>
<td>PIHF</td>
<td>0.23 0.20</td>
<td>0.46 0.17</td>
<td>0.04 0.12</td>
<td>0.34 0.21</td>
</tr>
<tr>
<td>NDW</td>
<td>13.88 15.55</td>
<td>45.50 29.08</td>
<td>2.65 5.87</td>
<td>38.90 3.96</td>
</tr>
<tr>
<td>Words per utterance</td>
<td>0.99 0.44</td>
<td>1.25 0.18</td>
<td>0.31 0.50</td>
<td>1.33 0.36</td>
</tr>
<tr>
<td>Total number spoken words</td>
<td>3.56 5.19</td>
<td>23.09 33.03</td>
<td>5.47 14.10</td>
<td>117.88 207.75</td>
</tr>
<tr>
<td>NDW spoken</td>
<td>2.62 3.59</td>
<td>12.91 17.38</td>
<td>1.94 4.29</td>
<td>38.67 44.00</td>
</tr>
</tbody>
</table>

*Note.* SC = Simultaneous communication, OC = oral communication, ICA = intentionally communicative acts, PIHF = proportion of informative or heuristic functions, NDW = number of different words.
sign, and the resulting variability of sign input among SC children might be expected to affect children’s use of sign to communicate. The relation between parents’ spoken output and children’s speech would not be expected to be as strong because presumably all hearing parents have approximately equal facility with their native spoken language.

To examine this relationship, Pearson $r$ correlations were calculated between parent communication variables and several linguistic variables. These coefficients appear in Table 6. For parents of SC children, variables included the NDW produced using sign (parents of 18-month-olds, $M = 39.33$, $SD = 23.90$; parents of 24–30-month-olds, $M = 62.60$, $SD = 40.90$; parents of 36–42-month-olds, $M = 108.64$, $SD = 80.79$; parents of 48–54-month-olds, $M = 99.00$, $SD = 74.01$) and the proportion of parent utterances containing sign (parents of 18-month-olds, $M = 23.88$, $SD = 13.50$; parents of 24–30-month-olds, $M = 33.45$, $SD = 26.90$; parents of 36–42-month-olds, $M = 53.01$, $SD = 25.57$; parents of 48–54-month-olds, $M = 47.28$, $SD = 24.04$). For parents of OC children, the communication variable was the NDW spoken (parents of 18-month-olds, $M = 200.17$, $SD = 77.56$; parents of 24–30-month-olds, $M = 160.91$, $SD = 47.75$; parents of 36–42-month-olds, $M = 188.00$, $SD = 74.14$; parents of 48–54-month-olds, $M = 191.27$, $SD = 83.68$). The NDW produced by the parent in sign was found to be significantly related to the maturity of the child’s communicative functions (PIHF), the number of utterances produced by the child (ICAs), and the vocabulary of the child (NDW). Likewise, the proportion of a mother’s utterances that contained sign was significantly related to the same child variables (PIHF, ICAs, and NDW). The broader the parent’s sign vocabulary and the more frequently the parent signed these words, the greater was the use of sign by the child. However, number of words per utterance was not significantly related to the parent’s sign competence variables. There was a correlation of $0.823 \ (p < .0001)$ between the mother’s NDW in sign and the proportion of her utterances that contained any sign.

As anticipated, parallel relationships did not hold for spoken language input in the oral group. Number of different spoken words used by the parents of oral children was not significantly related to communicative function, vocabulary, rate, or utterance length within this group. Thus, amount of speech used by the parent did not differ for children with little speech and communicative competence and children with considerable speech. Because parents had similar spoken language competence throughout their children’s development, their use of speech did not develop along with their children’s use of speech.

### Table 6  Correlations between parent sign-skill variables and child communication variables

<table>
<thead>
<tr>
<th>Child variables</th>
<th>Simultaneous communication mothers</th>
<th>Oral communication mothers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of different words in sign</td>
<td>Proportion of utterances containing sign</td>
</tr>
<tr>
<td>PIHF</td>
<td>.513*</td>
<td>.561*</td>
</tr>
<tr>
<td>Number ICAs</td>
<td>.494*</td>
<td>.549*</td>
</tr>
<tr>
<td>Number different words</td>
<td>.652*</td>
<td>.615*</td>
</tr>
<tr>
<td>Words per utterance</td>
<td>.458</td>
<td>.445</td>
</tr>
<tr>
<td>Chronological age</td>
<td>.370</td>
<td>.383</td>
</tr>
</tbody>
</table>

*Note. ICA = intentionally communicative acts, PIHF = proportion of informative or heuristic acts.

*Correlation was significant at the $p < .05$ level after Bonferroni correction.

### Discussion and Conclusions

**Comparing Children with and without Hearing Loss**

Deaf children from both SC and OC programs exhibited delays in overall output, in their use of informative or heuristic functions, and in their development of vocabulary and length of utterance. In this study, as in Lederberg & Everhart (2000), deaf children at 18 months of age were producing far fewer communicative acts than were the normally hearing children. These differences were found with the older age groups as well.

The finding that the overall rate of communication...
was slower in deaf children than in hearing children was not consistent with the results of Spencer (1993), who found the rates to be comparable. This difference might be due to the earlier average age of identification in the Spencer study (i.e., 7 months compared with 10–12 months for children in the SC and OC samples, respectively, in this study). However, due to methodological differences in coding communicative acts, this difference in results cannot be clearly interpreted. In any case, it is clear that much work remains to be done by parents and professionals to increase and make more effective the communicative attempts by these infants.

Certain communicative functions are apparently quite difficult for very young language-delayed deaf children to convey, regardless of modality. The use of any means, verbal or nonverbal, to request information (the Question function) seems to be particularly problematic for these children. This result was also observed in the young deaf children observed by Lederberg & Everhart (2000). One explanation may be that Question forms are mastered later than verbal forms used to express other functions. Alternatively, this communicative function may not be sufficiently developed in its nonverbal form to be a solid basis upon which a verbal form may be grounded. It is definitely possible to express a desire for information using nonverbal means, and several of children did this successfully, albeit on rare occasions. However, in their nonverbal forms, information-seeking behaviors may be simply too vague and nonspecific for a communicative partner to interpret accurately. Given repeated unsuccessful attempts with such ineffective means, it is not unlikely that a child may quickly give up (at least for the time being) trying to gain information from other people. Little incentive would follow for learning the appropriate verbal forms. Yoshi-naga-Itano and Stredler-Brown (1992) noted that the ability to express nonverbal Requests for Information was significantly and singularly predictive of later language success. As important as it is for small children to have an effective means of learning about their world, it seems that the task of remedying this situation should be a high priority for those working with deaf infants and preschoolers and their families.

The relation between age and communicative development was positive in both deaf and hearing groups but the rate at which these behaviors developed was substantially faster in hearing children. Both groups exhibited increases in performance at the same ages, even though the rate of growth differed. For both groups, significant increases in performance were observed for all communication and language variables measured between 18 months and 2 years of age and between 2 and 3 years of age but significant increases between ages 3 and 4 years were not found. Because these developmental trends are being interpreted from cross-sectional rather than longitudinal data, they are influenced by subject selection factors and may not reflect changes associated exclusively with age. It will be important to confirm this result through examination of longitudinal data.

Comparing SC and OC Children

Children from SC and OC educational programs did not differ in their overall communicativeness (number of ICAs), in the breadth of their vocabularies (NDW used), or in the frequency with which they used speech (total number of spoken words). For both the hearing and deaf children, the groups at 36–54 months did better than the group at 18–30 months. Thus, both approaches appear to be effective in promoting communicative development in deaf children. However, neither communication approach served to ameliorate the detrimental effects of severe and profound hearing loss on communicative development in these children when compared with hearing age mates.

Some advantages of SC input were earlier and greater use of informative or heuristic communicative functions and earlier use of words as measured by mean length of utterance at the youngest age group. Use of sign appeared to facilitate earlier access to an effective communication system. This advantage diminished with age, however, as children in OC emphasis programs acquired a verbal means of communicating. This change was reflected in significantly broader use of spoken vocabulary in the OC group and the absence of a significant OC-SC group difference in mean length of utterance at the oldest age group. Data for older age groups are needed to determine whether verbal language growth in OC children is associated with continued growth in their use of informative or heuristic functions. Data from older children could also address
whether differences between children in OC and SC settings increase or diminish with age and whether either of these groups ever achieves more normal communicative function use.

Parental Use of Sign

The impact of parental input on communicative competence deserves further study. In this investigation, parent sign use was reflected in the child’s output. Whether the breadth of the mother’s signed vocabulary was a cause or a result of the child’s communicative competence cannot be determined from these data. However, such a correspondence between the mother’s output and the child’s communicative ability was not observed for oral children because their mothers all had a fully developed spoken language.

It may be noted in addition that the link between parental sign competence and child communicative competence has to be interpreted with caution. Although parental production may show how much and what kind of input is potentially available to the child, it cannot tell us what the child actually sees and receives.

In summary, there is clearly more than one path to successful language development in severe to profoundly deaf children. Each family with a deaf child is unique in its needs and desires and in the opportunities that are available to it. It is hoped that continued efforts to gather and interpret data on the effects of various combinations of intervention timing, audiological devices, and educational methods on language and communication development will guide recommendations for families who need these services.

APPENDIX

Directive

Includes ICAs 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 could hand an object to the parent while saying, “open,” to get the parent to open a box. The child could point at a picture on the wall and vocalize while looking at the parent. Alternatively, the child could reach for a toy with a repetitive open-close hand gesture while making eye contact with the mother.

Marking

Comprises ICAs used to mark a variety of events. Usually these markings would be exclamations such as “oh,” “ow,” and “uh-oh” to mark attentiveness, emotion, and an event, respectively, or it could be a short phrase such as “Thank you.” Nonverbal examples might include the child nodding his or her head while looking at the parent after the parent has praised the child or the child’s excited vocalization with eye contact after watching a pop-up toy perform its action. Acknowledgment of an utterance by another person, such as agreement or disagreement with a statement, was coded as a Marking.

Statement

Indicates ICAs 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.” Nonverbal examples might include the child gesturing that something fell off of the table or gesturing to describe the size of an object.

Response

Indicates that the ICA was made in response to a parent’s question, including implied questions. As with all function categories, these can be verbal or nonverbal. An example of a nonverbal response would be the child pointing to a specific puzzle piece directly after a parent query.

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. A nonverbal example might be the child holding up one finger, then two fingers, and then three as he or she counts beans.
Question
Comprises requests for information. Examples are asking permission, “When are we going home?” or “Can I play with it?” and asking for clarification, “Huh?” Credit would also be given for nonverbal seeking of information, such as a child shrugging shoulders and holding hands up and out in a “where?” gesture, vocalizing with a rising tone, looking around and then at the parent with a quizzical expression.

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.”

Evaluation
Indicates the child’s assessment of either himself, herself, another (“I can’t do it”), or the parent (“You’re doing it wrong”). An example would be that the child watches the parent draw a picture, then gives the parent a thumbs-up gesture to indicate that he or she likes what the parent drew.

Repetition and Imitation
Indicates that the child either copied a parent’s communicative act or repeated his or her own previous communicative act.

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

Note
1. It is possible, of course, that any young child may attempt more communicative acts than are recognized by his or her communicative partner (and/or to coders) due to lack of intelligibility. One might speculate that deaf children produce a higher number of unrecognized acts than similarly aged hearing children. However, this article has as its focus those acts that successfully achieve an intention to communicate and an associated communicative function. It is expected that the frequency of production (and the relative proportion) of various communicative functions are uniformly affected by intelligibility problems and therefore are represented accurately. The causes and relative amounts of unrecognized communicative attempts in either deaf or hearing children are beyond the scope of this article.

References


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