Language Development in Deaf Children’s Interactions With Deaf and Hearing Adults: A Dutch Longitudinal Study

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The language development of two deaf girls and four deaf boys in Sign Language of the Netherlands (SLN) and spoken Dutch was investigated longitudinally. At the start, the mean age of the children was 3.5. All data were collected in video-recorded semistructured conversations between individual children and deaf and hearing adults. We investigated the lexical richness and syntactic complexity of the children’s utterances in SLN and spoken Dutch, as well as language dominance and interactional participation. Richness and complexity increase over time, as well as children’s participation. An important outcome is that syntactic complexity is higher in utterances with both sign and speech. SLN does not have higher outcomes on richness or complexity, but is dominant in terms of frequency of use.

In this study, we examine aspects of language development of six young bilingual deaf children in semi-spontaneous conversations with deaf and hearing adults. The children were raised in both Sign Language of the Netherlands (SLN) and spoken Dutch. An essential issue in deaf bilingual education is to compare children’s language behavior and proficiency in conversations with both deaf and hearing adult interaction partners for didactical as well as pedagogical reasons. However, longitudinal bilingual studies on language development are scarce. Therefore, an attempt was made to find an answer to the following research question: What is the children’s development in both languages with respect to (a) linguistic complexity (lexical richness and syntactic complexity), (b) language dominance, and (c) interactional participation?

The study was carried out at the Viataal Institute for the Deaf, when bilingual education was introduced for the first time in the institute’s curriculum. Over a period of 3 years, twice a year, semistructured conversations between 6 (individual) children and a deaf adult were organized, followed by similar conversations with a hearing adult. The deaf adult used SLN, the hearing adult spoken Dutch (and, if necessary, signs). The children were free to choose their language. The adults used toys and books to elicit communication. The interactions lasted 25 min on average, and were recorded on video. From each recording, 5 min were selected for further analysis.

Depending on the family in which a deaf baby is born, early communication takes place in sign language, spoken language or mixed varieties. Sign language development can best be observed in deaf children from deaf parents, as their signed input is most natural and complete. Extensive research, mainly on American Sign Language (ASL) and British Sign Language (BSL) but also on less well-known sign languages, indicates that, by and large, sign language development is comparable to spoken language acquisition as observed in hearing children (e.g., Marschark, Lang, & Albertini, 2002; Schembri, 2002; Schick, 2003). Compared to their deaf peers, deaf children from hearing parents generally show

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delay in developing sign language proficiency. In some cases they do not attain the level in sign language of deaf children from deaf parents (Marschark et al., 2002; Singleton, Supalla, Litchfield, & Schley, 1998).

Critical factors in the early acquisition of spoken language by deaf children are age at first intervention, early speech-reading ability, and possible thresholds of unaided hearing (Dodd, McIntosh, & Woodhouse, 1998; Gilbertson & Kamhi, 1995; Limbrick, McNaughton, & Clay, 1992; Marschark et al., 2002). Over the last decades, apart from new teaching/learning methods, technological advances such as neonatal screening capabilities, high-gain hearing aids, and multichannel cochlear implants have improved the potential for deaf children to develop and use spoken language (Blamey, 2003; Blamey et al., 2001; Spencer, 2004).

When the deaf child grows older, language choices and school curriculum preferences by the child's parents—possibly after consultation with professionals—further determine the signed and/or spoken language input and training their child will receive in intervention programs, preschool centers and schools (e.g., Oderwald, Klatter-Folmer, Goosen, Van Wietmarschen, & Wever, 2004, for language-related and educational decision processes by deaf children's parents).

In the Netherlands, 1 in 1,000 people are prelingually deaf—that is, deaf from birth or before their third year of life. Each year, approximately 100 children are diagnosed as being deaf. Approximately 5–10% of the Dutch deaf children have deaf parents (Knoors, 2001). General developmental stages in the acquisition of SLN are reviewed in Schermer, Fortgens, Harder, and De Nobel (1993), supplemented later on by the outcomes of several research projects, mainly initiated by Baker, Van den Bogaerde, and Crasborn (2003). Children acquiring SLN seem to go through similar developmental stages as learners of other sign languages, like ASL and BSL (Schermer, 1990). Although research on the acquisition of SLN is modest in comparison to ASL and BSL, several substantial studies have appeared (Bos, 1994, 1995; Coerts, 2000, on SLN basic word order; Fischer & Van der Hulst, 2003, on the comparison of SLN to other sign languages).

However, we do not have substantial data on the language development of deaf children for both SLN and spoken Dutch. For the Dutch situation, only the longitudinal study by Van den Bogaerde (2000) on very young deaf and hearing children (1.0–3.0 years) of deaf mothers is relevant. Over a period of 2 years, she followed six children of deaf mothers. Three of the children were deaf and 3 were hearing. The study by Van den Bogaerde provides data on the lexical richness and syntactic complexity of Dutch deaf children’s utterances in both SLN and Dutch. Unfortunately, another perspective of our study, that is, the condition of deaf versus hearing interaction partners, is not being covered in Van den Bogaerde's investigation. On the international level, not much research has been done on this specific topic either.

Active interactional participation is essential for children’s acquisition of effective communication skills. If children are invited to experience a great variety of participatory activities with adults and peers, they can build up a repertoire of communicative skills and strategies. They learn how to organize conversational processes with various partners (Shugar, 1993). According to Antia and Kreimeyer (2003), deaf children are just as interested as hearing pupils in engaging in conversations. However, they have less frequent interactions with peers than hearing children do and their conversations are briefer.

Interactional participation of deaf children with adults has been investigated mainly in the framework of exchanges with parents and teachers. Results show that the caretakers often hold long monologues, are directive and take most turns, as their assessment of the children's communicative capacities is rather low (e.g., Knoors, Meuleman, & Klatter-Folmer, 2003; Nienhuys, Horsborough, & Cross, 1985).

Hearing loss in itself is not a major determinant of interaction, but language ability may play an important role. Researchers have different views on the issue whether hearing-impaired children use the same strategies with respect to communicative initiatives as hearing pupils, or that they employ more direct and more nonlinguistic strategies (Antia & Kreimeyer, 2003). It is also by no means clear how deaf children learn to extend their linguistic competence during interactions with deaf and hearing adults. With respect to the
Dutch language area, apart from some general observations as can be found in, for example, Knoors et al. (2003), there is hardly any research on this topic.

With respect to linguistic complexity, Lederberg (2003) found that some deaf children of hearing parents show lexicons that are comparable in size to those of hearing peers, whereas others remain in the slow word-learning phase for quite some time. They slowly add new spoken words to their vocabulary and do not experience a rapid acceleration in spoken word learning.

For the Dutch situation, earlier we mentioned the study by Van den Bogaerde (2000). Over a period of 2 years, she followed 3 deaf and 3 hearing children of deaf mothers.

In order to measure lexical richness, Van den Bogaerde (2000) calculated the TTR (type/token ratio) for signs and spoken words for sessions where the children produced more than 100 (sign/spoken word) tokens. The results from the deaf children indicate that their lexical richness in signs increases, whereas their other language, spoken Dutch, lags behind. The lexical richness of the hearing children’s spoken Dutch did not show a marked increase. Van den Bogaerde explained the differences in spoken word and sign lexicons for the deaf children by relating the production of spoken words to the hearing status of the children: spoken language acquisition is for deaf children more problematic than sign language learning (Beers & Baker, 1997; Mogford, 1988).

In order to measure the development of syntactic complexity, Van den Bogaerde (2000) calculated the mean length of utterance (MLU) and the mean length of the 10 longest utterances (MLU10) for signs, spoken words, and for a mixed category of both signs and spoken words. The deaf children mainly show an increase in syntactic complexity in SLN and the hearing children in spoken Dutch. In both groups, the other language lags behind. The syntactic complexity in spoken Dutch of the hearing children, however, was lower than that of hearing peers (Gillis & Verlinden, 1988; Legtenberg, 1989; Schlichting, 1996; Van der Stelt, 1993). Both for the deaf and hearing children, the syntactic complexity of mixed utterances increases over time.

Van den Bogaerde has compared her results with the results of case studies in other sign languages. The results of the studies of Hoffmeister (1978), Kantor (1994), and Richmond-Welty and Siple (1999) show similar developmental patterns of lexical and syntactical complexity in this age group.

With respect to language dominance, we know from studies on hearing bilingual children that, at an early age, children almost exclusively follow the strategies or choices their parents and/or teachers implicitly or explicitly apply, whereas in subsequent years, this pattern may be altered under influence of factors like language proficiency and attitude of the interaction partner, formal and informal environment, and conversational topic (e.g., De Houwer, 1995; Deuchar & Quay, 2000; Fantini, 1985; Lucas & Valli, 1990). Hearing bilingual youngsters and adults are generally found to use the dominant language of the society they live in more frequently, both in inter- and intraethnic contacts, if they feel secure enough in using this language with members of the dominant community (Klatter-Folmer & Van Avermaet, 2001).

Most deaf children are also reported to make person-related language choices (e.g., Fortgens, 2003; Wodlinger-Cohen, 1991). It should be noted, however, that these research findings usually refer to slightly older children, as young deaf children’s command of the spoken language is often still weak (e.g., Fortgens, 2003).

In a Dutch research project by Fortgens (2003), Dutch deaf pupils were found to use more sign language with deaf interaction partners and more Dutch with hearing partners. Fortgens expected the children to use more SLN with the deaf adult indeed but not necessarily more Dutch with the hearing adult. Fortgens explained the strict distinction the children made by the strong monolingual attitude of the hearing adult.

In this study, the development of the 6 participating children in SLN and Dutch is investigated with respect to (a) linguistic complexity (lexical richness and syntactic complexity), (b) language dominance, and (c) interactional participation.

On the basis of international studies, mainly on ASL and BSL, and the available research on SLN, which seem to indicate that sign language is the most
natural and accessible language for deaf children, we had the following expectations. We expected “linguistic complexity” to increase over time—in the early years more for signs than for spoken words—and to be different in conversations with the deaf versus the hearing adults. We expected young children to be dominant in signs and to use significantly more signs with the deaf than with the hearing adults. We expected a clear pattern of “language accommodation” to emerge over time (“one person one language strategy”; after Harding & Riley, 1986). We also expected “interactional participation” to increase over time and to be independent from language or language mode. Furthermore, departing from theories on deaf and hearing language acquisition (e.g., Gillis & Schaerlaekens, 2000; Schick, 2003), our expectations were that the development of linguistic complexity would be comparable to that of other deaf children, but slower than for hearing peers, that language dominance patterns would be comparable to those of other bilingual deaf and bilingual hearing children and that interactional participation patterns would be comparable to other deaf and hearing peers.

Method

Participants

Six children participated in the study for 3 consecutive years. All parents agreed to the inclusion of their child in the investigation. School professionals carried out the selection procedure using the following criteria:

- hearing loss at least 80 dB on the best ear,
- prelingual hearing loss (i.e., before the age of 3),
- normal performance intelligence,
- no other severe disabilities.

At the start of the investigation in September 1998, 4 of these 6 children were placed in a group for 4-year-olds (pupils A1–A4) and 2 in a group for 3-year-olds (pupils B1 and B2). The 6 children belonged to the first generation of pupils at Viataal to be educated in a bilingual program. Table 1 gives basic information about the 6 children.

At the start, the mean age of the A children was 4;4 years (year;month), ranging from 3;10 to 4;7. The B children were 3;3 years on average. The age at which children were diagnosed deaf varied from 0;3 to 4;3. All pupils were enrolled in bilingual education programs at Viataal, involving both SLN and Dutch. In the course of the study, 3 children got cochlear implants: A1 at age 4;4, B1 at age 4;9, and B2 at age 4;1. One child (A2) had deaf parents and one deaf sibling, and another pupil (A4) had hearing parents, and three deaf and three hearing siblings. The other children had hearing parents and siblings.

Measures

The language development data were collected by conversations between children and adults. Twice a year, semistructured conversations between the individual children and a deaf adult were organized, followed by conversations with a hearing adult. The

<table>
<thead>
<tr>
<th>Information</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>B1</th>
<th>B2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Age at start of investigation (year;month)</td>
<td>3;10</td>
<td>4;5</td>
<td>4;7</td>
<td>4;7</td>
<td>3;1</td>
<td>3;5</td>
</tr>
<tr>
<td>Age at diagnosis of deafness (year;month)</td>
<td>1;0</td>
<td>1;5</td>
<td>0;7</td>
<td>4;3b</td>
<td>2;0</td>
<td>0;3</td>
</tr>
<tr>
<td>Hearing loss left (dB)</td>
<td>117</td>
<td>125</td>
<td>110–120</td>
<td>107</td>
<td>80</td>
<td>118</td>
</tr>
<tr>
<td>Hearing loss right (dB)</td>
<td>115</td>
<td>115</td>
<td>110–120</td>
<td>110</td>
<td>110</td>
<td>125</td>
</tr>
<tr>
<td>Educational group</td>
<td>4-year-olds</td>
<td>4-year-olds</td>
<td>4-year-olds</td>
<td>4-year-olds</td>
<td>3-year-olds</td>
<td>3-year-olds</td>
</tr>
<tr>
<td>Cochlear implant (year;month)</td>
<td>4;4</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>4;9</td>
<td>4;1</td>
</tr>
<tr>
<td>Hearing status family</td>
<td>Hearing</td>
<td>Deaf</td>
<td>Hearing</td>
<td>Mixed</td>
<td>Hearing</td>
<td>Hearing</td>
</tr>
</tbody>
</table>

*Child A2 has deaf parents and one deaf sibling.

*The parents of child A4 had to flee their home country when child A4 was 4 years old. They knew that the child was deaf, but he had not been diagnosed officially as deaf in their home country. When the family came to the Netherlands, child A4 was tested and diagnosed as deaf. Child A4 has hearing parents, three deaf siblings, and three hearing siblings.
interactions were recorded on video. Each conversation was filmed for 20–30 min.

From each video-recorded conversation, deaf and hearing researchers selected a 5-min section representing the most animated conversational fragment. This section was saved on CD-ROM and then linguistically transcribed in full. The transcription system was partly derived from MacWhinney (1991; the Childes manual) and partly from Johnson and Rash, and Aarssen (working documents applying Childes to young deaf [and hearing] children’s utterances, respectively; see the Childes manual, MacWhinney, 1991, on the definition of utterances). The transcription comprised a full account of all SLN and Dutch utterances of children and adults, as well as meta- and extralinguistic comments, for instance, on nonmanual markers and eye contact.

This database was then analyzed for linguistic complexity, language dominance, and interactional participation. Measures for linguistic complexity were lexical richness (Guiraud index) and the MLU10. The Guiraud index is a measure of lexical richness that attempts to quantify the degree to which a varied and large vocabulary is used. We did not apply TTR because reliability and validity of this index are too low when the numbers of tokens vary. The Guiraud index has proved to be an effective measure in early language acquisition (up to 3,000 words; Vermeer, 2000) and was also successfully applied to bilingual language data (Daller, Van Hout, & Treffers-Daller, 2003). The types and tokens of the children’s output in the video-recorded conversations were counted per recording session for SLN and spoken Dutch. The Guiraud index was calculated per session for both SLN and spoken Dutch types and tokens by dividing the number of sign/word types by the square root out of the total number of different sign/word tokens (types/$\sqrt{\text{tokens}}$). The square root has a mitigating effect on the impact of the number of tokens, which is necessary because the number of types increases much slower than the number of tokens in sampling texts (e.g., Baayen, 2001; Rietveld & Van Hout, 1993). Unlike, for instance, Van den Bogaerde (2000), we did not apply a minimum number of tokens.

The MLU is a measure of syntactic complexity and development (Brown, 1973). Often a subset of the longest utterances is regarded as a more valid indicator of the syntactic competence of a person. Vermeer (1986), for instance, opted for the MLU10; the Childes manual mentions the MLU5 and MLU50 (MacWhinney, 1991). In calculating the MLU10, we distinguished three types of utterances: (a) signs only, (b) mixed utterances, and (c) spoken words only. We excluded nonlinguistic utterances. A deaf and a hearing researcher coded all utterances of all transcripts independently. Their interrater reliability was perfect (1.0). A third hearing researcher rated a random selection of utterances and again the interrater reliability was perfect (1.0). The variable “mixed category” was introduced because tentative analyses already indicated clear-cut differences across languages and led us to suspect that mixed utterances could contribute to the interpretation of the MLU results. MLU10 values were calculated per child per recording session for each of the three types of utterances.

We based our definition of the concept of language dominance on the token frequencies of the two languages involved in the children’s contributions to the conversations. How frequent were the signs in relation to the number of spoken words? The relationship between speaking and signing can be expressed by computing the relative frequency, but a more useful index is the so-called logit. The logit is a standard measure nowadays in frequency analysis (e.g., Aldrich & Nelson, 1986), and in our case it is computed by ln((number of signs)/(number of spoken words)). The “ln” is the natural logarithm, and when the number of signs equals the number of spoken words, the resulting logarithmic value will be zero. When the number of signs is larger than the number of spoken words, the outcome will be positive. When the situation is the other way round, the number of spoken words being larger than the number of signs, the outcome will be negative. A positive value indicates sign language dominance, and a negative value indicates spoken language dominance.

The interactional participation was calculated by comparing each child’s total number of utterances to the total number of the child’s and adult’s utterances in a session.

Repeated measures analyses (Huynh-Feldt corrected) were performed to test main and interaction
effects for three independent variables (significance level is .05). The independent variables were language used (Dutch vs. SLN), time (development over 3 years), and language mode (deaf vs. hearing adult interaction partner). In the analyses, the two recordings per year with the respective adults were taken together in order to obtain more stable measures as well as to avoid missing observations. Occasionally, a recording was lacking, for practical reasons (illness of the child, for instance).

In addition, several language proficiency tests were administered. The results of the language proficiency tests are not the focus of this article. We will use the results of the BSL/SLN Receptive Skills Test to provide for reference data regarding the children’s language proficiency. The BSL test (the Receptive Skills Test of Assessing British Sign Language Development; Herman, Holmes, & Woll, 1999) is a standardized test developed using deaf and hearing children from deaf families who are native signers. The standardization sample was extended to deaf children from hearing families who had been exposed to BSL from an early age (BSL/English educational programs) and children from hearing families on Total Communication educational programs. The BSL Receptive Skills Test was adapted to SLN by asking 2 deaf students of the SLN Teacher Training Program to translate the items of the BSL test in SLN using as much as possible the same amount of signs and similar grammatical constructions. Standardized BSL scores can be obtained on the basis of the age of the child tested. The adapted test was administered in the second and third year of the data collection.

Procedure

The semistructured conversations were filmed in a room at school. The room was equipped with a low table and small chairs, toys, and books to elicit communication. All adults were school professionals with whom the children were familiar. The deaf adult was instructed to exclusively use SLN, whereas the hearing adult was instructed to speak Dutch, unless signs were necessary to carry on the conversation. In both situations, the children were free to choose their languages.

Right after the recording of the exchanges, the adults—who knew the children well—were asked to indicate the representativeness of the conversation in a written questionnaire. All conversations were judged to be representative of the communicative behavior of the participating children.

At the start of the project, when the children were younger, the conversations between the children and adults were mainly about the materials available in the room. As the children grew older, they started to tell more about their own experiences and perceptions. With some children it was fairly easy to get the conversation going, whereas others needed more time.

In the administration of the BSL/SLN Receptive Skills Test, first, a word list checking the child’s vocabulary was presented. Children passed the check when they succeeded in naming or recognizing 15 or more of the 20 test items. The word list was followed by the real test in which short sentences were signed and the child had to choose out of four the one corresponding picture. The translated version of the BSL was administered by a deaf professional.

Results

Reference Data Language Proficiency

The results of the BSL/SLN Receptive Skills Test (BSL test: Herman et al., 1999) are summarized in Table 2.

Table 2 shows that in both years in which the test was applied, all the children passed the vocabulary check. The children A2, A3, and B1 have scores appropriate for their ages in the second year. The children A1, A4, and B2 score below the mean that is appropriate for their ages. The results of the second test show that the SLN scores of almost all the children have improved. In the third year of our longitudinal study, all the children have standard scores that fit their ages. As the BSL Receptive Skills Test was standardized using both deaf and hearing native signers from deaf families and children from hearing families who had had consistent exposure to sign language via fluent language models before the age of 5, age appropriateness of SLN results can be derived for all 6 Dutch children and seems to indicate that their
level of proficiency in sign language is not delayed. However, this interpretation is tentative, as—although the parents of all six children have tried to organize consistent exposure to SLN for their young deaf child—only child A2 is a native signer from a deaf family.

Linguistic Complexity

This subsection presents the results for both lexical richness and MLU.

**Lexical richness.** The results of lexical richness are given in Table 3. Figure 1 gives a graphical representation of the mean scores.

The data were analyzed for possible effects of language used (SLN vs. spoken Dutch), time (development over 3 years), and language mode (deaf vs. hearing adults). Two main effects were found for lexical richness, namely for time and language mode. The effect for language used was not significant. Two interaction effects were observed: language mode by language and language mode by time.

The time effect means that, in the course of 3 years, the children’s lexical richness increased significantly, $F(2, 10) = 14.952, p = .008$. The absence of a main effect for language used signifies that there was no difference in the Guiraud index between spoken Dutch and SLN. After 3 years, the indices for the two languages met more closely than at the start of the investigation. There was a main effect for language mode, $F(1, 5) = 20.537, p = .006$, which implies that the context in which the conversation took place, that is, communicating with a deaf versus a hearing adult, did indeed make a difference. The two significant interaction effects add relevant information. The language mode by language used effect, $F(1, 5) = 17.944, p = .008$, points to the lower scores for spoken Dutch in interaction with the deaf adult. Figure 1 shows that over all 3 years the Guiraud scores are

<table>
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<tr>
<th>Table 2</th>
<th>Scores of vocabulary pretest and BSL test</th>
</tr>
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<tbody>
<tr>
<td>Child</td>
<td>Vocabulary pretest (maximum = 20)</td>
</tr>
<tr>
<td>A1</td>
<td>16</td>
</tr>
<tr>
<td>A2</td>
<td>17</td>
</tr>
<tr>
<td>A3</td>
<td>15</td>
</tr>
<tr>
<td>A4</td>
<td>17</td>
</tr>
<tr>
<td>B1</td>
<td>16</td>
</tr>
<tr>
<td>B2</td>
<td>15</td>
</tr>
</tbody>
</table>

*Note.* Standardized scores are based on the score of the children on the BSL test.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Mean values for lexical richness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean values (SD)</strong></td>
<td><strong>Interaction with</strong> 1 2 3 Research year</td>
</tr>
<tr>
<td>Hearing adult</td>
<td>Spoken words 3.32 (1.10) 4.28 (1.04) 5.05 (1.07)</td>
</tr>
<tr>
<td>Signs 3.69 (0.34) 3.97 (0.72) 4.32 (0.83)</td>
<td></td>
</tr>
<tr>
<td>Deaf adult</td>
<td>Spoken words 1.98 (0.31) 2.60 (0.72) 4.12 (1.06)</td>
</tr>
<tr>
<td>Signs 3.86 (1.05) 4.01 (1.22) 5.35 (0.92)</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The values represent mean values of the Guiraud index; standard deviations are given in parentheses.
systematically lower. In the conversation with the hearing adult the Guiraud scores for the two languages are far more similar. The language mode by time effect, $F(2, 10) = 6.661, p = .023$, reflects that the Guiraud scores for spoken words in the third year became so high that there is no longer a mean difference between the conversations with the deaf and the hearing adult.

**Mean length of utterance.** In Table 4 and Figure 2, the MLU10 results are presented. Table 4 and Figure 2 make clear that all conversations contained signed and mixed utterances. In many cases, however, children did not produce any monolingual utterance in spoken Dutch. Their MLU10 is set to 0, which explains the score less than 1 for MLU10 spoken Dutch. The mean value over all children for spoken Dutch never exceeds the value of 1 in Table 4 and Figure 2.

For the MLU10 in signs, no significant effects were found, neither for the main effects of time and language mode nor for the interaction effect of time by language mode. The values seem to increase over time, but the effect was not strong enough to be statistically significant for the 6 children investigated. For the MLU10 in spoken words, one effect is significant, that is, language mode, $F(1, 5) = 7.105, p = .045$. It means that monolingual utterances in spoken Dutch are more exceptional in the conversations with the deaf adult.

Unlike the results for MLU10 in spoken words and signs, the mixed category shows a significant development over time, $F(2, 10) = 15.148, p = .001$. No main effect for language mode was found, nor was an interaction effect found. This outcome seems to indicate that mixing is a crucial communicative instrument for the deaf children, and mixed utterances represent the children’s language development the best.

**Language Dominance**

In Table 5, the results of the 6 children are given for language dominance.

All mean values in Table 5 are positive, pointing out that sign language is by far the dominant vehicle of expression. A value of 1 indicates a situation where the number of signs is about twice as large as the number of spoken words. A value of 2 indicates that the

<table>
<thead>
<tr>
<th>Interaction with</th>
<th>Research year 1</th>
<th>Research year 2</th>
<th>Research year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing adult</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLU signs</td>
<td>2.27 (0.57)</td>
<td>2.61 (0.31)</td>
<td>2.73 (1.06)</td>
</tr>
<tr>
<td>MLU mixed</td>
<td>1.68 (0.69)</td>
<td>2.74 (0.65)</td>
<td>3.70 (0.98)</td>
</tr>
<tr>
<td>MLU spoken words</td>
<td>0.69 (0.50)</td>
<td>0.76 (0.64)</td>
<td>0.87 (0.63)</td>
</tr>
<tr>
<td>Deaf adult</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLU signs</td>
<td>2.17 (1.05)</td>
<td>2.61 (0.96)</td>
<td>3.16 (1.19)</td>
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<tr>
<td>MLU mixed</td>
<td>1.89 (0.64)</td>
<td>2.46 (1.10)</td>
<td>3.29 (0.82)</td>
</tr>
<tr>
<td>MLU spoken words</td>
<td>0.46 (0.71)</td>
<td>0.18 (0.43)</td>
<td>0.18 (0.45)</td>
</tr>
</tbody>
</table>

*Note.* The values represent mean values of the MLU10; standard deviations are given in parentheses.
number of signs is four to five times more frequent than the number of spoken words.

We investigated possible main and interaction effects for the two independent variables of language mode and time. Only a significant main effect for language mode could be established, $F(1, 5) = 12.235, p = .017$. What is salient in the results as depicted in Table 5 is that there is indeed significant evidence for language accommodation (language mode), but at the same time the children turn out to be dominant signers. Although the logarithm for exchanges with the deaf adult is more positive than for exchanges with the hearing adult, the children are dominant signers in both language modes, as is illustrated by the two lines being positive. The slight decrease in the logarithms over the years is not significant.

**Interactional Participation**

In Table 6, the results for interactional participation are given.

All percentages in Table 6 are between 30% and 40%, and the fairly constant outcome points out that the adults have to do, as can be expected, most of the interactional work.

**Table 5 Mean values for language dominance**

<table>
<thead>
<tr>
<th>Research year</th>
<th>Interaction with Hearing adult</th>
<th>Interaction with Deaf adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.45 (0.87)</td>
<td>1.81 (0.89)</td>
</tr>
<tr>
<td>2</td>
<td>1.21 (0.43)</td>
<td>2.05 (1.01)</td>
</tr>
<tr>
<td>3</td>
<td>1.06 (0.71)</td>
<td>1.41 (0.75)</td>
</tr>
</tbody>
</table>

_Note._ The values represent mean values of the logit (ln) of the number of signs versus the number of spoken words (s/w); standard deviations are given in parentheses.

**Table 6 Mean values for interactional participation**

<table>
<thead>
<tr>
<th>Research year</th>
<th>Interaction with Hearing adult</th>
<th>Interaction with Deaf adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.59 (6.15)</td>
<td>35.60 (5.75)</td>
</tr>
<tr>
<td>2</td>
<td>32.80 (6.14)</td>
<td>38.96 (4.82)</td>
</tr>
<tr>
<td>3</td>
<td>39.62 (1.29)</td>
<td>38.76 (5.07)</td>
</tr>
</tbody>
</table>

_Note._ The values represent mean values of interactional participation in percentages based on the number of utterances; standard deviations are given in parentheses.

Analyses of main and interaction effects only yielded a significant main effect for time: The participation scores of the children as a group increased significantly over the years of the study, $F(2, 10) = 4.615, p = .038$. The participation scores of the children as a group show a similar increase, both in the conversations with the deaf and the hearing adults. There is no extra accommodation effect in one of the two language modes.

**Discussion**

**Linguistic Complexity: Lexical Richness and MLU**

With respect to linguistic complexity, we expected an increase over time—in the early years more for signs than for spoken words, though—and different results for conversations with hearing and deaf adults.

First, the results of the BSL/SLN Receptive Skills Test, used here to offer reference data on the children’s language proficiency, showed that the six children were comparable to their (British) peers.

Second, in the semistructured conversations, lexical richness was indeed found to increase significantly over time and to be different in conversations with deaf and hearing adults. In conversations with the deaf partner, the lexical richness for signs proved to be larger than for spoken words, whereas in the interaction with the hearing adult, it was the other way around. Of course, the low index for spoken words in talking with the deaf adult may partly account for this outcome.

We recomputed the TTR scores of Van den Bogaerde (2000) for signs and spoken Dutch to Guiraud scores in order to compare our results to Van den Bogaerde’s data from children with deaf mothers. The mean Guiraud score for signs by the deaf children of Van den Bogaerde’s study of 2-, 2.5-, and 3-year-olds were 2.56, 4.01, and 4.74, respectively. The frequencies of spoken Dutch were too low to be included in the analyses. The Guiraud scores for words by Van den Bogaerde’s hearing children were 4.87, 4.75, and 5.24 for, respectively, 2-, 2.5-, and 3-year-olds. So, the lexical richness in signs of the deaf children increases, whereas their other
language, spoken Dutch, does not seem to show any progress. The lexical richness of the hearing children’s spoken Dutch does not show a marked increase, whereas their sign scores are lower than the scores for spoken Dutch (2.76, 2.70, 2.99).

If we compare these results with the scores of the children in our project, it appears that a difference of 2–3 years can be observed to the advantage of the children of Van den Bogaerde’s study (2000). In any case, this holds for sign language. For spoken Dutch, the comparison is much more problematic, as Van den Bogaerde leaves out frequencies lower than 100, whereas we do not. However, the trend is that the subjects of our studies show a delay of 2 or 3 years for spoken Dutch too, compared to van den Bogaerde’s subjects.

A possible explanation for the better results of Van den Bogaerde’s children is that their mothers were deaf and the children were raised in sign language, their most natural and accessible language. Unfortunately, there are hardly any other Dutch research data to check these observations.

Third, as expected, a significant effect for language used was found in the MLU10s. The expected increase in MLU10 over time was found to be significant only for the mixed category, not for spoken words or signs. The presence of a deaf or a hearing adult made a significant difference only in the case of spoken utterances, which may be explained by the fact that pure utterances in spoken Dutch are more exceptional in the conversations with the deaf adult.

In relation to the expectations formulated, these results show us that mixed utterances, consisting of either simultaneous or alternating language elements, are a crucial communication mode for the deaf children. Also, we feel that any analysis of a deaf child’s language that looks at only one language at a time would underestimate the child’s linguistic complexity given that we found the most advanced language when the child was using both speech and sign in a complementary manner.

Again, for the Dutch language situation, the study of Van den Bogaerde (2000) offers the most important reference data. As in other research projects (e.g., Hoffmeister, 1978 [ASL]; Kantor, 1994 [ASL]; and Richmond-Welty & Siple, 1999 [ASL]), progress in sign language development and in utterance length is demonstrated between the ages of 2;0 and 3;0. Van den Bogaerde found MLU10s for signs varying from 1.1 to 1.5 at the age of 1;6 years for deaf children of deaf parents. At the age of 3;0 years she found MLU10s ranging from 3.4 to 3.7. All the MLU10s for signs of the children in our study are smaller than the scores of the 3-year-old children of the study of Van den Bogaerde. She did not calculate MLU10s for deaf children’s spoken Dutch because of the few utterances available. She computed the MLU10s of mixed utterances for only one of the deaf children, which ranged between 1.8 and 2.8. The children in our project, again, seem to have a delay of 2–3 years, compared to the deaf subjects of Van den Bogaerde’s study. The delay is much less (1 year) if we would only consider the mixed utterances. In comparison to Dutch hearing peers, whose MLU ranges from 4 at age 3;4 to 8 at age 7;6, we find substantial differences (Bol, 2005).

Language Dominance

With respect to language dominance, we hypothesized that, in the early years, the children would be dominant in signs, their most natural and accessible language, but would use significantly more signs with the deaf than with the hearing adults. We expected a clear pattern of language accommodation to emerge over the years, analogous to findings on hearing bilingualism. However, our results presented a slightly different picture.

In this study, there is indeed significant evidence for language accommodation, but it is not very convincing. On the whole, the children appear to be dominant signers, regardless of whether they are communicating with a hearing or deaf adult, although sign language is more dominant in exchanges with the deaf adult than in conversations with the hearing adult. At the end of the investigation, the balance had not fundamentally changed. The “one person one language strategy” (after Harding & Riley, 1986), as propagated by the Viataal bilingual curriculum and also found in some other research projects on deaf children (e.g., Fortgens, 2003) and hearing bilinguals (Wodlinger-Cohen, 1991), is not yet clearly visible in the subjects.
of our study. Perhaps the hearing adult’s positive attitude towards sign language in this study and her obvious sign language skills explain the difference with Fortgens’ outcomes, where the hearing adult was a strong proponent of monolingualism in Dutch. Deaf children are probably also aware of the fact that a hearing adult may understand both signs and spoken words, whereas, for a deaf native signer, speech reading is much more difficult.

Interactional Participation

We expected interactional participation to increase over time but to be independent from language used or the presence of a deaf or hearing adult. Examination of the group results revealed a significant effect for time indeed, although in the last year, still, the adults did most of the interactional work. This increase was not related to either language used or hearing status of the interaction partner. Individual variation might be explained by the children’s language proficiency, age factors, and shy versus extrovert personalities.

As research in this area is scarce, especially where the comparison of deaf and hearing interaction partners is concerned, we cannot really compare our data to other researchers’ outcomes. The lower interactional contribution of the children compared to the adults, as observed in our study, can probably be explained by the adults’ negative assessment of the children’s communicative capacities, as found in, for example, Knoors et al. (2003) and Nienhuys et al. (1985).

From the summary of research of Antia and Kreimeyer (2003), we can cautiously conclude that deaf children’s conversational motivation is very well comparable to that of hearing peers, and with respect to individual variation—as we noted above—language ability and not so much the hearing impairment as such is important (e.g., Kolen, Klatter-Folmer, Knoors, & Tijsseling, 2003; Maassen & Povel, 1985; Shriberg, Austin, Lewis, Sweeny, & Wilson, 1997).

All in all, the findings for linguistic complexity and language dominance seem to sketch a picture of 6 deaf children who, in language terms, “do what they can.” They grow up in families where deaf parents and siblings use signs in a natural way or where hearing parents follow SLN courses and try to use SLN or sign-supported Dutch with their deaf children. In this way, in the families, there is no clear-cut language input pattern where languages are related to specific persons. Moreover, in another research project at the same school, it appeared that (hearing) parents who had opted for a bilingual curriculum were found to shift completely to Dutch as soon as their children socially and emotionally performed well. Their ultimate aim was to try and integrate their children in regular education (Oderwald et al., 2004).

At the time of the investigation, the Viataal schools tried to organize bilingual education in a “one person one language” framework in order to arrive at optimal language-learning conditions. However, due to personnel shortages, the 6 children in this study often received sign language instruction by hearing teachers. It is not surprising, then, that children get used to home and school contexts where they are allowed to use both languages independent of varying interaction partners and contexts.

In these more or less overlapping linguistic contexts, children probably try to adhere to once-established language-use rules, but, at the same time, seem to employ every possible means to convey their meanings. It is evident that this is positive for communication purposes, and it is also clear that young bilingual children are often found to produce mixed utterances in their early years. However, the question is whether the conditions for learning two languages at the same time (the Viataal bilingual education concept) are satisfied sufficiently. The data on length of utterance seem to support the observation that the children combine elements of the two languages in one utterance and do not optimally use either language. Also, the scores for both lexical richness and length of utterance show a delay in comparison to deaf children from another Dutch project (Van den Bogaerde, 2000).

The outcomes of the language proficiency tests of the present project, which fall outside the scope of this article, are not very positive for both languages either, although SLN scores are somewhat higher than Dutch scores. However, although we criticize the fact that the schools do not stimulate to a larger extent the optimal use of both languages and irrespective of the conclusion that especially the proficiency in Dutch as
measured by the tests could be improved, it is equally important to state that the growth of sign language was mixed with continuous Dutch language development. This suggests that signing does not hinder the children becoming more proficient in spoken Dutch, or, probably, that signing even further the development of Dutch. At the most, bilingually raised children need more time to arrive at expected levels in both languages.

It is reassuring in this respect that the children’s interactional participation shows a marked increase. This positive development is probably due to growing linguistic complexity in both languages, especially in lexical richness. The observed progress in both lexical richness and interactional participation is not related to a specific language.

The outcomes described in this article are based on the results of a sample of only 6 children. However, the findings are supported by the data of the other 5 children participating in the overall study. Finally, although relating to a rather small sample, the results for children participating in the overall study. Finally, although relating to a rather small sample, the results for linguistic complexity, language dominance, and interactional participation as described here may prompt school curriculum makers to further discuss the organization of bilingual programs.

References


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