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BILINGUALLY APPROACHED DEAF TODDLERS: WHAT ABOUT *SPOKEN* DUTCH?*

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Abstract

Two deaf children are followed longitudinally while attending a bilingual playgroup, offering communication in Dutch Sign Language (DSL) and in spoken Dutch. Unlike traditional approaches speech therapy was integrated in the playgroup activities. The research question focused on a description of the children's development of spoken Dutch. In the age range from 1;8 to 2;4 years they were video-recorded weekly (if possible) in at first unstructured, and later structured playgroup settings. Finally, two recordings were made in the children's homes. Three aspects in the development of spoken Dutch are studied: speech motor control, phonological development, and the communicative aspect in the verbal and non-verbal domains. Towards the end of the research period both children use words and sentences in spoken Dutch with and without simultaneous signing.

1. Introduction

More than 90% of deaf children have hearing parents. In the Netherlands there are three approaches in the professional guidance offered to families with a deaf child: 'oralism', Total Communication (TC), and the bilingual approach. After experience and expertise with TC as a means of communication, the view that deaf children need a suitable, fully accessible *language* in order to develop optimally has gained more and more prominence (Knoors, 1993).

This paper presents some findings of a study on the development of spoken Dutch in two deaf children who frequented a bilingual playgroup for children between the ages of 1;6 - 3;0 years. The families and the children were supported by a 'bilingual' approach. This approach is based on the view that access to both spoken Dutch and Dutch Sign Language (DSL) benefits the language development of deaf children and thus their overall development (Knoors, 1993). The paper describes the development of the children's speech motor control, their phonological development, and their communicative development.

The literature

The literature on the speech development of deaf and hearing-impaired children shows wide differences within and between samples used in research studies. The size of the

* The paper is based on the Master thesis in Speech Communication at the Institute of Phonetic Sciences: "En het *gesproken* Nederlands dan?" by M.M. Broekhof (1996).

sample is often limited and the children, although different with respect to type (conductive/sensorineural) or seriousness of impairment (65 dB /110 dB), are generally considered as one group of 'hearing-impaired' children. Caution is warranted in the interpretation of the results of such research. Findings on young hearing-impaired (HI) children are usually obtained on the basis of comparative analyses of matched hearing children.

Most research data on speech development of young HI children are related to the production of the first speech sounds, including the development of babbling. On the basis of these data it is generally concluded that HI children start reduplicated babbling at a later stage and that their babbling shows less variety than that of their hearing peers (Oller & Eilers, 1988; Stoel-Gammon, 1986). Although considerable variability occurs, HI children generally appear to be five to six months behind in their babbling development in comparison with hearing children.

According to a study on young HI children conducted by Stoel-Gammon (1988), the repertoire of consonants is dominated by labials. In children aged 19;0 to 39;4 months she finds 82% labials and 8% alveolars in the HI group, as opposed to 43% labials and 45% alveolars in the hearing group. Kent (1987), on the other hand, reports a large majority of alveolar consonants, but his study is based on just one case. Stoel-Gammon concludes that HI children produce a much smaller variety of consonants than hearing children. Research on the production and development of vowels in HI children is unknown to the present authors.

Information about speech perception is generally obtained through studies of older schoolchildren in the age range of about 8 to 20 years, who can be tested using 'real' tests. As regards the speech perception of severely HI children, Lamoré et al. (1985, 1990) conclude that with a hearing loss with a Fletcher Index (FI) in excess of 90 dB Hearing Level (HL), the perception of phonemes, in quiet and with a headphone, ranges from 0 to 50% of the total number of phonemes administered. According to Erber (1974), children with a FI in excess of 100 dB (HL) are capable only of perceiving the time and intensity aspects of speech. Boothroyd (1984) specifically examined HI children's perception of contrasts between various speech sounds. He concludes that the average hearing levels up to which a given contrast is accessible are: 100 dB (HL) for vowel place, 105 dB (HL) for talker sex (male/female), 115 dB (HL) for syllabic pattern, and in excess of 115 dB (HL) only vowel height contrasts were perceived. The literature offers insights into the possibilities and limitations of the perception of speech in cases of serious hearing loss.

This study

The two children in the present study are in a situation contrary to the oral situation of the children studied in the 1970s and 1980s. The support provided to the two children's families by the Netherlands Foundation for Deaf and Hard of Hearing Children (NSDSK) was based on the bilingual approach.

One morning per week the two children participated in a bilingual playgroup. In this playgroup, spoken Dutch and Dutch Sign Language (DSL) occupy an equal place. A deaf playgroup nurse communicates with the children in DSL, spoken Dutch supported by Signs (DsS) is offered by a hearing nurse, and a speech therapist uses spoken Dutch mainly. A new method of *integrated speech therapy* is used, which has been developed to enhance the auditory capacities of young HI children with a view to improving their spoken language skills. One of the basic ideas underpinning this approach is that language should be a source of enjoyment. That is why nursery rhymes and songs, both from the hearing culture (in DsS) and the deaf culture (in DSL), are given a central place in this approach. In addition, much attention is given to reading picture books.

2. Aims

The aim of the study was to describe the development of spoken Dutch in two deaf children. The study focused on three domains of speech development:

1. speech motor control
2. phonological development
3. communicative development (more specifically, vocabulary development and the use of speech sounds in varying situations)

The research questions which the study sought to answer were concerned with the developmental tendencies that can be observed in the Dutch speech production of two deaf children aged 1;8 to 2;4 years who are exposed to the bilingual method. The questions are treated together with the presentation of the results in section 6.

3. Subjects

In the literature, the term 'deaf' is used in cases where the hearing loss in the best ear equals or exceeds 90 dB. According to this definition, both children in the study can be designated to be profoundly deaf. Pure-tone audiometry shows that the girl (Arlen) has a left ear FI of 97 dB and a FI of 100 dB in the right ear. The boy's hearing loss (Wietse's) is worse: pure-tone audiometry reveals a FI of 110 dB in the right ear and of 115 dB in the left ear. As part of the audiological examination tympanometry was performed; neither of the children appeared to suffer from middle ear pathology at that moment.

Wietse was born deaf to hearing parents and started wearing two behind the ear (bte) hearing aids at the age of eight months. The cause of Arlen's deafness is unknown. She too has hearing parents. Twice she responded unsatisfactorily to the standard screening of the Youth Health Care Centre. She was subsequently examined at an audiological centre. She was already over 13 months when she was diagnosed as being deaf and started wearing two (bte) hearing aids from the age of 15 months.

In the period when the children attended the bilingual playgroup, a psychological examination was conducted using the Bayley Development Scales (BDS). It was found that the psychological development of both children was not below the average level of (hearing) children of the same age. At the start of the study, the children could be considered as 'average' deaf children, with respect to their speech motor and auditory skills.

4. Data collection

Data were collected by means of (if possible) weekly video recordings of the two focus children. All recordings were made with a Philips video camera/camcorder, type Explorer VKR 6853 VHS/C. The videotapes were played on an AKAI videorecorder, type VS-G21(EOH), connected to a Philips television monitor type 26C/565/12Z.

When the first recording was made, Arlen was aged 1;9 years and Wietse was 1;8 years. During the first four months of the study, recordings were made in the playgroup, in the last two months at the children's homes. The first five recordings were made in 'free-play' situations, during which the children played with other children and/or the playgroup staff. Next, five recordings were made in structured play situations, where the two children played with one staff member in a separate room. The final two recordings of the two children were made in their homes, as the

playgroup was closed for summer holidays. During these recordings the children played alternately with other children (friends, brothers, sisters) and their parents.

5. Coding system

As there was no literature available describing similar research on development in deaf children, ideas as to how to encode the various aspects of the children's development were operationalised in the course of the study.

In the transcription of the videotapes, one utterance was defined as the sound produced during one respiratory cycle (e.g. Koopmans-van Beinum & Van der Stelt, 1979; 1986; Van der Stelt & Koopmans-van Beinum, 1981). Per utterance, the manner of phonation (either interrupted or uninterrupted) was transcribed and, with regard to articulation, the number of syllables was counted in order to monitor the development of the children's speech motor control. The articulation of sounds composing the various syllables was transcribed (with regard to manner and place) in order to determine the developmental variation of articulation. In the analysis of the words used by the children three categories were used:

- onomatopes
- words or parts of words of spoken Dutch used in combination with a sign
- words or parts of words of spoken Dutch used without a sign.

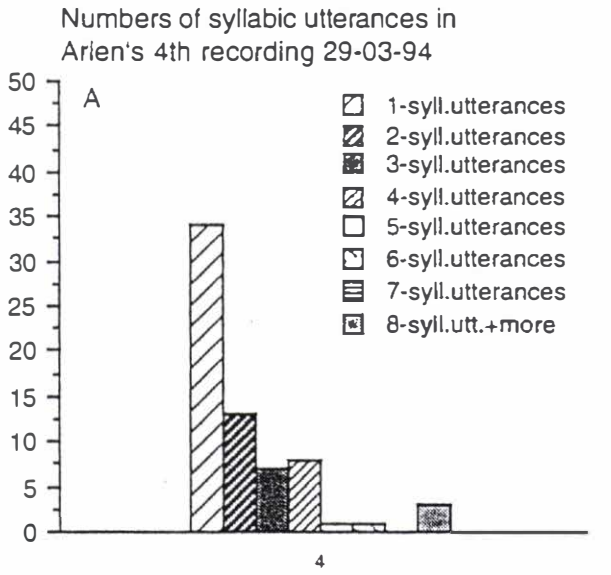
The transcription then proceeded to look at the children's non-verbal behaviour and their use of any signs accompanying the utterance. For this purpose a special diagram was developed to categorise information about the following aspects: signs, sound productions, fine-motor movements, gross-motor movements, pointing, and 'communicative behaviours' (meaning that the utterance is a conscious attempt on the part of the child to communicate a message to another person). The interjudge reliability between the first author and a native signer of DSL in coding of the children's signs was a mean of 87%.

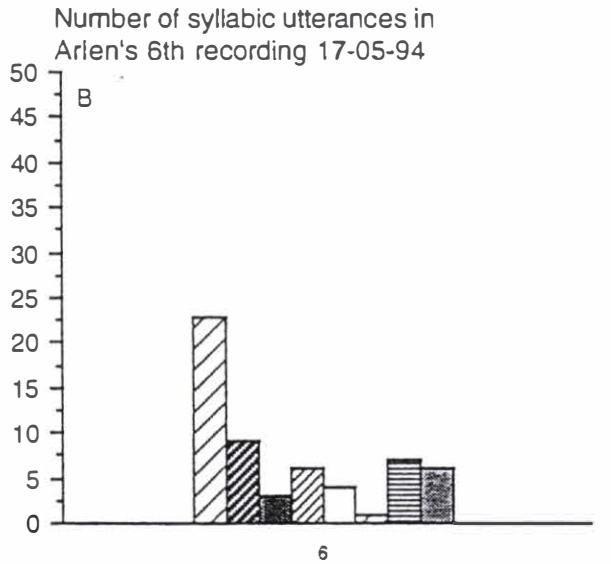
6. Results

In this section the results are given for the development of spoken Dutch in the two deaf children. First of all the development of speech motor control is analysed with the utterance as a basic unit. The development in the production of vowels and consonants is studied next, followed by results in the communicative aspects by means of words and sentences in spoken Dutch, and simultaneously present signing and non-verbal behaviour.

6.1. Development of speech motor control

With regard to the speech motor control in these bilingually approached deaf children, we expected an increase in multi-syllabic utterances for just the pleasure of playing with the movements followed by a decrease in number of syllables per utterance once they 'understood' that these sounds have a meaning. This explains the renewed increase in mono- and bisyllabic utterances, which in hearing children occurs with the first word production around the first birthday.





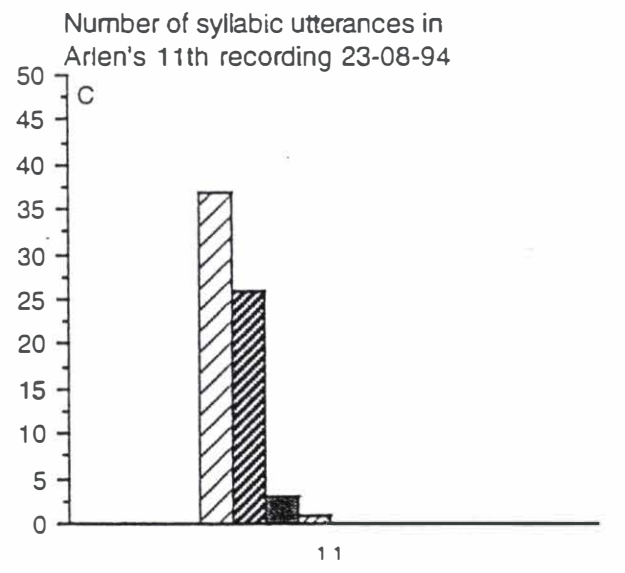


Figure 1 a, b, and c. Numbers of various syllabic utterances in three recordings with about equal numbers of utterances of Arlen.

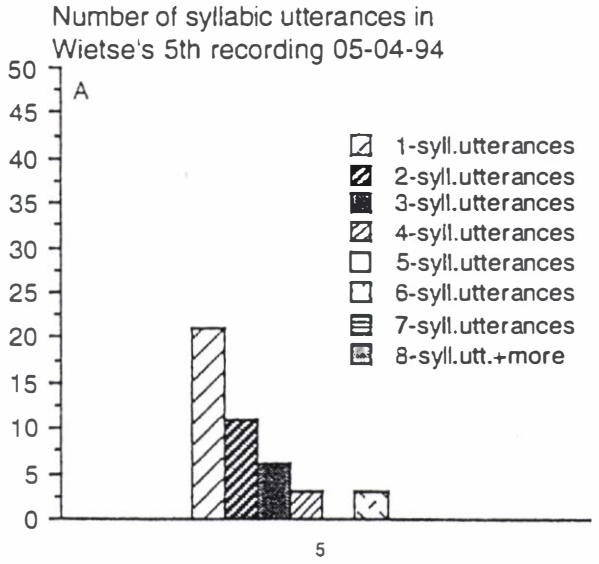
Wietse has produced 599 utterances in 12 recordings which is a larger number of utterances than Arlen, who made 405 utterances in 11 recordings (she was on holiday at the time of the 10th session). Percentages of mono-syllabic, bi-syllabic, 3-syllabic and 4-and-more-syllabic utterances per total number of utterances in each recording were calculated. Sometimes the children produced long utterances in which the same syllables were repeated. These utterances bear a strong resemblance to the babbling sounds of hearing children. In literature different forms of babbling are described such as reduplicated, variegated, or canonical babbling (e.g. Oller, 1986). In this part on speech motor control in the two deaf children we disregarded the differentiation in forms of babbling, since that is based on the acoustic or perceptive quality of the syllables in an utterance. We decided to interpret utterances of 4-and-more-syllables as 'babbling motor practice', and hypothesised that the syllabic sounds were uttered merely to practice the movements, possibly for the sheer joy of making them. The longest utterance consisted of 20 syllables (!) and was produced by Arlen in recording number 4.

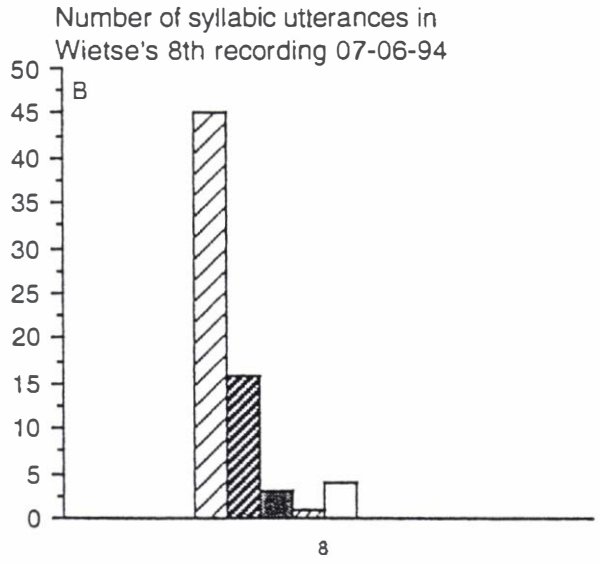
The development of speech motor control

Per child three recordings of about equal length and number of utterances were selected for further analysis of their speech motor control. For Arlen, comparing the figures 1a, b, and c, it can clearly be shown that the percentages of utterances with 4-or-more syllables (defined as babbling sounds) are prominent in the first two recordings, 19.4% and (!) 40% respectively. In the third recording these sounds compose only 1.5% of the utterances. These results suggest that, during the period she was studied, Arlen went through a kind of babbling phase, because she practises long, rhythmic sound productions. The situations in which these utterances were produced warrant the conclusion that their primary function was "playing with speech sounds", since the sound production was not directed at another person. At the same time figure 1c shows that the percentages of mono- plus bi-syllabic utterances are undeniably high in this last selected recording of Arlen.

No proof was found of an explicit babbling phase in Wietse during the research period. The three figures (2a, b, and c) show that the number of 4-or more syllabic utterances per total number of utterances varies in the three recordings from 13.6% in figure 2a to 7% in figure 2b, and 8.6% in figure 2c respectively. Wietse is approached with signs from his birth onwards and he was given his first (bte) hearing aids when he was eight months old, as stated before. It is possible that Wietse has been babbling during his first year of life, before the video recordings were made. Another possibility is that Wietse never went through a babbling phase at all. It is found to be characteristic of Wietse that he most of the times combines a sound with the movement of a sign. The length of his utterances often corresponds to the duration of his body and/or hand movements. Sign movements, transmitting a meaning, do not correspond to the playful long repetitive babbling sounds. If Wietse develops spoken Dutch on the basis of sign language, this may have as a consequence that he never went through an explicit vocal babbling phase. The larger part of the sounds he produces are combined with movements or signs and already intended to convey a meaning.

It can be concluded that the syllabic structure of the utterances of the two children become progressively more conventional during the research period. In the case of Wietse, this is evident from the gradual increase in the number of mono- and bi-syllabic utterances, and in the case of Arlen it appears both from the decline in the number of babbling sounds and from the increase in the number of mono- and bi-syllabic utterances. Still, some caution is warranted in the interpretation of these data. In early phases of speech development, mono-syllabic utterances have a different function from that in the later first-words stage, as was explained above (6.1).





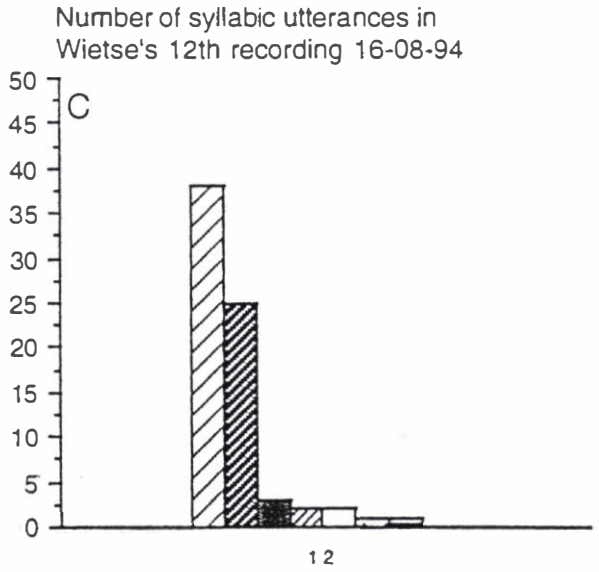


Figure 2 a, b, and c. Numbers of various syllabic utterances in three recordings with about equal numbers of utterances of Wietse.

Anticipating on the children's vocabulary development, we may already state here that, of the total number of Wietse's mono- and bi-syllabic utterances in the three recordings, 4.3% , 9.4% and 27% respectively consist of words. The corresponding figures for Arlen are: 0% , 0% and 19%. This shows that the development of speech motor control is accompanied by a simultaneous development of meaning. In consequence, it is not easy to draw clear-cut conclusions about the development of speech motor control alone. It is obvious that the form, content and use of language influence each other continuously during the process of speech and language development.

6.2. Phonological development

We expected that the phonological development in the bilingually approached deaf children would show an increasing variability in vowels and consonants.

We have studied the development of vowel quality and, for the consonants the manner as well as place of articulation. The tables 1 and 2 provide an overview of the changes in the children's production of vowels and consonants. For both children, the numbers of vowels and consonants per recording are given, as well as the different types of vowels and consonants. The types of vowels and consonants correspond to the phonemes of spoken Dutch. In the sections 6.2.1. and 6.2.2. we will discuss more specifically the development in type of consonants and of vowels.

For Arlen, the development of consonants and the development of vowels present similar distributions (see tables 1 and 2). In the period up to and including the 9th recording, compared to the final two recordings, the variety in *types* of consonants is smaller. This change may be due to the fact that these final recordings are made in the home setting. Yet, it is still possible that Arlen has made a developmental 'leap' both for vowels and for consonants..

In the case of Wietse, the number of different types of consonants increases in the last three recordings. Up to and including recording 9, the range of consonants is much smaller than in the last three recordings (see table 1). Wietse seems to have made a developmental 'leap' in consonant production, because the number of different consonants increases in the final playgroup recording (number 10). He practises this new ability in the following home setting recordings since these consonant types occur in large numbers of utterances then as well. Wietse's vowel production (table 2) does not show a clear developmental process.

Table 1: The numbers and types of **consonants** produced by Arlen and Wietse per recording. The asterixes indicate recordings with a short duration. For Arlen the 10th recording is missing.

Arlen	8\3 1	15\3 2	22\3 3	29\3 4	5\4 5*	17\5 6	31\5 7	7\6 8	14\6 9*	 10	29\7 11	23\8 12
number	15	14	112	121	18	163	3	31	11		66	65
type	3	2	2	3	3	5	1	3	3		10	7
Wietse	8\3 1	15\3 2	22\3 3	29\3 4	5\4 5	17\5 6	31\5 7	7\6 8	14\6 9*	21\6 10	18\7 11	16\8 12
number	7	6	24	35	78	52	36	62	14	59	135	124
type	3	2	4	2	4	1	4	4	2	10	9	7

Table 2: The numbers and types of vowels produced by Arlen and Wietse per recording. The asterixes indicate recordings with a short duration. For Arlen the 10th recording is missing.

Arlen	8\3 **1**	15\3 **2**	22\3 **3**	29\3 **4**	5\4 **5***	17\5 **6**	31\5 **7**	7\6 **8**	14\6 **9***	**10**	29\7 **11**	23\8 **12**
number	33	24	133	143	20	205	37	83	24		87	97
type	5	3	3	5	5	5	5	6	4		11	11
Wietse	8\3 **1**	15\3 **2**	22\3 **3**	29\3 **4**	5\4 **5**	17\5 **6**	31\5 **7**	7\6 **8**	14\6 **9***	21\6 **10**	18\7 **11**	16\8 **12**
number	27	44	65	28	102	58	65	85	14	94	186	128
type	4	3	6	3	4	3	7	7	3	7	9	5

6.2.1. The consonants

Manner of articulation

We have classified consonants according to manner of articulation into four categories. Plosives are expected to occur more often and earlier than the other consonant categories, because the closure phase is easier to control for children than approximations in the other consonant productions. The [h]-sound is considered an aspect of phonation and is therefore not included in the analysis.

As regards the manner of articulation of Arlen (see table 3), it appears that plosives occur indeed most frequently. Then, the non-nasal sonorants come in second place, occurring in eight recordings. These are followed by nasals. Fricatives are produced only in recording 11. This recording is the only one in which all articulation categories are represented. It appears that for Arlen no clear 'developmental process' can be identified in the articulation of the four groups of consonants.

Table 3: Consonant production of Arlen categorised with regard to **manner of articulation**. Percentages of these consonants per total number of consonants per recording are given. The asterixes indicate recordings with a short duration.

Arlen	nasals	plosives	non-nasal sonorants	fricatives
8\3 **1**	--	53.3 %	46.7 %	--
15\3 **2**	7.1 %	--	92.9 %	--
22\3 **3**	--	36.6 %	63.4 %	--
29\3 **4**	--	40.5 %	59.5 %	--
5\4* **5**	37.5 %	25.0 %	37.5 %	--
17\5 **6**	0.6 %	32.5 %	66.9 %	--
31\5 **7**	--	100.0 %	--	--
7\6 **8**	19.4 %	80.6 %	--	--
14\6* **9**	9.1 %	90.9 %	--	--
29\7 **11**	3.0 %	62.1 %	12.1 %	22.7 %
23\8 **12**	--	53.8 %	46.2 %	--

Table 4: Consonant production of Wietse categorised with regard to **manner of articulation**. Percentages of these consonants per total number of consonants per recording are given. The asterixes indicate recordings with a short duration.

Wietse	nasals	plosives	non-nasal sonorants	fricatives
8\3 1	4.9 %	--	57.1 %	--
15\3 2	--	50.0 %	50.0 %	--
22\3 3	58.3 %	20.8 %	20.8 %	--
29\3 4	94.3 %	--	5.7 %	--
5\4 5	26.9 %	33.3 %	39.7 %	--
17\5 6	100.0 %	--	--	--
31\5 7	52.6 %	21.1 %	21.0 %	5.3 %
7\6 8	69.4 %	4.8 %	24.2 %	1.6 %
14\6* 9	100.0 %	--	--	--
21\6 10	61.0 %	8.5 %	28.8 %	1.7 %
18\7 11	51.1 %	34.1 %	14.1 %	0.7 %
16\8 12	49.2 %	26.6 %	23.4 %	0.8 %

Table 4 on the 'manner of articulation' clearly shows that Wietse mainly uses nasal sounds. The non-nasal sonorants come in second place, followed in frequency by the plosives. The fricatives come in the fourth place, occurring in only five recordings. If we disregard recording 9 with a relatively short duration, we may conclude that from the 7th recording onwards Wietse (who is then exactly 2 years old) produces sounds from all four categories in all recordings.

Clearly, the two children follow their own path with regard to the manner of articulation of consonants.

Place of articulation

With regard to place of articulation, we expected that (partly) visible articulations like bilabials and labiodental would be fairly frequent in deaf children, conform results reported in literature (e.g. Stoel-Gammon, 1988). Only supraglottal consonantal sounds were considered in this study. In consequence, the [h] is disregarded.

Table 5: Consonant production of Arlen categorised with regard to **place of articulation**. Percentages of these consonants per total number of consonants per recording are given. The asterixes indicate recordings with a short duration.

Arlen	bilabial	labiodental	alveolar	palatal	velar
8\3 1	53.3 %	46.7 %	--	--	--
15\3 2	7.1 %	92.9 %	--	--	--
22\3 3	36.6 %	63.4 %	--	--	--
29\3 4	40.5 %	59.5 %	--	--	--
5\4* 5	62.5 %	37.5 %	--	--	--
17\5 6	32.5 %	66.9 %	0.6 %	--	--
31\5 7	100.0 %	--	--	--	--
7\6 8	100.0 %	--	--	--	--
14\6* 9	90.9 %	9.1 %	--	--	--
29\7 11	56.1 %	27.3 %	7.6 %	4.5 %	4.5 %
23\8 12	20.0 %	10.8 %	21.5 %	35.4 %	12.3 %

Table 6: Consonant production of Wietse categorised with regard to **place of articulation**. Percentages of these consonants per total number of consonants per recording are given. The asterixes indicate recordings with a short duration.

Wietse	bilabial	labiodental	alveolar	palatal	velar
8\3 1	42.9 %	28.6 %	--	28.6 %	--
15\3 2	50.0 %	50.0 %	--	--	--
22\3 3	75.0 %	20.8 %	4.2 %	--	--
29\3 4	94.3 %	--	5.7 %	--	--
5\4 5	59.0 %	39.7 %	--	--	1.3 %
17\5 6	100.0 %	--	--	--	--
31\5 7	73.7 %	26.3 %	--	--	--
7\6 8	74.2 %	25.8 %	--	--	--
14\6* 9	92.9 %	--	--	--	7.1 %
21\6 10	64.4 %	6.8 %	6.8 %	16.9 %	5.1 %
18\7 11	83.0 %	14.1 %	2.2 %	--	0.7 %
16\8 12	71.8 %	14.5 %	4.0 %	8.9 %	0.8 %

As regards the place of articulation in consonants produced by Arlen (see table 5), it appears that bilabial sounds are indeed the most frequent ones, followed by the labiodentals. Bilabials occur in all recordings, and labiodentals occur in nine out of eleven recordings. Arlen seems to make a developmental 'leap' in the period before the last two recordings when she starts to produce all five categories of consonants.

For Arlen, we may conclude that both the data concerning the number of different consonants (types) and the data concerning the place of articulation show a clear developmental progress in the quality of the consonants. At the end of the research period, Arlen has then reached the age of 2;3 years.

Wietse does not differ much from Arlen as regards the 'place of articulation' (table 6). Bilabials are the most frequently occurring consonants, present in all recording. The labiodentals come in second place, occurring in 10 recordings out of 12. Alveolars, palatals, and velars occur infrequently. In two recordings (10 and 12), Wietse produces sounds from all five categories.

In the case of Wietse, the variation in types of consonants (see table 1) increases fairly suddenly in recording 10. This tendency is corroborated by his data on the manner and more specifically on place of articulation of the consonants (table 4 and 6). At the time of the 10th recording Wietse is 2;2 years old.

6.2.2. The vowels

With regard to the variation in vowel production is was expected that the /a/ and /ə/ sound would be frequent, because in the production of these sounds the fairly effortless jaw movement is crucial. The /i/ and /ɪ/ sounds would be less frequent because visually as well as perceptually these sounds are difficult to distinguish. For the elaboration of the data on the vowel production of the two children, it was decided to divide the vowels into four categories: /a, ɑ, ɛ/, /o, ɔ, ʊ/, /i, I, e/, and /ə/ (see tables 7 and 8).

Table 1 showed the total number of vowels and the number of different types of vowels produced by Arlen per recording. It is clear that from recording 1 to 9 the number of different types of vowels remain about the same, irrespective of the total

number of vowels in Arlen's utterances. In the last two recordings Arlen shows a sudden increase in vowel types, since she then starts to use 11 different vowels.

Table 7 gives an overview of the variation in types of vowels, divided into four categories. The two categories /a, ɑ, ɛ/ and /ə/ occur in all recordings, which confirms our expectations. The category /o, ɔ, u/, occurs in seven recordings, and Arlen produces one or more vowels from the category /i, I, e/ in six recordings. In the last two recordings all four vowel categories are present. As expected, the /i, I/ sounds are less frequent than the /a/ and /ə/ sounds.

Wietse's production of vowels develops along slightly different lines compared to Arlen. Table 1 does not show a clear leap in development of vowel production for Wietse. Roughly speaking, it seems that (if we disregard the short 9th recording) the variation in vowels increases somewhat from recording 7 onwards. Except for recording 3, when Wietse uses six different vowels (see table 2), the variation in types of vowels is small in the first six recordings. In the 7th recording Wietse produces suddenly seven different vowel types, and proceeds likewise in subsequent recordings (with the exception of the short 9th recording as well as the final one).

Table 7: The distribution in percentages of the vowels per recording produced by Arlen. The vowels are divided into four categories. The asterixes indicate recordings with a short duration.

Arlen		/a, ɑ, ɛ/	/o, ɔ, u/	/i, I, e/	/ə/
8\3	1	72.7 %	--	3.0 %	24.2 %
15\3	2	50.0 %	--	--	50.0 %
22\3	3	85.0 %	3.0 %	--	12.0 %
29\3	4	81.1 %	0.7 %	--	18.2 %
5\4*	5	10.0 %	15.0 %	--	70.0 %
17\5	6	74.6 %	--	0.5 %	24.9 %
31\5	7	24.3 %	27.0 %	2,. %	45.9 %
7\6	8	21.7 %	20.5 %	14.5 %	43.4 %
14\6*	9	83.3 %	--	--	16.7 %
29\7	11	40.2 %	4.6 %	19.5 %	34.5 %
23\8	12	59.8 %	7.2 %	12.4 %	13.4 %

Table 8: The distribution in percentages of the vowels per recording produced by Wietse. The vowels are divided into four categories. The asterixes indicate recordings with a short duration.

Wietse	/a, ɑ, ɛ/	/o, ɔ, u/	/i, I, e/	/ə/
8\3 1	18.5 %	--	3.7 %	77.8 %
15\3 2	13.6 %	4.5 %	--	81.8 %
22\3 3	36.9 %	7.7 %	--	55.4 %
29\3 4	21.4 %	--	--	78.6 %
5\4 5	82.4 %	1.0 %	--	16.7 %
17\5 6	24.1 %	--	--	75.9 %
31\5 7	23.1 %	6.2 %	--	67.7 %
7\6 8	28.2 %	5.9 %	--	64.7 %
14\6* 9	35.7 %	--	--	64.3 %
21\6 10	30.9 %	5.3 %	--	62.8 %
18\7 11	67.2 %	9.1 %	0.5 %	20.4 %
16\8 12	78.9 %	3.9 %	--	17.2 %

Table 8 presents an overview of the distribution of the four categories of vowels produced by Wietse. This table does not show an increase in the variation of vowels, conform data presented in table 2. Like Arlen, Wietse produces fair amounts of vowels from the 'open' category /a, ɑ, ɛ/ and the 'neutral' category /ə/ in all recordings. The category /o, ɔ, u/ comes in third place. As expected, Wietse hardly produces vowels from the category /i, I, e/. He only produced /i/ and /e/ once in different recordings.

6.3. The communicative aspect of spoken Dutch

Deaf children, engaged in complex communicative situations, will gradually discover the effects of speech sound production as well as the non-vocal aspects of their behaviour. In sections 6.1. and 6.2. we have presented the precursor aspects of spoken Dutch in the bilingually approached deaf children. The communicative aspects in speech and language development are composed of auditory as well as visual components (e.g. Van der Stelt, 1993), that evolve into meaningful movements. Words and sentences are one part, signs and non-verbal behaviour are the other part. In the following sections we present the progress of the deaf children in these respects.

6.3.1. Words and sentences

Words

At the time of the last recording, Arlen is 2;4 years old. She then has used a total of 32 words (see table 9) during the recording sessions including 24 different ones (type/token ratio is 0,75). The distribution over the different word categories is as follows: 14 words or parts of words occur simultaneous with a sign, 12 words are produced in spoken Dutch only; and six words are regarded as onomatopes.

Table 9: The number of words (all categories, see text) produced by Arlen and Wietse per recording. The asterixes indicate recordings with a short duration. For Arlen the 10th recording is missing.

Arlen	8\3	15\3	22\3	29\3	5\4	17\5	31\5	7\6	14\6		29\7	23\8
	1	**2**	**3**	**4**	**5***	**6**	**7**	**8**	**9***	**10**	**11**	**12**
number		1				2		3	2		11	13
Wietse	8\3	15\3	22\3	29\3	5\4	17\5	31\5	7\6	14\6	21\6	18\7	16\8
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9***	**10**	**11**	**12**
number		2	4		2	1	5	6	2	2	23	17

In order to draw conclusions about the development of the active vocabulary, we compared the data of the first nine recordings with those of the last two recordings. In the first nine recordings Arlen uses eight words altogether. Half of these are onomatopes, three are in spoken Dutch only, and one is used in combination with a sign. The number of words in the final two recordings following the 'developmental leap' is 24, of which two onomatopes, 11 words with a sign, and 11 words in spoken Dutch only. We can conclude that Arlen, in a period of 10 months of attending the playgroup, shows a huge increase in her production of spoken Dutch words.

Wietse is 2;3 years old at the time of the final recording. By then, he spoke 64 words during the recording sessions altogether (see table 9), including 23 different ones (type/token ratio is 0,35). The distribution over the different word categories is as follows: 32 words or parts of words accompanied by a sign; 23 words in spoken Dutch only, and 7 onomatopes. In about 72% of the situations Wietse uses words and signs simultaneously, which is understandable since his parents use signs from birth onwards. Like Arlen, Wietse too uses a much larger number of words in the final two recordings than in the previous sessions. Up to the 10th recording Wietse uses 24 words: six onomatopes, six words in spoken Dutch only, and 12 words in combination with a sign. The total number of words in the final two recordings is 40 of which only one is an onomatope. Just as for Arlen, about 50% of the words are in spoken Dutch only. Wietse produces 19 words without a sign. Although Wietse's history is different from Arlen's, he also shows an obvious progression in the development of communication and in spoken Dutch.

Sentences

The transition from the one-word phase to the two-word phase in speech and language development takes place gradually. It is often a combination of separate words, uttered in one breath unit, which results in a two-word sentence. In the recordings, Arlen produces one three-word sentence, and no two-word sentences:

/Ja Kiki jawe/ Ja, Vincent 'jawe' / Yes, Vincent, 'jawe' (?).

Wietse produces three two-word sentences:

/Waa ei/ Waar is het ei? / where is the egg?
/Maa-ə ba/ Maarten bal / Maarten ball
/Oma waa?/ Waar is oma? / Where is granny?

Clearly, these sentences have a communicative function with respect to the situation of the children and the various persons involved.

6.3.2. Non-verbal behaviour and signs

Besides data concerning the development of spoken Dutch, a number of items on communication in the observation scheme were further elaborated. The choice of these items was prompted by their communicative aspect and the supposition that young children generally produce sounds in combination with actions or movements. Tables 10 and 11 show for the two children the scores on the selected items, as percentages of the total number of utterances over all recordings. The item *0+'communicative'* stands for communicative sound productions without sign, fine- or gross-motor movements, or imitation.

If we look at all recordings from the angle of non-verbal behaviour and signs, it appears that Arlen produces most utterances in combination with gross-motor movements. Utterances in combination with pointing or signing come in second and third place, respectively. Wietse produces most utterances in combination with a sign. This means that he often uses speech sounds with a communicative purpose. Sounds accompanied with gross- or fine-motor movements come in second and third place, respectively.

The communicative aspect of sound production is particularly evident in the categories 'pointing', '0+communicative' and 'signs'. In the case of Arlen this amounts up to 29.2% of the total number of utterances, and in the case of Wietse it is 44.4%. The difference between the two children lies mainly in the percentages of utterances in combination with signs. Wietse, used to signs from birth, makes a sign in 24.7% of the utterances, while Arlen does so only in 10.4% of the utterances. In the category '0+communicative' the two children obtain similar scores: Arlen 6.7%, and Wietse 7.8% of the total number of utterances.

Fostering awareness of the communicative function of sounds and encouraging the communicative use of sounds should be major objectives of today's speech therapy with young deaf children. The above findings suggest that in bilingually approached children sign language can make an important contribution to these objectives.

Table 10: The categories of non-verbal behaviour and signs used by Arlen, given in percentages of the total number of utterances over all recordings.

total number of utterances Arlen = 405	
signs	10.4 %
fine-motor mov.	7.2 %
gross-motor mov.	18.3 %
pointing	12.1 %
0 + comm.	6.7 %

Table 11: The categories of non-verbal behaviour and signs used by Wietse, given in percentages of the total number of utterances over all recordings.

total number of utterances Wietse = 599	
signs	24.7 %
fine-motor mov.	13.0 %
gross-motor mov.	19.9%
pointing	11.9 %
0 + comm.	7.8 %

7. Discussion

In this study the development of spoken Dutch of the two deaf children, attending a bilingual playgroup, can be called very favourable. After a relatively short period of attending the bilingual playgroup, these profoundly deaf children come to understand the functions of sound production with or without signs, and they can produce spoken Dutch words and even sentences.

The final two recordings made in the home settings show that the children, in spite of their severe auditory handicap, have managed to familiarise with spoken Dutch in their environment. After the home recordings we had planned to make at least one more recording of the children in the playgroup setting. The recordings might have showed that the children continued to communicate successfully in spoken Dutch and DSL, along with the requests of the situations. Unfortunately, this project could not be executed along these lines.

The two home recordings of both children show a discrepancy with the previous recordings in a positive way. The question thus remains in what degree the familiar home settings played a role in the children's development of spoke Dutch and DSL. But even so, the fact that the children manage very well to incorporate spoken Dutch in their communicative patterns cannot be denied.

The discussion about 'oralism', Total Communication, bilingual approach, and other manners of communicative support for deaf children is not closed yet. It is still a question whether in a bilingual approach the visual/manual language can fertilise the oral/auditive language. As Mayberry (1994) stated:

> *"... language acquisition in early childhood may facilitate the acquisition of a second language after childhood, even when the two languages have completely different sensory and motor form - visual and gestured in the case of ASL, and auditory and spoken in the case of English."* (p. 85)

More structured observational research focusing on communicative aspects in the development of spoken Dutch in young deaf children is needed, taking into account the long-term effects of the various approaches as well. It is our stern impression that an individual path is the most favourable with regard to the child's progress, which must be evaluated in the home settings, in the playgroup, and at school.

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